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40 CFR Part 98

Mandatory Reporting of Greenhouse Gases: Additional Sources of Fluorinated GHGs; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 98

[EPA–HQ–OAR–2009–0927; FRL–9226–8]

RIN 2060–AQ00

Mandatory Reporting of Greenhouse Gases: Additional Sources of Fluorinated GHGs

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: EPA is issuing a regulation to require monitoring and reporting of greenhouse gas emissions from additional sources of fluorinated greenhouse gases, including electronics manufacturing, fluorinated gas production, electrical equipment use, electrical equipment manufacture or refurbishment, as well as importers and exporters of pre-charged equipment and closed-cell foams. This rule requires monitoring and reporting of greenhouse gases for these source categories only for sources with carbon dioxide equivalent emissions, imports, or exports above certain threshold levels. This rule does not require control of greenhouse gases.

DATES: The final rule is effective on December 31, 2010. The incorporation by reference of certain publications listed in the rule is approved by the Director of the Federal Register as of December 31, 2010.

ADDRESSES: EPA established a single docket under Docket ID No. EPA–HQ–OAR–2009–0927 for this rule. All documents in the docket are listed on the *http://www.regulations.gov* Web site. Although listed in the index, some information is not publicly available, e.g., confidential business information (CBI) or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and will be publicly available only in hard copy form. Publicly available docket materials are available either electronically through *http://www.regulations.gov* or in hard copy at EPA's Docket Center, Public Reading Room, EPA West Building, Room 3334, 1301 Constitution Avenue, NW., Washington, DC 20004. This Docket Facility is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744, and the telephone number for the Air Docket is (202) 566–1742.

FOR FURTHER INFORMATION CONTACT: Carole Cook, Climate Change Division, Office of Atmospheric Programs (MC–6207J), Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460; telephone number: (202) 343–9263; fax number: (202) 343–2342; e-mail address: *GHGReportingRule@epa.gov.* For technical information and implementation materials, please go to the Greenhouse Gas Reporting Program Web site *http://www.epa.gov/climatechange/emissions/ghgrulemaking.html.* To submit a question, select Rule Help Center, followed by Contact Us.

SUPPLEMENTARY INFORMATION: *Regulated Entities.* The Administrator determined that this action is subject to the provisions of Clean Air Act (CAA) section 307(d). *See* CAA section 307(d)(1)(V) (the provisions of CAA section 307(d) apply to "such other actions as the Administrator may determine."). This final rule affects owners and operators of electronics manufacturing facilities, fluorinated gas production facilities, electric power systems, and electrical equipment manufacturing facilities, as well as importers and exporters of pre-charged equipment and closed-cell foams. Regulated categories and entities include those listed in Table 1 of this preamble.

TABLE 1—EXAMPLES OF AFFECTED ENTITIES BY CATEGORY

Category	NAICS	Examples of affected facilities
Electronics Manufacturing	334111	Microcomputers manufacturing facilities.
	334413	Semiconductor, photovoltaic (solid-state) device manufacturing facilities.
	334419	Liquid Crystal Display (LCD) unit screens manufacturing facilities.
	334419	Micro-electro-mechanical systems (MEMS) manufacturing facilities.
Fluorinated Gas Production	325120	Industrial gases manufacturing facilities.
Electrical Equipment Use	221121	Electric bulk power transmission and control facilities.
Electrical Equipment Manufacture or Refurbishment.	33531	Power transmission and distribution switchgear and specialty transformers manufacturing facilities.
Importers and Exporters of Pre-charged Equipment and Closed-Cell Foams.	423730	Air-conditioning equipment (except room units) merchant wholesalers.
	333415	Air-conditioning equipment (except motor vehicle) manufacturing.
	336391	Motor vehicle air-conditioning manufacturing.
	423620	Air-conditioners, room, merchant wholesalers.
	443111	Household appliance stores.
	423730	Automotive air-conditioners merchant wholesalers.
	326150	Polyurethane foam products manufacturing.
	335313	Circuit breakers, power, manufacturing.
	423610	Circuit breakers merchant wholesalers.

Table 1 of this preamble is not intended to be exhaustive, but rather provides a guide for readers regarding facilities likely to be affected by this action. Table 1 of this preamble lists the types of facilities that EPA is now aware could be potentially affected by the reporting requirements. Other types of facilities and companies not listed in the table could also be subject to reporting requirements. To determine whether you are affected by this action, you should carefully examine the applicability criteria found in 40 CFR part 98, subpart A and the relevant criteria in the subparts related to electronics manufacturing facilities, fluorinated gas production facilities, electric power transmission or distribution facilities, electrical equipment manufacturing or refurbishment facilities, and importers and exporters of pre-charged equipment and closed-cell foams. If you have questions regarding the applicability of this action to a particular facility, consult the person listed in the preceding **FOR FURTHER GENERAL INFORMATION CONTACT** section.

Many facilities that are affected by the final rule have greenhouse gas (GHG) emissions from multiple source categories listed in 40 CFR part 98. Table 2 of this preamble has been developed as a guide to help potential reporters in the source categories subject to this reporting rule identify the source categories (by subpart) that they may need to (1) consider in their facility applicability determination, and/or (2) include in their reporting. The table should only be seen as a guide. Additional subparts in 40 CFR part 98 may be relevant for a given reporter. Similarly, not all listed subparts are relevant for all reporters.

TABLE 2—SOURCE CATEGORIES AND RELEVANT SUBPARTS

Source category (and main applicable subpart)	Subparts recommended for review to determine applicability
Electricity Generation	Electrical Equipment Use.
Electronics Manufacturing	General Stationary Fuel Combustion.
Fluorinated Gas Production	General Stationary Fuel Combustion Suppliers of Industrial Greenhouse Gases.
Electrical Equipment Use	General Stationary Fuel Combustion.
Imports and Exports of Fluorinated GHGs Inside Pre-charged Equipment and Closed-Cell Foams.	Suppliers of Industrial Greenhouse Gases.
Electrical Equipment Manufacture or Refurbishment.	Sulfur Hexafluoride and PFCs from Electrical Equipment Manufacture and Refurbishment.
	General Stationary Fuel Combustion Imports and Exports of Fluorinated GHGs Inside Pre-charged Equipment and Closed-Cell Foams.

What is the effective date? The final rule is effective on December 31, 2010. Section 553(d) of the Administrative Procedure Act (APA), 5 U.S.C. Chapter 5, generally provides that rules may not take effect earlier than 30 days after they are published in the **Federal Register.** EPA is issuing this final rule under section 307(d)(1) of the Clean Air Act, which states: "The provisions of section 553 through 557 * * * of Title 5 shall not, except as expressly provided in this section, apply to actions to which this subsection applies." Thus, section 553(d) of the APA does not apply to this rule. EPA is nevertheless acting consistently with the purposes underlying APA section 553(d) in making this rule effective on December 31, 2010. Section 5 U.S.C. 553(d)(3) allows an effective date less than 30 days after publication "as otherwise provided by the agency for good cause found and published with the rule." As explained below, EPA finds that there is good cause for this rule to become effective on or before December 31, 2010, even if this results in an effective date fewer than 30 days from date of publication in the **Federal Register**.

While this action is being signed prior to December 1, 2010, there is likely to be a significant delay in the publication of this rule as it contains complex diagrams, equations, and charts, and is relatively long in length. As an example, EPA signed a shorter technical amendments package related to the same underlying reporting rule on October 7, 2010, and it was not published until October 28, 2010, 75 FR 66434, three weeks later.

The purpose of the 30-day waiting period prescribed in 5 U.S.C. 553(d) is to give affected parties a reasonable time to adjust their behavior and prepare before the final rule takes effect. Where, as here, the final rule will be signed and made available on the EPA Web site more than 30 days before the effective date, but where the publication is likely to be delayed due to the complexity and length of the rule, that purpose is still met. Moreover, through June 30, 2011, facilities covered by this rule may use Best Available Monitoring Methods (BAMM) for any parameter for which it is not reasonably feasible to acquire, install, or operate a required piece of monitoring equipment in a facility, or to procure measurement services from necessary providers. This will provide facilities a substantial additional period to adjust their behavior to the requirements of the final rule. Accordingly, we find good cause exists to make this rule effective on or before December 31, 2010, consistent with the purposes of 5 U.S.C. 553(d)(3).[1]

Judicial Review.

Under CAA section 307(b)(1), judicial review of this final rule is available only by filing a petition for review in the U.S. Court of Appeals for the District of Columbia Circuit by January 31, 2011. Under CAA section 307(d)(7)(B), only an objection to this final rule that was raised with reasonable specificity during the period for public comment can be raised during judicial review. This section also provides a mechanism for EPA to convene a proceeding for reconsideration, "[i]f the person raising an objection can demonstrate to EPA that it was impracticable to raise such objection within [the period for public comment] or if the grounds for such objection arose after the period for public comment (but within the time specified for judicial review) and if such objection is of central relevance to the outcome of this rule." Any person seeking to make such a demonstration to EPA should submit a Petition for Reconsideration to the Office of the Administrator, Environmental Protection Agency, Room 3000, Ariel Rios Building, 1200 Pennsylvania Ave., NW., Washington, DC 20004, with a copy to the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section, and the Associate General Counsel for the Air and Radiation Law Office, Office of General Counsel (Mail Code 2344A), Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20004. Note, under CAA section 307(b)(2), the requirements established by this final rule may not be challenged separately in any civil or criminal proceedings brought by EPA to enforce these requirements.

Acronyms and Abbreviations. The following acronyms and abbreviations are used in this document.

ASTM American Society for Testing and Materials
BAMM Best Available Monitoring Methods
BLS Bureau of Labor Statistics
CAA Clean Air Act
CARB California Air Resources Board
CBI confidential business information
CFC chlorofluorocarbon
CFR Code of Federal Regulations
CO_2 carbon dioxide
CO_2e CO_2-equivalent
DE destruction efficiency
DRE destruction or removal efficiency
ECD electron capture detector
EF_C emission factor for the valve-hose combination
EIA Economic Impact Analysis

[1] We recognize that this rule could be published at least 30 days before December 31, 2010, which would negate the need for this good cause finding, and we plan to request expedited publication of this rule in order to decrease the likelihood of a printing delay. However, as we cannot know the date of publication in advance of signing this rule, we are proceeding with this good cause finding for an effective date on or before December 31, 2010.

EO Executive Order
EPA U.S. Environmental Protection Agency
FERC Federal Energy Regulatory Commission
F–GHG fluorinated greenhouse gas
FTIR fourier transform infrared (spectroscopy)
FID flame ionization detector
GC gas chromatography
GHG greenhouse gas
GWP global warming potential
HAP hazardous air pollutant(s)
HCFC hydrochlorofluorocarbon
HFC hydrofluorocarbon
HFE hydrofluoroether
HTF heat transfer fluid
IBR incorporation by reference
ICR information collection request
IPCC Intergovernmental Panel on Climate Change
kg kilograms
LCD liquid crystal displays
LED light-emitting diode
MEMS micro-electro-mechanical systems
$MMTCO_2e$ million metric tons carbon dioxide equivalent
MRR mandatory greenhouse gas reporting rule
MS mass spectrometry
MVAC motor vehicle air conditioner
N_2O nitrous oxide
NACAA National Association of Clean Air Agencies
NAICS North American Industry Classification System
NERC North American Energy Reliability Corporation
NESHAP National Emissions Standard for Hazardous Air Pollutants
NF_3 nitrogen trifluoride
NMR nuclear magnetic resonance
NRECA National Rural Electric Cooperative Association
NSPS New Source Performance Standards
NTTAA National Technology Transfer and Advancement Act of 1995
OMB Office of Management and Budget
PFC perfluorocarbon
POHC principal organic hazardous constituent
PSD Prevention of Significant Deterioration
PSEF process-vent-specific emission factor
PV photovoltaic cells
QA quality assurance
QA/QC quality assurance/quality control
QMS Quadrapole Mass Spectroscopy
R&D research and development
RF radio frequency
RFA Regulatory Flexibility Act
RGGI Regional Greenhouse Gas Initiative
RIA Regulatory Impact Analysis
RPS remote plasma source
SBREFA Small Business Regulatory Enforcement Fairness Act
SSM startup, shutdown, and malfunction
SF_6 sulfur hexafluoride
TCR The Climate Registry
TSD technical support document
U.S. United States
UMRA Unfunded Mandates Reform Act of 1995
VOC volatile organic compound(s)
WCI Western Climate Initiative

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I. Background

A. Organization of This Preamble

This preamble is broken into several large sections, as detailed in the Table of Contents. The paragraphs below describe the layout of the preamble and provide a brief summary of each section.

The first section of this preamble contains the basic background information about the origin of this rule, including a brief discussion of the rationale for revising the initially proposed requirements for subparts L, DD, and SS. This section also discusses EPA's use of our legal authority under the CAA to collect the required data, and the benefits of collecting the data.

The second section of this preamble provides a brief summary of the key design elements for each subpart. For each subpart, this section includes (1) The definition of the source category, (2) GHGs to report, (3) GHG emission calculating and monitoring methods, (4) data reporting requirements, and (5) records that must be retained. Each subpart also includes a summary of major changes since proposal and a summary of comments and responses. Please refer to the specific source category of interest for more details.

The third section provides the summary of the cost impacts, economic impacts, and benefits of this rule from the Economic Analysis. Finally, the last section discusses the various statutory and executive order requirements applicable to this rule.

B. Background on the Final Rule

This action finalizes monitoring and reporting requirements for the following five source categories: Electronics manufacturing, fluorinated gas production, electrical equipment use, electrical equipment manufacture and refurbishment, and importers and exporters and pre-charged equipment and closed-cell foams.

EPA initially proposed reporting requirements for electronics, fluorinated GHG production, and electrical equipment use on April 12, 2009 (74 FR 16448) as part of a larger rulemaking effort to establish a GHG reporting program for all sectors of the economy. In that proposal, EPA also requested comment on requiring reporting of the quantities of fluorinated GHGs imported and exported inside pre-charged equipment and foams. However, EPA did not include requirements for these source categories in the Final Mandatory GHG Reporting Rule (Part 98) (40 CFR part 98), which was signed by EPA Administrator Lisa Jackson on September 22, 2009 and published in the **Federal Register** on October 30, 2009 (74 FR 56260).

EPA deferred action on these source categories because EPA received a number of lengthy, detailed comments regarding the proposed requirements for these source categories. These comments, which are described in more detail in the discussions of the individual source categories in the April 12, 2010 proposed rule, raised concerns about the costs and technical feasibility of implementing subparts I and L as initially proposed, requested clarification of how "facility" should be interpreted under subpart DD, and both favored and opposed a requirement to report fluorinated GHGs contained in

imported and exported pre-charged equipment and closed-cell foams.

EPA recognized the concerns raised by stakeholders, and decided to re-propose significant pieces of these subparts. The revised proposed rule was published in the **Federal Register** on April 12, 2010. A public hearing on the proposed rule was held on April 20, 2010 in Washington, DC, and the 60-day public comment period ended on June 11, 2010.

For subparts I and L this rule incorporates a number of technical changes including, but not limited to, the addition of different methodologies that provide improved emissions coverage at a lower cost burden to facilities as compared to the initial April 2009 proposal. Where aspects of the initial proposals for subparts I and L are retained in this rule, such as in the basic mass-balance methodology for subpart L (as an option for some facilities) and in many of the equations for subpart I, this rule adds more flexibility in how and how frequently the underlying data are gathered. In addition, EPA is requiring facilities to report emissions from manufacture or refurbishment of electrical equipment and to report the quantities of fluorinated GHGs imported and exported inside pre-charged equipment and foams.

We have concluded that the monitoring approaches required in this rule, which combine direct measurement and facility-specific calculations, effectively balance accuracy and costs, and that they are warranted because the resulting data will enable EPA to analyze and develop a range of potential CAA GHG policies and programs. A consistent and accurate data set is crucial to serve this intended purpose.

Under this rule, facilities and suppliers will begin data collection in 2011 following the methods outlined in this rule and will submit data to EPA by March 31, 2012. EPA is allowing facilities and suppliers to use the Best Available Monitoring Methods (BAMM) through June 30, 2011 without submitting a petition to EPA. EPA is also allowing facilities to request an extension for the use of BAMM beyond the initial 6-month period. For details on BAMM extension requests, including their due dates and required contents, refer to the Monitoring and QA/QC Requirements section of each subpart and to the preamble discussions for subparts I and L.

C. Legal Authority

EPA is finalizing requirements for five source categories (electronics manufacturing, production of fluorinated gases, use of electrical transmission and distribution equipment, manufacture or refurbishment of electrical equipment, and imports and exports of pre-charges equipment and closed cell-foams) under its existing CAA authority; specifically, authorities provided in CAA section 114. As discussed in detail in Sections I.C and II.Q of the preamble to the 2009 final rule (74 FR 56260, October 30, 2009), CAA section 114(a)(1) provides EPA with broad authority to require emissions sources, persons subject to the CAA, manufacturers of process or control equipment, or persons whom the Administrator believes may have necessary information to monitor and report emissions and provide such other information the Administrator requests for the purposes of carrying out any provision of the CAA. Further information is available in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Legal Issues" (available in EPA–HQ–OAR–2008–0508)

II. Requirements for Specific Source Categories

A. Overview of the Greenhouse Gas Reporting Program

On October 30, 2009, the U.S. Environmental Protection Agency (EPA) published a rule for the mandatory reporting of greenhouse gases (GHG) (also referred to as 40 CFR part 98) from large GHG emissions sources in the United States. Implementation of 40 CFR Part 98 is referred to as the Greenhouse Gas Reporting Program (GHGRP).

The rule requires reporting of GHG emissions and supply from certain sectors of the economy, and apply to certain downstream facilities that emit GHGs, as well as to certain upstream suppliers of fossil fuels and industrial GHGs. The regulations require annual reporting of GHGs including carbon dioxide (CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and other fluorinated compounds (e.g., hydrofluoroethers (HFEs)).

Part 98 regulations require only that source categories subject to the rule monitor and report GHGs in accordance with the methods specified in the individual subparts. In this action, EPA is adding five source categories to part 98. For a list of the specific GHGs to be reported and the GHG calculation procedures, monitoring, missing data procedures, recordkeeping, and reporting required for facilities subject to subparts I, L, DD, QQ, and SS see the relevant subpart description below.

B. Overview of Confidentiality Determination for Data Elements in the Greenhouse Gas Reporting Rules

This action does not address whether data reported under subparts I, L, DD, QQ, or SS will be treated as confidential business information (CBI). EPA published a proposed confidentiality determination on July 7, 2010 (75 FR 39094) which addressed this issue. In that action, EPA proposed which specific data elements would be treated as CBI and which data elements must be available to the public under CAA section 114. EPA has received several comments on the proposal, and is in the process of considering these comments. A final determination will be issued before any data is released, and the final determination will include all of the data elements under these subparts.

C. Summary of Changes to the General Provisions of the General Provisions of 40 CFR Part 98 Related to the Addition of Subparts I, L, DD, QQ, and SS

Changes to Applicability. We are making changes to 40 CFR 98.3(c)(5) to be consistent with previous revisions that were made on July 12, 2010. On July 12, 2010 (75 FR 39736), we made a number of conforming changes to the General Provisions (subpart A to part 98) to accommodate the addition of new source categories that were being added to Part 98. In the July 12, 2010 notice, we added Tables A–3 through A–5 to replace the list of source categories and supplier categories in 40 CFR 98.2(a)(1), (a)(2), and (a)(4), respectively. Under this revised approach, as new subparts are adopted, a new row is added to the appropriate table for the year in which reporting is required to commence for the new source category or supplier category. As a conforming change, the text of 40 CFR 98.3(c)(4) was reworded to refer to "Table A–3 and Table A–4" instead of "subparts C–JJ."

In this action, we are amending Tables A–3, A–4, and A–5 to subpart A to add entries for five subparts: DD, SS, I, L, and QQ. Because we are now adding a new supplier category to the reporting requirements, we are also making a conforming change to 40 CFR 98.3(c)(5)(i) and (ii) to replace the reference to "subparts KK through PP" with a reference to "Table A–5." This conforming change does not alter any reporting requirements.

The following source categories have been added to the list of source categories in Table A–3 to subpart A because they have a production capacity

or gas consumption threshold rather than a CO_2e emission threshold.

• Electric power transmission or distribution facilities that include the total nameplate capacity located within the facility, when added to the total nameplate capacity of SF_6 and PFC containing equipment that is not located within the facility but is under common ownership or control, exceeds 17,820 pounds of sulfur hexafluoride (SF_6)or perfluorocarbons (PFCs) (subpart DD).

• Electric power equipment manufacturing or refurbishing facilities with total annual SF_6 and PFC purchases (combined) that exceed 23,000 pounds per year (subpart SS).

The following source categories are subject to the rule if facility emissions are equal to or greater than 25,000 metric tons CO_2e per year. Therefore, these source categories have been added to the list of emission threshold source categories referenced in Table A–4 to subpart A.

• Fluorinated gas production facilities whose emissions would exceed 25,000 $mtCO_2e$ in the absence of control technologies (subpart L).

• Electronics manufacturing facilities whose emissions would exceed 25,000 $mtCO_2e$ in the absence of control technologies (subpart I).

For all of these facilities, whether they are listed in Table A–3 or A–4 to subpart A, the annual GHG report must cover stationary fuel combustion sources, miscellaneous uses of carbonates, and all applicable source categories listed in Table A–3 and Table A–4 to subpart A.

Importers and exporters of certain types of pre-charged equipment or closed-cell foam products containing fluorinated GHGs, N_2O, or CO_2 (subpart QQ) have been added to Table A–5 to subpart A because they are suppliers of GHGs.

As is true for the source categories covered by the final Part 98, a facility or supplier in any of these source categories may cease reporting if their emissions are less than 25,000 $mtCO_2e$ per year for five consecutive years or less than 15,000 $mtCO_2e$ per year for three consecutive years, subject to the procedures at 40 CFR 98.2(i).

Reporting CO_2e emissions. EPA is adding a paragraph to 40 CFR 98.3(c)(4) to clarify that facilities that emit fluorinated GHGs are required to calculate and report CO_2e emissions only for those fluorinated GHGs that are listed in Table A–1 of this subpart, not for other fluorinated GHGs. However, it is important to note that fluorinated GHG emitters are still required to report all fluorinated GHGs emitted under 40 CFR 98.3(c)(4)(iii) (in metric tons of GHG). This change clarifies that emitters are not required to develop GWPs for fluorinated GHGs that are not listed in Table A–1 and ensures consistent reporting of such fluorinated GHGs among different reporters. The change is being made in parallel with a similar change to 40 CFR 98.3(c)(5) through a separate rulemaking.

Definitions. EPA is revising one definition in 40 CFR part 98 subpart A and is adding a number of definitions applicable to specific source categories to the corresponding subparts. The definition that is being revised in subpart A is the definition of "destruction efficiency," which is being revised to be expressed in tons of specific greenhouse gases rather than tons of CO2e. This revision and the rationale for it are discussed in more detail in Section II.E of this preamble.

The definitions that are applicable to specific source categories are not being added to the definitions section in 40 CFR part 98 subpart A because they do not have broader applicability to part 98. EPA has sought to avoid any conflict between these subpart-specific definitions and the definitions in Subpart A. In one instance, for electric power systems, EPA is applying a category-specific definition of facility rather than the general definition of facility in the General Provisions. The reasons for this source-category-specific definition of facility are set forth in Section II.G of this preamble. The remaining definitions are intended as supplements to the definitions section in the General Provisions. EPA does not expect these definitions to create conflicts with the General Provisions. To the extent regulated entities are in doubt as to which definition applies, they should assume that the category-specific definitions are controlling.

Incorporation by Reference (IBR). We are amending 40 CFR 98.7 (incorporation by reference) to include standard methods used in the subparts. In particular, for subpart I, we are adding the following three standards: the 2006 International SEMATECH Manufacturing Initiative's Guideline for Environmental Characterization of Semiconductor Process Equipment (International SEMATECH #06124825A–ENG), the 2001 International SEMATECH's Guidelines for Environmental Characterization of Semiconductor Equipment (International SEMATECH #01104197A–XFR), and EPA's Protocol for Measuring Destruction or Removal Efficiency (DRE) of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing, Version 1, EPA 430–R–10–003. These standards are referenced in 40 CFR 98.94 (Monitoring and QA/QC requirements for subpart I), 40 CFR 98.96 (Data reporting requirements for subpart I), 40 CFR 98.97 (Records that must be retained for subpart I), and 40 CFR 98.98 (Definitions for subpart I).

In addition, for subpart L, we are revising the paragraphs listing several ASME standards and one ASTM standard that are already contained in 40 CFR 98.7 to indicate that these standards are also referenced by 40 CFR 98.124 (Monitoring and QA/QC requirements in 40 CFR part 98, subpart L, fluorinated gas production). We are also adding the following seven standards: ASTM D2879–97 (Reapproved 2007) Standard Test Method for Vapor Pressure-Temperature Relationship and Initial Decomposition Temperature of Liquids by Isoteniscope; ASTM D7359–08 Standard Test Method for Total Fluorine, Chlorine and Sulfur in Aromatic Hydrocarbons and Their Mixtures by Oxidative Pyrohydrolytic Combustion followed by Ion Chromatography Detection (Combustion Ion Chromatography-CIC); Tracer Gas Protocol for the Determination of Volumetric Flow Rate Through the Ring Pipe of the Xact Multi-Metals Monitoring System (also known as Other Test Method 24); Approved Alternative Method 012: An Alternate Procedure for Stack Gas Volumetric Flow Rate Determination (Tracer Gas); the Emission Inventory Improvement Program, Volume II: Chapter 16, Methods for Estimating Air Emissions from Chemical Manufacturing Facilities; Protocol for Equipment Leak Emission Estimates; and EPA's Protocol for Measuring Destruction or Removal Efficiency (DRE) of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing, Version 1, EPA 430–R–10–003. These are referenced in 40 CFR 98.123 (Calculating GHG emissions for subpart L), 40 CFR 98.124 (Monitoring and QA/QC requirements for subpart L), and 40 CFR 98.128 (Definitions for subpart L).

D. Electronics Manufacturing (Subpart I)

1. Summary of the Final Rule

Source Category Definition. The electronics manufacturing source category consists of any of the following five production processes. Facilities that use these processes include, but are not limited to, those facilities that manufacture micro-electro-mechanical systems (MEMS), liquid crystal displays (LCDs), photovoltaic cells (PV), and semiconductors (including light-emitting diodes).

• Electronics manufacturing production processes in which the etching process uses plasma-generated fluorine atoms and other reactive fluorine-containing fragments, which chemically react with exposed thin-films (e.g., dielectric, metals) or substrate (e.g., silicon) to selectively remove portions of material.

• Electronics manufacturing production processes in which chambers used for depositing thin films are cleaned periodically using plasma-generated fluorine atoms and other reactive fluorine-containing fragments.

• Electronics manufacturing production process in which wafers are cleaned using plasma generated fluorine atoms or other reactive fluorine-containing fragments to remove residual material from wafer surfaces, including the wafer edge.

• Electronics manufacturing production processes in which the chemical vapor deposition process (CVD) or other manufacturing processes use N_2O.

• Production processes which use fluorinated GHGs as heat transfer fluids to cool process equipment, to control temperature during device testing, to clean substrate surfaces and other parts, and for soldering (e.g., vapor phase reflow). Heat transfer fluids commonly used in electronics manufacturing include those sold under the trade names "Galden®" and "Fluorinertsu.™"

Reporting Threshold. Electronics manufacturing facilities that meet the applicability criteria in the General Provisions (40 CFR 98.2) must report GHG emissions. Electronics manufacturing facilities covered by subpart I are those that have emissions equal to or greater than 25,000 $mtCO_2e$. For electronics manufacturing, EPA is requiring that uncontrolled emissions be used for purposes of determining whether a facility's emissions are equal to or greater than 25,000 $mtCO_2e$.[2] Facilities must determine if they meet the applicability criteria in the General Provisions (40 CFR 98.2(a)(2)) by using the methods in 40 CFR 98.91 and summarized as follows:

• Semiconductor, MEMS, and LCD manufacturing facilities are required to use gas specific emission factors and 100 percent of annual manufacturing capacity. Because heat transfer fluids are widely used in semiconductor manufacturing, to account for emissions from heat transfer fluids, semiconductor manufacturing facilities are required to add 10 percent of total clean and etch emissions at a facility to their total estimate. For semiconductor and LCD manufacturing facilities, the gas specific emission factors are consistent with the 2006 IPCC Tier 1 emission factors. For MEMS manufacturing facilities, because there is no IPCC factor available, the emission factor was developed by EPA and is based on the IPCC Tier 2b SF_6 emission factor for semiconductors.[3]

• PV manufacturing facilities are required to multiply annual fluorinated GHG purchases or consumption by the gas-appropriate 100-year GWPs (provided in Table A–1 to subpart A of this part).

It is important to clarify that these methods for determining whether a manufacturer exceeds the threshold are different from those used to calculate and report annual GHG emissions. The methods for calculating GHG emissions and consumption for reporting purposes are provided in the following paragraphs.

GHGs to Report. Each facility must calculate and report the following GHG emissions and consumption:

• Fluorinated GHG emissions from plasma etching, chamber cleaning, and wafer cleaning.

• N_2O emissions from chemical vapor deposition and other electronics manufacturing processes.

• Fluorinated GHG emissions from heat transfer fluid use.

• Consumption for all fluorinated GHGs and N_2O including gases used for manufacturing processes other than those listed above.

• CO_2, CH_4, and N_2O combustion emissions from stationary combustion units by following the requirements of 40 CFR part 98, subpart C (General Stationary Fuel Combustion Sources).

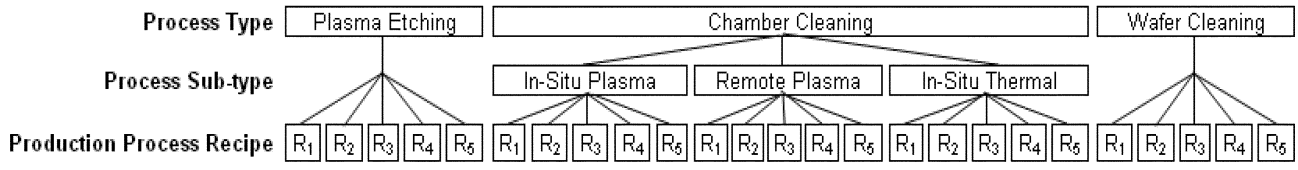
GHG Emissions Calculation and Monitoring. To calculate fluorinated GHG and N_2O emissions from electronics manufacturing, reporters must use the following methods, as appropriate for each electronics manufacturing facility (depending on the product manufactured, i.e., MEMS, LCD, PV, or semiconductors).

Fluorinated GHG Emissions

All electronics manufacturing facilities are required to calculate fluorinated GHG emissions from etch and clean processes by estimating emissions of input fluorinated GHGs and of by-product fluorinated GHGs. This is done by applying utilization factors and by-product formation factors (collectively referred to as "emission factors" below) to the consumption of each fluorinated GHG by each process type, process sub-type or recipe, as appropriate. However, the methods prescribed for use by different types of electronics manufacturing facilities differ in the values of these emission factors, the level of aggregation to which the factors are applied (process type, process sub-type, or recipe), and whether defaults or recipe-specific factors are applied. This framework is discussed in detail in the following paragraphs.

To calculate and report fluorinated GHG emissions, reporters must adhere to the typology shown in Figure 1 of this preamble.

Figure 1. Typology for Calculating Fluorinated GHG Emissions from Electronics Manufacturing



[2] For purposes of calculating and reporting emissions for this subpart, facilities may report controlled emissions if they abide by provisions in 40 CFR 98.94(f) of this rule.

[3] For a more detailed explanation of the MEMS default factor, please refer to the Electronics Manufacturing TSD (EPA–HQ–OAR–2009–0927).

At the top of the typology figure are process types, which consist of plasma etching, chamber cleaning, and wafer cleaning. The second level in the figure consists of process sub-types, which are identified for only the chamber cleaning process type. As explained in Section II.D.2 of this preamble (Summary of Major Changes Since the Proposal) and Section II.D.3 of this preamble (Summary of Comments and Responses), EPA is only establishing sub-types for the chamber cleaning process type because sufficient information was available for these sub-types to establish default emission factors. The three chamber cleaning process sub-types are in-situ plasma, remote plasma, and in-situ thermal cleans. The bottom of the figure displays production process recipes. Definitions are provided in the paragraphs below.

Process Type. EPA is defining a process type as a broad group of manufacturing steps used at a facility associated with substrate (e.g., wafer) processing during device manufacture for which fluorinated GHG emissions and fluorinated GHG usages are calculated and reported. The process types are plasma etching, chamber cleaning, and wafer cleaning.[4]

Process Sub-type. EPA is defining a process sub-type as a set of similar manufacturing steps, more closely related within a broad process type. (For clarity, EPA is referring to what was previously termed process categories in the April 2010 proposed rule (75 FR 18652) as process sub-types).

In situ plasma process sub-type consists of the cleaning of thin-film production chambers, after processing substrates, with a fluorinated GHG cleaning reagent that is dissociated into its cleaning constituents by a plasma generated inside the chamber where the films are produced.

Remote plasma process sub-type consists of the cleaning of thin-film production chambers, after processing substrates, with a fluorinated GHG cleaning reagent dissociated by a remotely located (e.g., upstream) plasma source.

In situ thermal process sub-type consists of the cleaning of thin-film production chambers, after processing substrates, with a fluorinated GHG cleaning reagent that is thermally dissociated into its cleaning constituents inside the chamber where one or more thin films are produced.

Production Process Recipe (Recipe). EPA has included definitions of "individual recipe" and "similar" with respect to recipes in this final rule as an aid to understanding the portions of the rule where a facility is required or allowed to calculate emissions on a recipe-specific basis. The final rule uses the term "individual recipe" to refer to a specific combination of gases, under specific conditions of reactor temperature, pressure, flow, radio frequency (RF) power and duration, used repeatedly to fabricate a specific feature on a specific film or substrate. EPA is also introducing the term "similar," with respect to recipes, to refer to recipes that are composed of the same set of chemicals and have the same flow stabilization times and where the documented differences, considered separately, in reactor pressure, individual gas flow rates, and applied RF power are less than or equal to plus or minus 10 percent. For purposes of comparing and documenting recipes that are similar, facilities may use either the best known method provided by an equipment manufacturer or the process of record, for which emission factors for either have been measured (see the Electronics Manufacturing TSD (EPA–HQ–OAR–2009–0927) for supporting information). Generally, where facilities develop recipe-specific utilization and by-product formation rates, they may apply the utilization and by-product formation rates developed for an individual recipe to any "similar recipe.[5]"

Electronics manufacturing facilities must calculate and report emissions of each fluorinated GHG used at the facility by adhering to typologies discussed and defined earlier in this section, as appropriate, and using the following methods based on the use of (1) Gas consumption, and (2) emission factors for fluorinated-GHG utilization and by-product formation rates. Where facilities are required to estimate and calculate emissions for sub-types or recipes, they are also required to report those emissions in aggregate by process type.

The required methods are summarized in Table 3 of this preamble. EPA is naming the methodologies described below using a format similar to that used in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. While EPA's methodologies may be viewed generally as an extension from and building upon the IPCC's methods, EPA's approach is distinct in terms of its applicability and level of detail.

TABLE 3—SUMMARY OF FINAL PROVISIONS FOR ELECTRONICS MANUFACTURING FACILITIES TO ESTIMATE AND REPORT FLUORINATED GHG EMISSIONS FROM ETCHING AND CLEANING PROCESSES

Product manufactured	Manufactured wafer size	Annual capacity[a]	Required methodology	Optional methodology
PV, MEMS, LCDs.	NA	NA	Modified Tier 2b—Use EPA default emission factors[b] for plasma etching and chamber cleaning process types.[c]	Tier 3—Use recipe-specific emission factors for all production processes that use fluorinated GHGs.
Semiconductors	300 mm and smaller.	Less than or equal to 10,500 m^2 of substrate.	Tier 2c—Use EPA default emission factors for plasma etching, chamber cleaning (including in-situ plasma cleaning, remote plasma cleaning, in-situ thermal cleaning sub-types), and wafer cleaning process types.[c]	Tier 3—Use recipe-specific emission factors for all production processes that use fluorinated GHGs.

[4] As defined in the final rule, the plasma etching process type consists of any production process using fluorinated GHG reagents to selectively remove materials that have been deposited on a substrate during electronics manufacturing. Also as defined in the final rule, the wafer cleaning process type consists of any production process using fluorinated GHG reagents to clean wafers at any step during production.

[5] To be included in a set of similar recipes for the purposes of this subpart, a recipe must be similar to the recipe in the set for which recipe-specific utilization and by-product formation rates have been measured.

TABLE 3—SUMMARY OF FINAL PROVISIONS FOR ELECTRONICS MANUFACTURING FACILITIES TO ESTIMATE AND REPORT FLUORINATED GHG EMISSIONS FROM ETCHING AND CLEANING PROCESSES—Continued

Product manufactured	Manufactured wafer size	Annual capacity[a]	Required methodology	Optional methodology
Semiconductors	300 mm and smaller.	Greater than 10,500 m^2 of substrate.	Tier 2d—Use EPA default emission factors for chamber cleaning (including in-situ plasma cleaning, remote plasma cleaning, in-situ thermal cleaning sub-types), and wafer cleaning process types, and recipe-specific emission factors for plasma etching.[c]	Tier 3—Use recipe-specific emission factors for all production processes that use fluorinated GHGs.
Semiconductors	Larger than 300 mm.	NA	Tier 3—Use recipe-specific emission factors for all production processes that use fluorinated GHG.	None.

[a] Manufacturing capacity is 100 percent of annual manufacturing capacity of a facility as determined by summing the area of maximum designed substrate starts of a facility per month over the reporting period.
[b] These emission factors are consistent with emission factors published in the 2006 IPCC Guidelines.
[c] Where default emission factors are not provided in Tables I–3, I–4, I–5, I–6, or I–7 for a particular fluorinated GHG and process type or subtype combination, a facility must either use utilization and by-product formation rates of 0 or use directly measured recipe-specific emission factors using the procedures of this subpart.

Gas Consumption

Electronics manufacturing facilities must use the following methods to calculate and apportion fluorinated GHG consumption:

• Total annual gas consumption, for all fluorinated GHGs, calculated using the facility's purchase records, disbursements, gas container inventories, and gas- and facility-specific heel factors.

• Total annual gas consumption apportioning factors developed using facility-specific engineering models based on quantifiable metrics (i.e., a metric that is proportional to gas usage) of fluorinated GHG-using activity. Facilities must document these models in their site GHG Monitoring Plans (as required under 40 CFR 98.3) and verify them. At a minimum, facilities must verify and document the information listed in 40 CFR 98.94(c) and 40 CFR 98.97(c), respectively. This information must be updated each reporting year.

Fluorinated GHG Utilization and By-Product Formation Rates (Emission Factors)

Electronics manufacturing facilities must use the following methods for applying (and in some cases, developing) fluorinated GHG emission factors, as appropriate. Where a facility uses less than 50 kg of a fluorinated GHG in one reporting year, rather than calculate emissions using an emission factor, they may report the emissions of that gas as equal to consumption.

Facilities That Manufacture MEMS, LCDs, and PV

Facilities that manufacture MEMS, LCDs, and PV are required to calculate and report their fluorinated GHG emissions from two process types: Plasma etching and chamber cleaning. These facilities are required to use default emission factors presented in Tables I–5, I–6, or I–7 to subpart I for MEMS, LCDs, PV, respectively. EPA is using the term "Modified Tier 2b Method" to refer to this methodology.

A facility may use directly measured recipe-specific emission factors in lieu of defaults for all production processes that use fluorinated GHGs only if the recipe-specific emission factors are measured using the 2006 ISMI Guidelines, International SEMATECH #06124825A–ENG, with limited exceptions.[6] The facility must develop recipe-specific factors for each individual recipe except that a factor developed for one individual recipe may be applied to similar recipes. In a given reporting year, a facility must develop new recipe-specific emission factors only for recipes which are not similar to any recipe used in a previous reporting year. Facilities that choose the recipe-specific approach must also aggregate the recipe-specific emissions and report the total emissions by process type (plasma etching and chamber cleaning). In addition, where a facility reports using recipe-specific emission factors, they are required to report the film or substrate that was etched/cleaned and the feature type that was etched.

A facility that is using a method based on default emission factors, but uses a fluorinated GHG for a particular process type for which default emission factors are not provided in Tables I–5, I–6, or I–7, must either use utilization and by-product formation rates of 0 or, in that particular instance, use directly measured recipe-specific emission factors measured using the 2006 ISMI Guidelines, International SEMATECH #06124825A–ENG, with limited exceptions.[7] The facility must develop and report the recipe-specific emission factors using the same procedures as discussed in the paragraph above.

With the exception of where default emission factors are not provided in Tables I–5, I–6, or I–7 for a particular process type, EPA is prohibiting a facility from creating and using a hybrid method to ensure consistent methods of calculating and reporting emissions. This means that a single facility must choose between using only default emission factors or using recipe-specific emission factors for all process types; hybrid methods using both default emission factors and recipe-specific factors within the same reporting year are not permitted. This restriction will enable EPA to analyze emissions and trends using a consistent set of data.

Facilities That Manufacture Semiconductors

EPA is requiring facilities that manufacture semiconductors to use a method to calculate and report their fluorinated GHG emissions which varies depending on the size of wafers that the facility is manufacturing (i.e., whether the facility manufactures wafers measuring 300 mm and less or greater than 300 mm). This distinction was proposed in the April 2010 proposed rule (75 FR 18652). For facilities that manufacture wafers measuring 300 mm and less, EPA is requiring the use of one of two following methods for calculating and reporting emissions, depending on the facility's manufacturing capacity: (1) A method for facilities that have an annual manufacturing capacity that is less than or equal to 10,500 m^2 of substrate, and (2) a method for those

[6] EPA is permitting facilities to use emission factors measured using the 2001 ISMI Guidelines, International SEMATECH #01104197A–XFR, provided the emissions factors were measured prior to January 1, 2007. Documentation for the measurements is required.

[7] See footnote 6.

that have an annual manufacturing capacity greater than 10,500 m^2 of substrate. A facility's manufacturing capacity (as calculated using Equation I–5 of subpart I) is 100 percent of the maximum designed substrate starts, expressed as surface area, for the reporting year. This distinction in manufacturing capacity was part of EPA's initial April 2009 proposed rule (74 FR 16448).

Semiconductor Manufacturing Facilities That Fabricate Devices on Wafers Measuring 300 mm or Less in Diameter and That Have an Annual Manufacturing Capacity of Less Than or Equal to 10,500 m^2 of Substrate

Semiconductor manufacturing facilities that fabricate devices on wafers measuring 300 mm or less in diameter and that have an annual manufacturing capacity of less than or equal to 10,500 m^2 of substrate [8] must calculate and report their fluorinated GHG emissions using the following five process types and sub-types, and the corresponding default emission factors presented in Tables I–3 and I–4 to subpart I:

- Plasma etching process type.
- Chamber cleaning process type which includes the following three process sub-types:
  - —In-situ plasma chamber cleaning process sub-type.
  - —Remote plasma chamber cleaning process sub-type.
  - —In-situ thermal chamber cleaning process sub-type.
- Wafer cleaning process type.

Default emission factors are differentiated by 150/200 mm and 300 mm wafer technologies. The default emission factors were developed using the data provided in Table 5 of the report Draft Emission Factors for Refined Semiconductor Manufacturing Process Categories (EPA–HQ–OAR–2009–0927–0073). EPA is using the term "Tier 2c Method" to refer to this methodology.

A facility may use directly measured recipe-specific emission factors for each individual recipe or recipe that is not a similar recipe in lieu of defaults only if the recipe-specific emission factors are measured using the 2006 ISMI Guidelines, International SEMATECH #06124825A–ENG, with limited exceptions.[9] The facility must develop recipe-specific factors for each individual recipe except that factors developed for one individual recipe may be applied to similar recipes. In a given reporting year, a facility must develop recipe-specific emission factors only for new recipes which are not similar to any recipe used in a previous reporting year. Facilities that choose the recipe-specific approach must also aggregate the recipe-specific emissions and report the total emissions by process type (plasma etching, chamber cleaning, and wafer cleaning). In addition, where a facility reports using recipe-specific emission factors, they are required to report the film or substrate that was etched/cleaned and the feature type that was etched.

A facility that is using a method based on default emission factors, but uses a fluorinated GHG for a particular process type or sub-type for which default emission factors are not provided in Tables I–3 and I–4, must either use utilization and by-product formation rates of 0 or, in that particular instance, use directly measured recipe-specific emission factors measured using the 2006 ISMI Guidelines, International SEMATECH #06124825A–ENG, with limited exceptions.[10] The facility must develop and report the recipe-specific emission factors using the same procedures as discussed in the paragraph above.

With the exception of where default emission factors are not provided in the Tables I–3 and I–4 for a particular process type or sub-type, a facility must use either default emission factors only, or recipe-specific emission factors only for all process types and sub-types; creating and using a hybrid method is not permitted for the reasons discussed earlier in this section.

Semiconductor Manufacturing Facilities That Fabricate Devices on Wafers Measuring 300 mm or Less in Diameter and That Have an Annual Manufacturing Capacity of Greater Than 10,500 m^2 of Substrate

Semiconductor manufacturing facilities that fabricate devices on wafers measuring 300 mm or less in diameter and that have an annual manufacturing capacity greater than 10,500 m^2 of substrate (the "largest" semiconductor manufacturing facilities) [11] must calculate and report their emissions using a combination of default emission factors and directly measured recipe-specific emission factors.

For the following four process types and sub-types, facilities must calculate emissions using only the default emission factors in Tables I–3 and I–4 of subpart I:

- Chamber cleaning process type:
  - —In-situ plasma chamber cleaning process sub-type.
  - —Remote plasma chamber cleaning process sub-type.
  - —In-situ thermal chamber cleaning process sub-type.
- Wafer cleaning process type.

Default emission factors are differentiated by 150/200 mm and 300 mm wafer technologies. These emission factors, which are the same emission factors as specified for the Tier 2c method, were developed using the data provided in Table 5 of the report Draft Emission Factors for Refined Semiconductor Manufacturing Process Categories (EPA–HQ–OAR–2009–0927–0073). EPA is using the term "Tier 2d Method" to refer to this methodology.

For the plasma etching process type, facilities must calculate emissions using only directly measured recipe-specific emission factors. The facility must develop recipe-specific factors for each individual recipe except that factors developed for one individual recipe may be applied to similar recipes. In a given reporting year, a facility must develop new recipe-specific emission factors only for recipes which are not similar to any recipe used in a previous reporting year. Plasma etching recipe-specific emission factors must be measured using the 2006 ISMI Guidelines, International SEMATECH #06124825A–ENG, with limited exemptions.[12] Facilities must also aggregate the recipe-specific emissions and report the total emissions by plasma etching process type. In addition, the facility is required to report the film or substrate that was etched/cleaned and the feature type that was etched for recipes used.

A facility also has the option of using directly measured recipe-specific emission factors in lieu of default emission factors for the chamber and wafer cleaning process types, but only if the recipe-specific factors are measured using the 2006 ISMI Guidelines, International SEMATECH #06124825A–ENG, with limited exceptions.[13] The facility must develop recipe-specific factors for each individual recipe except that factors developed for one individual recipe may be applied to similar recipes. In a given reporting year, a facility must develop new recipe-

[8] As calculated in Equation I–5 of subpart I, manufacturing capacity is 100 percent of annual manufacturing capacity of a facility as determined by summing the area of maximum designed substrate starts of a facility per month over the reporting period.

[9] See footnote 6.

[10] See footnote 6.

[11] EPA estimates that the largest semiconductor facilities comprise 29 facilities out of 175 total semiconductor facilities. See the Electronics Manufacturing TSD available in the docket (EPA–HQ–OAR–2009–0927) for EPA's analysis.

[12] See footnote 6.

[13] See footnote 6.

specific emission factors only for recipes which are not similar to any recipe used in a previous reporting year. Facilities that choose the recipe-specific approach for the chamber and wafer cleaning process types must also aggregate the recipe-specific emissions and report the total emissions by those process types. In addition, where a facility reports using recipe-specific emission factors, they are required to report the film or substrate that was etched/cleaned and the feature type that was etched.

A facility that is using a method based on default emission factors, but uses a fluorinated GHG for a particular process type or sub-type for which default emission factors are not provided in Tables I–3 and I–4, must either use utilization and by-product formation rates of 0 or, in that particular instance, use directly measured recipe-specific emission factors measured using the 2006 ISMI Guidelines, International SEMATECH #06124825A–ENG, with limited exceptions.[14] The facility must develop and report the recipe-specific emission factors using the same procedures as discussed in the paragraph above.

With the exception of where default emission factors are not provided in the Tables I–3 and I–4 for a particular process type or sub-type, a hybrid method using both default emission factors and recipe-specific factors for the chamber cleaning and wafer cleaning process types within the same reporting year is not permitted for reasons discussed earlier in this section.

Semiconductor Facilities That Fabricate Devices on Wafers Measuring Greater Than 300 mm in Diameter

Semiconductor manufacturing facilities that fabricate devices on wafers measuring greater than 300 mm in diameter, regardless of capacity, must calculate and report all of their emissions from processes that use fluorinated GHGs (including plasma etching, chamber cleaning, and wafer cleaning process types) using directly measured recipe-specific emission factors (i.e., an approach consistent with the 2006 IPCC Tier 3 methodology). EPA is using the term "Tier 3 Method" to refer to this methodology. In a given reporting year, a facility must develop new recipe-specific emission factors only for recipes which are not similar to any recipe used in a previous reporting year. Emission factors must be measured using the 2006 ISMI Guidelines, International SEMATECH #06124825A–ENG, with limited exceptions.[15] Facilities must also aggregate the recipe-specific emissions and report the total emissions by process type (plasma etching, chamber cleaning, and wafer cleaning). In addition, each facility is required to report the film or substrate that was etched/cleaned and the feature type that was etched for recipes used.

N_2O Emissions: Electronics manufacturing facilities must calculate emissions of N_2O using:

- Requirements for calculating and apportioning gas consumption as outlined above for "Fluorinated GHG Emissions."
- Production process emission factors for chemical vapor deposition and other electronics manufacturing processes using either defaults provided in Table I–8 to subpart I or facility-specific N_2O emission factors based on facility measurements of N_2O. Emission factors must be measured using the 2006 ISMI Guidelines, International SEMATECH #06124825A–ENG, with limited exceptions.[16] Where a facility uses less than 50 kg of N_2O in one reporting year, rather than calculate emissions using an emission factor, they may report the emissions as equal to consumption.

Heat Transfer Fluid Emissions: Electronics manufacturing facilities must calculate and report emissions from heat transfer fluids using a mass balance approach.

Reporting Controlled Emissions from Abatement Systems: Electronics manufacturing facilities that wish to calculate and report controlled fluorinated GHG and N_2O emissions from the use of abatement systems must certify that their abatement systems are installed, operated, and maintained in accordance with the manufacturers' specifications, as well as account for uptime of abatement systems.[17] Facilities must calculate controlled emissions from abatement systems using either:

- Destruction or removal efficiencies based on a default value of 60 percent. This approach requires certification that the abatement system is specifically designed for fluorinated GHG and N_2O abatement. A facility must support its certification that the abatement system is specifically designed for fluorinated GHG and N_2O abatement by documenting the suppliers specifications; or
- Directly measured destruction or removal efficiencies measured in accordance with EPA's Protocol for Measuring Destruction or Removal Efficiency of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing (EPA's DRE Protocol), Version 1, EPA 430–R–10–003. These destruction or removal efficiencies must be measured at a frequency specified by EPA's random sampling abatement system testing program (RSASTP).

Best Available Monitoring Methods. EPA is allowing electronics manufacturing facilities to use Best Available Monitoring Methods (BAMM) through June 30, 2011 for this source category without submitting a request. The owner or operator must use the calculation methodologies and equations in the Calculating GHG Emissions section of subpart I (40 CFR 98.93), but may use BAMM for any parameter for which it is not reasonably feasible to acquire, install, or operate a required piece of monitoring equipment in a facility, or to procure measurement services from necessary providers. EPA is allowing facilities to use BAMM for 6 months based on EPA's experience implementing the Final MRR issued in October 2009 and because it has determined that some electronics manufacturing facilities may need additional time to comply with the requirements in the final rule.

Facilities wishing to extend the use of BAMM beyond the initial 6-month period, but no later than December 31, 2011, must submit a petition to EPA by February 28, 2011. Requests for BAMM extensions must include detailed explanations and supporting documentation to describe why it is not reasonably feasible for the facility to comply with the required provisions. In general, extension requests must include detailed descriptions and evidence that it is not reasonably feasible to acquire, install, or operate a required piece of monitoring equipment in a facility, or to procure necessary measurement services from providers by July 1, 2011.

Where a facility is required to estimate emissions using recipe-specific utilization and by-product formation rates for the plasma etching process type (i.e., the Tier 2d method) and they are unable to develop those factors, EPA is requiring the facility to provide reasons why it is not reasonably feasible to obtain, install, or operate the needed equipment, or to procure necessary measurement services, before December 31, 2011 (in lieu of July 1, 2011) because recipe-specific emission factors may be measured at any time during the reporting year. These facilities must

[14] See footnote 6.

[15] See footnote 6.

[16] See footnote 6.

[17] In the final rule, EPA is defining controlled emissions as the quantity of emissions that are released to the atmosphere after application of an emission control device (e.g., abatement system).

submit a petition to EPA by June 30, 2011.

BAMM extension requests must also document the facility's efforts to comply with the requirements and explain the best available monitoring method that the facility will use, should EPA approve the request.

EPA is requiring that if a facility is allowed to use BAMM in 2011 the facility must recalculate and resubmit 2011 emissions with their report for the 2012 reporting year (to be submitted in 2013). For example, such a facility having been granted BAMM may use a default etch emission factor to calculate and report its 2011 emissions. This facility must then recalculate and report its 2011 emissions with its 2012 report. Where a facility is allowed to use BAMM for apportioning gas consumption it is not required to verify its 2011 engineering model with its recalculated report.

EPA does not anticipate approving the use of BAMM beyond December 31, 2011; however, EPA reserves the right to approve any such requests submitted by June 30, 2011 for unique and extreme circumstances which include safety, technical infeasibility, or inconsistency with other local, State or Federal regulations. Facilities requesting BAMM past December 31, 2011 would have to submit similar documentation to support the request as was required for BAMM requests in 2011. In addition, these facilities would be required to describe the unique and extreme circumstances which necessitate the extended use of BAMM. Facilities allowed to use BAMM through 2012 would be required to recalculate and resubmit their 2012 emissions. The recalculated emissions must be reported with the 2013 report (submitted in 2014). Where a facility is allowed to use BAMM for apportioning gas consumption it is not required to verify its 2012 engineering model with its recalculated report.

Data Reporting. In addition to the information required to be reported by the General Provisions (40 CFR 98.3(c)), reporters must annually submit additional data used to calculate GHG emissions and consumption. A list of the specific data to be reported for this source category is contained in 40 CFR 98.96.

Recordkeeping. In addition to the records required by the General Provisions (40 CFR 98.3(g)), reporters must keep records of additional data used to calculate GHG emissions and consumption. A list of specific records that must be retained for this source category is included in 40 CFR 98.97.

2. Summary of Major Changes Since Proposal

The major changes in this rule since the April 2010 proposal are identified in the following list. The rationales for these, and the identification of and rationale for other significant changes to the proposed rule can be found below or in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart I: Electronics Manufacturing" (available in the docket, EPA–HQ–OAR–2009–0927). Relevant comments on EPA's initial April 2009 proposal for electronics manufacturing are included below or in the Response to Comment Document. In addition to the changes identified below, EPA reorganized sections of the proposed regulatory text and made editorial changes to improve clarity and readability.

Definition of the source category:

• EPA has clarified that semiconductors include, among others, light-emitting diodes (LEDs). As explained in more detail in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart I: Electronics Manufacturing," (available in the docket, EPA–HQ–OAR–2009–0927), LEDs are a semiconductor light source. When a LED is switched on, electrons are able to recombine with holes within the device, releasing energy in the form of light whose color is governed by the nature of the semiconductor. Many LEDs are manufactured on a wafer (usually different than silicon) using methods that are similar to the manufacture of integrated circuits.

Reporting threshold:

• EPA has clarified what manufacturing capacity of a facility means by providing a new equation (Equation I–5 of this rule) in the final rule that specifies manufacturing capacity is 100 percent of annual manufacturing capacity of a facility as determined by summing the area of maximum designed substrate starts of a facility per month over the reporting period. EPA has also provided a definition of maximum designed substrate starts.

Calculating GHG emissions:

• EPA has revised the requirements for semiconductor manufacturing facilities that fabricate devices on wafers measuring 300 mm or less in diameter to calculate and report fluorinated GHG emissions from etching and cleaning process types. In the final rule, EPA is requiring these facilities to use one of two different methodologies, depending on the manufacturing capacity of the facility.

• EPA has modified the requirement for semiconductor manufacturing facilities that fabricate devices on wafers measuring 300 mm or less in diameter to require those facilities that have an annual manufacturing capacity of less than or equal to 10,500 m^2 of substrate to calculate and report fluorinated GHG emissions based on five process types and sub-types, as opposed to nine emitting process sub-types as proposed in the April 2010 rule. These facilities must calculate and report fluorinated GHG emissions from the etching process type, the chamber cleaning process type and its associated sub-types (in-situ plasma, remote plasma, in-situ thermal), and the wafer cleaning process type. The five process types and sub-types are differentiated by two wafer technologies (150/200 mm and 300 mm wafer size). EPA is using the term "Tier 2c" to refer to this methodology. EPA is combining default emission factors for 150 mm and 200 mm wafer technologies because EPA did not have sufficient measured emissions data to establish different factors for these two technologies. For each of these process types and associated sub-types, EPA provides default emission factors accounting for (1) The mass fraction of the input gas that is utilized during manufacturing (i.e., not emitted from the process type or sub-type), and (2) the mass of each reportable fluorinated GHG by-product formed as a fraction of the mass of the fluorinated GHG input gas with the largest mass flow used.

• EPA has added provisions to require the largest semiconductor facilities (defined as facilities with annual capacities of greater than 10,500 m^2 of substrate) to calculate and report their emissions from the plasma etching process type using directly measured recipe-specific emission factors, while using EPA's default emission factors for chamber cleaning sub-types, and for the wafer cleaning process type. EPA is using the term "Tier 2d" to refer to this hybrid methodology. All emission factors (utilization and by-product formation rates) for the etch processes are required to be measured using the 2006 ISMI Guidelines, with limited exceptions.[18]

The requirement for semiconductor manufacturing facilities to calculate their emissions using process-specific process utilization and by-product formation rates (i.e., recipe-specific emission factors) was originally proposed in EPA's initial April 2009 proposal (74 FR 16448). In that proposed rule, EPA proposed to require the large semiconductor manufacturing

[18] See footnote 6.

facilities to calculate and report emissions from all fluorinated GHG using processes using such an approach. Further, in EPA's April 2010 proposal (75 FR 18652), EPA proposed, as an alternative to the Refined Method, to require all semiconductor manufacturing facilities to estimate and report using recipe-specific emission factors.[19]

• EPA clarified the requirement for recipe-specific measurements to facilitate the implementation of the Tier 2d and Tier 3 methods. EPA provided definitions of "individual recipe" and "similar" with respect to recipes. For recipe-specific emission factors, rather than requiring each and every individual recipe to be measured, EPA is permitting a facility to apply one measured recipe-specific emission factor to a group of "similar recipes." In a given reporting year, a facility must develop new recipe-specific emission factors only for recipes which are not similar to any recipe used in a previous reporting year. In addition, where a facility reports using recipe-specific emission factors, EPA is requiring that they report the film or substrate that was etched/cleaned and the feature type that was etched.

Monitoring and QA/QC requirements:

• EPA has modified the procedures by which facilities must develop gas consumption apportioning factors. In the final rule, facilities must apportion gas consumption using facility-specific engineering models based on quantifiable metrics of activity. Facilities must verify these models as specified by EPA in 40 CFR 98.96(c) and document them in their site GHG Monitoring Plans (as required under 40 CFR 98.3). EPA will permit the use of facility-specific gas apportionment models based on quantifiable metrics, such as wafer pass or wafer starts, provided the facility documents and verifies the model. As part of these new requirements, EPA has added definitions for actual gas consumption, modeled gas consumption, repeatable, and wafer starts. Further, EPA has clarified that all electronics manufacturing facilities must apportion consumption of fluorinated GHGs and N_2O used at a facility using the apportioning methods outlined in the final rule.

• EPA has revised the requirement to recalculate gas- and facility-specific heel factors. EPA is requiring facilities to recalculate gas- and facility-specific heel factors if the trigger point for change out used to establish a gas- and facility-specific heel factor differs by more than 5 percent, expressed as a percent of the previously used trigger point for change out. To clarify requirements to develop gas- and facility-specific heel factors, EPA has added a definition for trigger point for change out.

EPA made this revision in response to comments received on its proposal. EPA agrees with commenters that asserted the proposed requirement to recalculate the heel factor when the percentage change from the original trigger point exceeded 1 percent was too burdensome. Please refer to "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart I: Electronics Manufacturing" (available in the docket, EPA–HQ–OAR–2009–0927) for additional information on EPA's rationale.

• EPA has added equations specifying how to calculate uptime and how to account for uptime in DREs for abatement systems where a facility is calculating and reporting controlled emissions. EPA has also modified how uptime is calculated by defining an "operational mode" for abatement systems and removing the reference to SEMI Standard E–10–0304[E], Specification for Definition and Measurement of Equipment Reliability, Availability, and Maintainability.

• EPA has modified the Best Available Monitoring Methods (BAMM) provisions for subpart I to allow electronics manufacturing facilities to use BAMM through June 30, 2011 without submitting a request to EPA. Facilities wishing to extend the use of BAMM beyond the initial 6-month period, but no later than December 31, 2011, must submit a petition to EPA by February 28, 2011 (or June 30, 2011 where a facility is requesting the use of BAMM for recipe-specific emission factors for the plasma etching process type). EPA anticipates facilities will need to use best available monitoring methods only under limited circumstances. See Section II.D.1 of this preamble for additional information about the BAMM provisions.

Based on comments received on EPA's proposed rules (i.e., EPA's April 2009 and April 2010 proposed rules for electronics manufacturing) regarding the complexities perceived in implementing the methods contained in the final rule, EPA has concluded that some electronics manufacturing facilities may need additional time to fully meet the requirements finalized in this rule. However, EPA expects all electronics manufacturing facilities will be prepared to fully comply with this rule's requirements no later than year-end 2011. Therefore, extension of BAMM provisions beyond 2011 would only be granted in unique and extreme circumstances which include safety, technical infeasibility, or inconsistency with other local, State or Federal regulations. For a more detailed discussion on EPA's rationale, see "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart I: Electronics Manufacturing" (available in the docket, EPA–HQ–OAR–2009–0927).

3. Summary of Comments and Responses

This section contains a brief summary of major comments and responses. A large number of comments were received on this subpart covering numerous topics. Responses to additional significant comments received can be found in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart I: Electronics Manufacturing" (available in the docket, EPA–HQ–OAR–2009–0927).

Comment: EPA received a broad range of comments stating that the initial and revised methodologies for calculating GHG emissions in subpart I were overly burdensome and costly. For example, with respect to EPA's revised proposal (75 FR 18652, April 2010), commenters asserted that the requirements for apportioning of gas usage without the use of "engineering judgment" would require the development of complex software systems and monitoring of activity data at a level of detail that would be costly and time-intensive. In another example, in regards to EPA's initial proposal (74 FR 16448, April 2009), commenters argued that the direct measurement requirement would result in high costs associated with the development of process-specific gas utilization and by-product formation factors for the largest semiconductor manufacturing facilities.

Response: EPA considered all of these comments, and evaluated alternative methods for calculating GHG emissions for electronics manufacturing, controlled and uncontrolled. EPA considered alternative methods that would result in reduced burden on industry while maintaining or improving the quality and breadth of reported data. EPA also considered the gaps in the available emission factor knowledge base and has implemented a method to gain additional data to improve EPA's efforts to characterize the sector's GHG emissions.

[19] EPA's "Refined Method" as proposed in April 2010 (75 FR 18652) is based on nine process sub-types under the etching, chamber cleaning, and wafer cleaning process types (four etching process sub-types, three chamber cleaning process sub-types, and two wafer cleaning process sub-types) and EPA-published default emission factors.

EPA has made every effort to reduce burden to the industry while maintaining requirements that it has determined are necessary to obtain facility-specific emission estimates. For example, based on comments received, EPA has revised the gas apportioning method to allow for the use of quantifiable metrics other than wafer passes. In the final rule, facilities will be allowed to develop apportioning factors based on other quantifiable metrics provided the method is described in writing, is repeatable, and is verified through comparison with actual gas consumption. This approach provides facilities flexibility in the choice of apportioning methods and assures a high degree of data quality. Additional details on the gas apportioning method are described in this Section II.D.3 (Summary of Comments and Responses) of the preamble.

As another means to reduce burden to the industry, EPA is only requiring the largest semiconductor manufacturing facilities to calculate and report emissions using directly measured recipe-specific emission factors, ensuring that burden is commensurate with potential to emit. The largest semiconductor manufacturing facilities account for nearly two-thirds of uncontrolled emissions while accounting for less than 20 percent of all facilities expected to report under subpart I. In addition, the largest semiconductor manufacturing facilities are only required to directly measure etch process emissions. Etch processes are the least understood of the electronics manufacturing processes in terms of GHG emissions, and EPA lacks sufficient data to establish default emission factors for multiple etch processes. Lastly, in the final rule, EPA is also allowing the use of "similar recipe" emission factors to reduce the number and burden of direct measurements required.

Additional details on steps taken to reduce the burden are described in this section II.D.3 (Summary of Comments and Responses) and in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart I: Electronics Manufacturing" (available in the docket, EPA–HQ–OAR–2009–0927).

In general, while commenters asserted that EPA's proposed requirements were too burdensome and costly, comments lacked sufficient quantitative detail or substantiation. However, in response to concerns that EPA did not fully account for compliance costs in its economic analysis, EPA did update its costs estimates to reflect the costs associated with the requirements finalized in the rule. EPA has concluded that its final cost estimates appropriately account for the compliance burden under this rule. For details on how EPA developed its final costs for this rule, please see Sections 4 & 5 of the Economic Impact Analysis (EIA) (available in the docket, EPA–HQ–OAR–2009–0927).

Method for Calculating GHG Emissions

Comment: While some commenters supported EPA's intent for the Refined Method to gather representative and accurate facility level emissions estimates, they argued that the Refined Method itself was not supported for several reasons.[20] Commenters asserted that the Refined Method stemmed from a technically flawed uncertainty analysis and apparent misunderstandings of current process realities. Commenters also stated that extending the 2006 IPCC Tier 2b etch category ("process type") from one to four refined categories ("sub-types") was not justified given the limited data available for developing emissions factors. Several commenters suggested that etch emission factors could be developed through another process (i.e., not part of the rule) such as through the existing Memorandum of Understanding between EPA and the semiconductor industry.[21] As an alternative to EPA's Refined Method, many commenters suggested an "Alternative Refined Method," that they argued would achieve greater accuracy than the 2006 IPCC Tier 2b method and would avoid uncertainty issues created by EPA's Refined Method.

The "Alternative Refined Method," as described in comments, would be comprised of five process types and sub-types, which include: The three chamber clean sub-types (remote plasma clean, in-situ plasma clean, and in-situ thermal clean), the wafer cleaning process type, and one process type for all etch processes. Commenters suggested that this method would be superior to EPA's proposed Refined Method in terms of accuracy and cost.

One commenter stated that the use of EPA's Refined Method to estimate emissions would result in less accurate emission data as compared to the 2006 IPCC Tier 3 Method. This commenter encouraged EPA to require the use of the 2006 IPCC Tier 3 method for all semiconductor facilities given the need for accurate data and the significant emissions from this sector, but argued that at a minimum EPA should rely on Tier 3 estimation for "large facilities," as it did in its initial proposal.

Response: In general, EPA agrees with commenters that stated the available data as of the proposal was sufficient to establish default emissions factors for multiple chamber clean process sub-types, but insufficient to support establishing default emission factors for multiple etch process sub-types. EPA did not receive enough additional data during the comment period to address this insufficiency.[22] Accordingly, EPA is not establishing default emissions factors for etch sub-types in this final rule. EPA also agrees with the commenter that stated an estimation approach based on the IPCC Tier 3 method would result in the most accurate data. However, EPA is mindful of the burden that would be imposed by requiring all covered facilities to use an approach based on the 2006 IPCC Tier 3 method for all emissions.

In this final rule, EPA is requiring semiconductor facilities to calculate and report fluorinated emissions by adhering to one of three different emission estimation methodologies, depending on the wafer size manufactured and the facility's manufacturing capacity.[23] These requirements are presented in section II.D.1 (Summary of the Final Rule) of this preamble and summarized in Table 3 of this preamble. EPA has determined that the requirements in the final rule effectively balance EPA's objectives with an appropriate level of burden to industry.

In response to comments received on EPA's proposed methodology for semiconductor manufacturing facilities, EPA undertook another analysis to evaluate the uncertainty associated with emission estimation methods. Specific information on the analysis can be

[20] See footnote 19.

[21] Since 1996, EPA has maintained a partnership with the U.S. semiconductor industry, EPA's PFC Reduction/Climate Partnership for the Semiconductor Industry. As part of the Partnership, semiconductor facilities have committed to reduce fluorinated GHG emissions by at least 10 percent below the industry's 1995 baseline level by year-end 2010.

[22] In its proposed rule (75 FR 18652, April 2010), for each emission factor for the nine proposed process categories, EPA published a range of values. EPA proposed a range of values because it had not received sufficient data to select a specific value within each range. Based on additional information received after publication of the proposed rule, EPA published a Notice of Data Availability where it made available to the public draft default emission factors for semiconductor manufacturing refined process categories (75 FR 26904, May 2010). As of publication of this final rule, EPA has not received additional data (i.e., utilization and by-product formation rates).

[23] As calculated in Equation I–5 of this rule, manufacturing capacity is 100 percent of annual manufacturing capacity of a facility as determined by summing the area of maximum designed substrate starts of a facility per month over the reporting period.

found in the Electronics Manufacturing TSD (EPA–HQ–OAR–2009–0927). In summary, results from this exercise showed (a) emissions estimated with a Tier 2b method are understated, (b) more facility-level, emissions-relevant information would permit an uncertainty analysis to be performed with more meaningful and robust results, and (c) moving from the use of a default factor(s) for etch sub-types to the use of recipe-specific measurements appears to increase certainty in emission calculations. These results support the methodology finalized in the final rule.

Given the current lack of available facility-level gas usage and emission information for etching in particular, and EPA's need for increased accuracy in emission estimates relative to the 2006 Tier 2b method, EPA is requiring that the largest semiconductor facilities estimate and report recipe-specific emission factors for all etch processes. EPA views the generation of such data as essential to improving future efforts to characterize this sector's GHG emissions.

While EPA recognizes that more than half of the gas consumed in semiconductor manufacturing is for chamber cleaning, EPA also recognizes that most of the variability in gas consumption, and hence emissions, across many facilities is found for recipes used under the plasma etch process type. Etch recipes utilize many gases (approximately six or more either alone or in combination) with varying GWPs. Process recipes vary between facilities because they are a crucial part of company competitiveness and innovation.

While EPA is finalizing the Tier 2c method for some semiconductor facilities (i.e., not the largest semiconductor manufacturing facilities) and has determined that it is an improvement over the 2006 IPCC Tier 2b method, EPA maintains that estimating emissions based on process sub-types for etch with robust default factors would result in more accurate facility-level emission estimates as compared to estimating emissions using a single broad etch process type. To this end, in future years, EPA may evaluate the recipe-specific emission factors received through this final rule to determine whether a sufficiently robust data set exists to establish default emission factors for plasma etching process sub-types. In the future, EPA may consider requiring the semiconductor facilities that will be using a default emission factor for the etch process type under this final rule to estimate and report emissions using an approach based on multiple etch and chamber clean process sub-types similar to the Refined Method EPA proposed in April 2010.

EPA is requiring only the largest facilities to report recipe-specific emission factors for etching processes, rather than requiring all semiconductor facilities to report all etch processes regardless of capacity, or requiring the largest facilities to report all process emissions using recipe-specific emission factors, because EPA has concluded that this approach minimizes burden to industry. Further, this requirement ensures that the burden associated with reporting is proportional to the magnitude of a facility's potential emissions.

EPA selected 10,500 m^2 of substrate as the threshold for large facilities because facilities above this threshold are expected to account for nearly two-thirds of uncontrolled emissions while accounting for less than 20 percent of all facilities expected to report under subpart I. Based on EPA's analysis, the expected number of the "largest" facilities is 29 of the 175 total facilities. EPA originally proposed this distinction (i.e., facilities with an annual manufacturing capacity of greater than 10,500 m^2) in its initial proposal for semiconductor manufacturing facilities (75 FR 18652, April 2009). In response to EPA's proposal, some commenters stated that in the semiconductor industry, "large" facilities do not inherently have higher emissions of fluorinated GHGs. These commenters noted that beginning with the second generation of 200 mm facilities, transitions to NF_3 remote cleans and deployment of point of use abatement resulted in significantly lower emissions as compared to older facilities. In response, while EPA acknowledges qualitative reports on second generation 200 mm wafer facilities adopting NF_3 remote plasma cleans and point of use abatement systems as presented in comments, it is unaware of published studies that quantitatively document the market penetration of either NF_3 remote plasma source (RPS) or point of use fluorinated GHG abatement systems in those facilities.

In the final rule, EPA is also clarifying what meets the requirement for recipe-specific measurements to facilitate implementation of the Tier 2d and Tier 3 methods. EPA recognizes a facility may employ potentially hundreds of recipes. Therefore, as a means to reduce burden for facilities that are required or elect to develop recipe-specific measurements, EPA is permitting a facility to apply the same emission factor to a group of "similar recipes." In this regard, once a facility develops a recipe-specific emission factor for an individual recipe, it may apply that emission factor to recipes that are similar. This provision allows a facility to measure fewer manufacturing processes to develop the emission factors required for Tier 2d and Tier 3, thereby reducing burden in comparison to a more stringent approach which would require measurements for each and every individual recipe used at a facility. As another means to reduce burden EPA is clarifying that in a given reporting year, a facility must develop new recipe-specific emission factors only for recipes which are not similar to any recipe used in a previous reporting year.

EPA is defining an individual recipe as a specific combination of gases, under specific conditions of reactor temperature, pressure, flow, RF power, and duration, used repeatedly to fabricate a specific feature on a specific film or substrate. EPA is defining similar, with respect to recipes, as those recipes that are composed of the same set of chemicals and have the same flow stabilization times and where the documented differences, considered separately, in reactor pressure, individual gas flow rates, and applied RF power are less than or equal to plus or minus 10 percent. For purposes of comparing and documenting recipes that are similar, facilities may use either the best known method provided by an equipment manufacturer or the process of record, for which emission factors for either have been measured (see the Electronics Manufacturing TSD for supporting information).

Monitoring and QA/QC Requirements

Comment: Many commenters voiced concerns regarding the burden associated with EPA's proposed requirement to measure DRE of abatement equipment in accordance with EPA's DRE Protocol, (EPA 430–R–10–003). Some commenters also argued the required frequency of measurements in the proposed random sampling abatement system testing program (RSASTP) is overly burdensome and unnecessary.

With respect to EPA's requirement to measure DRE in accordance with EPA's Protocol, commenters noted few facilities have characterized the DRE of installed abatement systems using EPA's DRE Protocol because the Protocol was published in 2010. One commenter requested that EPA permit the use of measurements made prior to the publication of EPA's DRE Protocol as long as the facility can demonstrate the measurements were based on test

methods substantially similar to those outlined in EPA's Protocol. In addition to providing comments on the required use of the DRE Protocol, commenters also requested that EPA allow the use of CF_4 as a tracer to determine dilution when an abatement system is in "low fire" and that EPA permit the use of a Fourier Transform Infrared Spectroscopy (FTIR) without the additional use of Quadrapole Mass Spectroscopy (QMS).

In regards to EPA's proposed RSASTP, many commenters asserted that the burden placed on facilities to comply with the RSASTP is not necessary. One commenter noted that that RSASTAP is an excessive burden as large facilities may have hundreds of abatement systems. Further, commenters argued that new abatement systems should not be required to be tested as long as the facility has installed, operated, and maintained the equipment properly. Some commenters asserted that testing should be required only for new models of abatement systems that are not simply a variant of an existing system used at a facility. Other commenters also suggested alternative testing regimes to the RSASTP that would place most of the DRE measurement burden in the early years of testing.

Response: In general, EPA does not agree with commenters and is finalizing the requirements for measurement of abatement DRE using EPA's DRE Protocol and for the testing frequency described in the RSASTP.

EPA is finalizing the requirement that facilities measure abatement system DREs in accordance with EPA's DRE Protocol because it will ensure that measured DREs are accurate through properly accounting for dilution and by meeting EPA's established performance standard (as specified in EPA's DRE Protocol). EPA's DRE Protocol is the only protocol (i.e., standard measurement method, not guideline) that exists to date for measuring DREs of abatement equipment used in electronics manufacturing. EPA's DRE Protocol is reliable because it was based upon and validated by actual experience and data collection in fully operational manufacturing facilities during multiple measurement studies performed by EPA in collaboration with industry.[24] EPA's DRE Protocol has been through two public peer review processes over the course of two years and is based on input from national and international industry experts. For documentation of the comments received during these peer reviews, and EPA's response, please refer to the docket (EPA–HQ–OAR–2009–0927).

It is important to clarify that EPA is not specifically prohibiting the use of previously measured DREs; a facility may use previously measured DREs provided the facility can demonstrate that the measurements were made in accordance with EPA's DRE Protocol. EPA's DRE Protocol permits flexibility in measurement practices provided the measurements achieve a performance standard that, among other things, ensures dilution is properly measured.

EPA does not wholly prohibit the use of CF_4 as a tracer in the DRE Protocol. Specifically, with respect to measuring systems that do not abate CF_4 and/or SF_6, EPA's DRE Protocol states, "In such systems, CF_4 or SF_6 can be used in place of an inert gas since their DREs are zero percent. Table 2 of the Protocol provides a list of acceptable gases for measuring total abatement system flows, along with their use conditions." As discussed in this excerpt, EPA's DRE Protocol does not permit the use of either CF_4 or SF_6 as tracer gases in abatement systems designed to abate these gases. Additionally, EPA prohibits use of CF_4 as a tracer in fluorinated GHG abatement systems operating in "low fire" because reviewers of early drafts of EPA's DRE Protocol made repeated claims that one could not be certain some abatement was not occurring.

EPA does not agree with commenters who suggested that the use of only an FTIR and not a QMS to measure dilution, and hence DREs, should always be permitted. The DRE Protocol permits the use of an FTIR in place of a QMS when tracer gases, such as CF_4 and SF_6, are used in place of an inert gas to measure dilution (provided the abatement system which is being tested does not abate the tracer gas (CF_4 or SF_6)). The DRE Protocol does not permit, however, the use of an FTIR in place of a QMS for measuring dilution with tracers that are inert because while a method that uses FTIR-measurable gases may become available, EPA is not aware of robust measurements that demonstrate such a method.

With respect to EPA's requirement to measure DREs with the frequency prescribed in the RSASTP, EPA does not agree with commenters who suggested the RSASTP is burdensome and unnecessary. Commenters did not provide EPA sufficient information or data to support their claim that the RSASTP is unnecessary. As described below, the RSASTP provides a much less burdensome device measurement scheme when compared to requiring a facility to test all abatement systems used annually, but still allows EPA to ensure a facility has measured DREs accurately and at least once every five years.

EPA considered commenters' concerns about the RSASTP and EPA does not agree with commenters who state that new abatement systems should not be required to be tested as long as the facility has installed, operated, and maintained the equipment properly. Abatement manufacturer specified installation, operation and maintenance practices are based upon the testing and development of abatement systems in controlled settings. When using these systems in actual facility settings, ensuring the proper installation, operation, and maintenance of abatement systems may not always be a means to guarantee that the abatement system will run exactly as abatement manufacturers intended, or that the manufacturer supplied DRE will be achieved. However, EPA is maintaining the requirement for facilities to properly install, operate, and maintain abatement systems according to system manufacturer specifications. This practice is expected to reduce the likelihood of inaccurate estimations of DREs.

Even if abatement systems rely on the same operating principle (e.g., thermal oxidation) and are used to abate the same gases, their performance can vary depending on their operation and maintenance. Thus, maintenance that is adequate for abatement systems in some applications may not be adequate for abatement systems in others (e.g., those that handle high volumes of etched or cleaned material, which can be deposited inside abatement equipment and clog lines).

EPA has concluded that there is a need for gradually testing all of the abatement systems within a class, and for retesting individual abatement systems over time. As EPA stated in the preamble to the April 2010 proposed rule (75 FR 18652), some fluorinated GHGs, such as CF_4, are harder to destroy than others; thus, the performance of abatement systems with one fluorinated GHG cannot necessarily be assumed to

[24] For more information about the three studies, please see the following reports: *Developing a Reliable Fluorinated Greenhouse Gas (F–GHG) Destruction or Removal Efficiency (DRE) Measurement Method for Electronics Manufacturing: A Cooperative Evaluation with IBM* (EPA 430–R–10–004); *Developing a Reliable Fluorinated Greenhouse Gas (F–GHG) Destruction or Removal Efficiency (DRE) Measurement Method for Electronics Manufacturing: A Cooperative Evaluation with NEC Electronics, Inc.* (EPA 430–R–10–005); and *Developing a Reliable Fluorinated Greenhouse Gas (F–GHG) Destruction or Removal Efficiency (DRE) Measurement Method for Electronics Manufacturing: A Cooperative Evaluation with Qimonda* (EPA 430–R–08–017).

apply to other fluorinated GHGs. It is well known across the industry that abatement system performance varies greatly depending on a variety of abatement device and process parameters such as temperature, flow and exhaust composition.[25] As stated by many commenters, facilities develop and ultimately use new processes potentially every year, and the parameters of these processes vary. To this end, by requiring the gradual testing and retesting of abatement systems over time through the RSASTP, EPA can ensure properly measured DREs and DRE class averages used at a facility will accurately reflect controlled emissions. In addition, through the use of the RSASTP, EPA is reducing burden, for instance, for facilities that continually modify their processes. EPA is basing the RSASTP around classes defined as abatement systems grouped by manufacturer model number(s) and by the gas which the system is used to abate; varying process parameters, such as flows, temperature and exhaust composition do not factor into the requirements of the RSASTP.

Comment: In general, most commenters supported the inclusion of a default DRE value, but opposed EPA's proposed default DRE value of 60 percent. Commenters argued EPA's proposed default DRE factor of 60 percent was unreasonably low, in part because the 60 percent default factor was based on CF_4 destruction data and therefore, should not be applied to other fluorinated GHGs. Commenters noted that CF_4 is the most stable compound and the most difficult among all fluorinated GHG to destroy and, as a result, it should be addressed separately to avoid significantly overestimating emissions. Further, one commenter asserted that the unreasonably low value for the default DRE penalizes semiconductor manufacturers who have operated voluntarily and in good faith under EPA's MOU and other GHG reduction programs to install and maintain control devices.[26]

As an alternative, commenters recommend that IPCC and/or abatement system manufacturer default DREs should be permitted, and potentially discounted by 10 percent to account for differences between field and lab certification conditions. Commenters also suggested that EPA provide additional default factors for C_2F_6 and other fluorinated GHGs that are easier to abate than CF_4.

One commenter opposed EPA's default DRE value and asserted that default DREs should not be permitted at all because a default DRE does not capture the potentially high variability in DREs across different systems and across similar systems installed at different facilities. In addition, the commenter noted that EPA's default value was based on only 11 actual measured DRE values. The commenter encouraged EPA to require only direct measurement of DREs in accordance with EPA's DRE Protocol and disallow any application of a default DRE.

Response: EPA disagrees with commenters that asserted EPA should permit electronics manufacturing facilities to report controlled emissions from abatement systems using 2006 IPCC default factors or the manufacturer's DRE values, with or without applying a 10 percent discount. As EPA stated in the proposal, EPA is not permitting the use of the IPCC 2006 default factors or the manufacturer's DRE values because once installed, abatement equipment may fail to achieve the IPCC 2006 default or supplier's claimed DRE. DRE performance claimed by equipment suppliers and upon which the 2006 IPCC default factors were based may have been incorrectly measured due to a failure to account for the effects of dilution (e.g., CF_4 can be off by as much as a factor of up to 10 (Burton, 2007). This understanding is supported by industry assessments as presented in Beu, 2005. As EPA stated in the proposal, the 60 percent default DRE value was calculated using data from measurements assured to properly account for the effects of dilution. In addition, the tested systems were properly installed, operated, and maintained.

EPA is including the option for facilities to use a default DRE in the final rule to permit those facilities that have fluorinated GHG and N_2O abatement systems to calculate and report controlled emissions using an approach that is less burdensome than directly measuring abatement systems in accordance with EPA's DRE Protocol. The default DRE is based on EPA's practical experience measuring the performance of abatement systems during the development of the DRE Protocol.[27] Further, for a facility to use the default DRE, they are required to certify that their abatement systems are installed, operated, and maintained in accordance with the manufacturers' specifications, and provide certification that the abatement system is specifically designed for fluorinated GHG and N_2O.

EPA is proud of its extensive collaboration with the semiconductor industry via the PFC Reduction/Climate Partnership for the Semiconductor Industry.[28] EPA and its Partners have investigated the origins and magnitude of GHG emissions as well as technologies to minimize this pollution. EPA does not agree with one commenter's claim that the 60 percent default DRE penalizes Partner's facilities. One of many important lessons learned by the Partnership concerns the challenge of properly measuring and maintaining fluorinated GHG abatement system performance. As discussed above, the 60 percent default DRE value is based upon EPA's technical experience studying abatement systems, properly installed, operated and measured in actual production settings.

Further, EPA does not agree with commenters' suggestion to apply a 10 percent discount to the manufacturer's DRE values to account for differences between field and lab certification conditions. The 10 percent discount appears arbitrary and was not accompanied by any empirical data. To this end, EPA is not permitting electronics manufacturing facilities to apply a 10 percent discount to manufacturers' DRE values.

EPA agrees with commenters, in principle, that default DRE values could be developed for specific fluorinated GHGs, for example those that are easier to abate than CF_4. However, EPA does not have sufficient DRE data for other fluorinated GHGs that were measured using EPA's DRE Protocol and thus assured to properly account for the effects of dilution. Further, commenters did not provide any such data in their comments to the proposed rule. In future years, EPA may consider establishing default DRE values for other fluorinated GHGs and N_2O using data received from DRE measurements made in accordance with EPA's DRE Protocol.

Comment: Most commenters opposed EPA's proposed procedures to account for abatement system uptime. Although several commenters agreed that accounting for uptime of abatement systems used at a facility is reasonable, some commenters asserted that EPA's proposed procedures may not reflect actual practices at most facilities.

In some cases, commenters stated that tools and abatement systems are

[25] Beu, L. (2005). "Reduction of Perfluorocarbon (PFC) Emissions: 2005 State-of-the-Technology Report", TT#0510469AENG, International SEMATECH Manufacturing Initiative (ISMI), December 2005. Available at: *http://www.epa.gov/highgwp/semiconductor-pfc/documents/final_tt_report.pdf.*

[26] See footnote 21.

[27] See footnote 24.

[28] *http://www.epa.gov/semiconductor-pfc/.*

interlocked (i.e., a tool can not be operated if an abatement device is not operating). As an alternative, commenters suggested that EPA allow facilities to monitor uptime by documenting where abatement systems and production tools are interlocked and recording instances when abatement systems fail.

One commenter asserted that EPA's inclusion, in the uptime calculation procedures, of SEMI Standard E–10–0304^{E}, Specification for Definition and Measurement of Equipment Reliability, Availability, and Maintainability was incorrect. The commenter noted that the SEMI Standard E–10–0304^{E} does not include the concept of co-dependent uptime of different equipment in any of its metrics. As a result, the commenter urged EPA to remove the reference to the SEMI standard and to define the appropriate calculation and its individual terms in the regulation unless EPA determines that one of the SEMI E–10–0304^{E} formulas may in fact be used.

Response: EPA took into consideration all concerns from commenters about the methods by which EPA proposed to calculate uptime of abatement systems. In response, EPA has modified the procedures required for monitoring and accounting for uptime by removing reference to SEMI E–10–0304^{E} because EPA agrees with the commenter that SEMI E–10–0304^{E} does not fit appropriately in this rule. To this end, the final rule allows a facility to calculate an abatement system's uptime by taking the ratio of (1) The total time during which the abatement system is in an operational mode with fluorinated GHGs or N_2O flowing through production process tool(s) connected to that abatement system, to (2) the total time during which fluorinated GHGs or N_2O are flowing through production process tool(s) connected to that abatement system. Further, EPA has defined operational mode as the time in which an abatement system is being operated within the range of parameters as specified in the operations manual provided by the system manufacturer. For clarification purposes, EPA has also added a discrete equation for calculating uptime into this rule. Lastly, also for clarification, EPA has added an equation that provides direction for facilities to account for uptime in overall facility emissions calculations.

With respect to the commenter who suggested that EPA allow facilities to monitor and track uptime by documenting that tools are interlocked and instances in which abatement systems have failed, EPA appreciates the comment, but is not modifying the uptime requirements as suggested by the commenter. EPA expects facilities with interlocked abatement systems should be able to easily monitor and account for uptime of abatement systems using the methods provided in this rule. Also, EPA is not permitting facilities to use the method suggested by the commenter as this would allow the use of multiple methods to monitor and account for uptime. Where feasible, EPA would like to ensure that facilities are using consistent methods as part of estimating emissions because these methods will create a consistent basis on which to compare industry emissions and will also reduce EPA's administrative burden. Lastly, EPA is requiring detailed monitoring and reporting of uptime because this information will allow EPA to carry out emissions verification to ensure the consistency and accuracy of data collected under this rule.

Comment: Many commenters expressed concern with EPA's proposed method to apportion gas consumption to the nine sub-types of the Refined Method (previously referred to as refined process categories in the April 2010 proposal) for semiconductor facilities using a quantifiable metric. According to commenters, the proposed method of apportioning gas to the nine process sub-types of the Refined Method using a facility-specific engineering model based on wafer passes is overly burdensome and not currently feasible. More specifically, commenters asserted that because many facilities do not currently track wafer passes, to do so would impose a burden in the form of capital costs for the software needed to collect these data. Some commenters argued that it is not feasible to apportion gas to the nine proposed process sub-types solely based on wafer pass information. For example, one commenter noted that when one recipe is used to etch multiple films in one wafer pass, emissions from the use of that one recipe would fall under multiple process sub-types for etch (which were based on film type). The commenter further stated that because tools do not, and can not, track how much of each gas in the recipe was specifically used for each film etched in that one wafer pass, it is not feasible in this situation to apportion gas based on wafer pass.

In most cases, commenters provided alternative methods for apportioning gas consumption. For example, some commenters suggested more flexible methods in which the apportioning is based on at least one quantifiable indicator and engineering knowledge. Commenters also asserted that apportionment should be determined by the facility and that EPA should not prescribe specific quantifiable indicators for apportioning gas consumption in the final rule.

Response: EPA appreciates the concerns raised by commenters about EPA's proposed method to apportion facility gas consumption. EPA is sensitive to the burden imposed by the rule and seeks to minimize it when possible without compromising the accuracy of reported emission estimates.

Apportioning gas consumption to process types, process sub-types, or recipes, as defined in 40 CFR 98.98, regardless of the type of electronics manufacturing facility, is an essential part of the emission estimation methodology required by EPA in this subpart. Apportionment is required because emission factors are for specific process types, process sub-types, or recipes, and are based on knowledge of the amount of gas consumed. Requiring facilities to apportion gas consumption based on a metric that is quantifiable and measurable (a metric that is proportional to gas usage) is necessary for EPA to ensure that methods by which gas is apportioned, and hence emissions are estimated, are verifiable and accurate.

In the final rule, to effectively balance commenters' concerns about burden and feasibility with EPA's objectives, EPA has decided to permit the use of facility-specific engineering models based on a quantifiable metric selected by the facility, (such as wafer passes or wafer starts) to apportion gas consumption. Under this final requirement, to develop apportioning factors, facilities must develop an engineering model that utilizes measureable process information.[29] EPA is not specifying the quantifiable metric that must be used in these models; rather EPA is allowing reporters the flexibility to select the most appropriate quantifiable metric on which to base the facility-specific engineering model, provided model documentation and verification requirements as described below are met.

Documentation: As part of recordkeeping requirements, EPA is requiring facilities to document, in their site GHG Monitoring Plans (as required under 40 CFR 98.3), specific information about their facility-specific engineering model, including definitions of variables, derivations of

[29] An apportioning factor denotes the amount of a specific gas consumed during a specific manufacturing process relative to the total amount of that gas used during all processes at the facility.

equations and formulas, and example calculations to ensure apportioning factors are repeatable. This information must be updated annually in the facility's site GHG monitoring plan. EPA is requiring this documentation as a means to verify that facility-specific engineering models are developed and then verified and documented each year for each facility, and that the apportioning factors developed from these models are based on a quantifiable metric. EPA is requiring facilities to update model documentation and verification each year to account for changes to tools or process at a facility between reporting periods.

Verification: EPA is requiring facilities to verify their engineering models used to apportion gas consumption by demonstrating that the results from the model are repeatable [30] and by comparing the difference between modeled gas usage and actual gas usage. EPA is requiring this comparison to be made yearly for two different gases, one corresponding to the gas used in the largest quantity for etching on a mass basis, and one used in the largest quantity for chamber cleaning on a mass basis during a reporting period, based on the total amount of gas usage measured by a facility. EPA would consider a model as verified when the apportioned plasma etching gas usage as modeled differs from the actual gas usage by less than or equal to 5 percent relative to actual gas consumption, reported to one significant figure using standard rounding conventions. This verification requirement only applies to the comparison for the plasma etching gas, and does not have to be completed for the comparison for the chamber cleaning gas.

EPA selected a verification standard of 5 percent as a means for a facility to demonstrate to EPA that the uncertainty in modeled estimates of gas usage does not appreciably affect the uncertainty in that facility's reported emissions.[31] EPA is focusing the verification of facility-specific engineering models on etching because information received in comments [32] on the proposed rule and from Partner reports from EPA's PFC Reduction/Climate Partnership for the Semiconductor Industry show that reportable gases used for etching rank second and third in total quantities of usage industry-wide, and have the highest emission factors, which together make gas usage for etching process types a significant contributor to total facility emissions.[33]

To reduce burden associated with verification, in the final rule, EPA is requiring that gas usage data for verification purposes be collected only for a single 30-day period of operation during which the capacity utilization equals or exceeds 60 percent of the design capacity. EPA selected a 30-day period for model verification to minimize disruptions to normal manufacturing operations while, at the same time, establishing a time period that is sufficiently long and a utilization that is sufficiently high to be representative of facility operations.

E. Fluorinated Gas Production (Subpart L)

1. Summary of Final Rule

Source Category Definition.

• The fluorinated gas production source category consists of processes that manufacture a fluorinated gas from any raw material or feedstock chemical, except for processes that generate HFC–23 during the production of HCFC–22. Producing a fluorinated gas includes the following:

—Producing a fluorinated GHG as defined at 40 CFR 98.410(b).

—The manufacture of a chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) from any raw material or feedstock chemical, including the manufacture of a CFC or HCFC as an isolated intermediate for use in a process that will result in its transformation either at or outside of the production facility.

• Producing a fluorinated gas does not include the following:

—The reuse or recycling of a fluorinated gas.

—The creation of HFC–23 during the production of HCFC–22.

—The creation of intermediates that are created and transformed in a single process with no storage of the intermediates.

—The creation of fluorinated GHGs that are released or destroyed at the production facility before the production measurement at 40 CFR 98.414(a). However, although such release and destruction do not themselves constitute fluorinated gas production, they must be reported when they occur during fluorinated gas production.

Reporters must submit annual GHG reports for facilities that meet applicability criteria in the (General Provisions (40 CFR 98.2)).

GHGs to Report. For facilities that produce fluorinated gases, report the following:

• CO_2, CH_4, and N_2O combustion emissions from each stationary combustion unit

• The total mass of fluorinated GHG emitted from:

—Each fluorinated gas production process and all fluorinated gas production processes combined.

—Each fluorinated gas transformation process that is not part of a fluorinated gas production process and all such fluorinated gas transformation processes combined.

—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.

—Venting of residual fluorinated GHGs in containers (e.g., returned heels).

GHG Emission Calculation and Monitoring. Reporters must calculate F–GHG emissions for each process as follows:

• *Initial Scoping speciation.* Perform an initial scoping speciation under 40 CFR 98.124(a) to identify all fluorinated GHGs that occur in the process. The deadline for completing the scoping speciation is February 29, 2012.

• *Estimating emissions.* There are two methods for estimating fluorinated GHG emissions from fluorinated gas production and transformation processes: The mass balance method and the emission factor method.

• Mass balance method.

—*Accuracy and Precision Requirements.* Before using the mass-balance approach to estimate emissions from a process, you must ensure that the process and the equipment and methods used to measure it meet either the error limits specified at 40 CFR 98.123(b) or the requirements specified at 40 CFR 98.124(b)(8).

• *Error limits.* Based on one of the approaches described in the rule, determine the absolute error and the relative error of using the mass balance method to estimate emissions from the process. If these calculations show that use of the mass-balance approach to estimate emissions from the process will result in an absolute error less than or equal to 3,000 metric tons CO_2e per year or a relative error less than or equal to 30 percent of the estimated emissions,

[30] Repeatable means that the variables used in the formulas for the facility's engineering model for gas apportioning factors are based on observable and measurable quantities that govern gas consumption rather than engineering judgment about those quantities or gas consumption.

[31] Please refer to the Electronics Manufacturing TSD (EPA–HQ–OAR–2009–0927) for more details on the verification metric.

[32] Refer to comment number EPA–HQ–OAR–2009–0927–0131.

[33] Although EPA understands that chamber cleaning processes require the largest quantities of gas usage, the emission factors for chamber cleaning are low compared to etching emission factors.

then you may use the mass-balance approach to estimate emissions from the process. Otherwise, you must either comply with the alternative to the error limits or use the emission factor (or emission calculation factor) method.

• *Alternative to error limits.* You must ensure that the process, and the equipment and methods used to measure it, meet the following requirements:

• The process must have a total annual throughput of 500,000 $mtCO_2e$ or less, where the throughput is defined as the sum of the CO_2-weighted masses of the fluorinated GHG reactants, products, and by-products.

• You must measure the masses and concentrations identified in the rule at least weekly, and you must calculate emissions at least weekly.

• You must measure the masses identified in the rule with an accuracy and precision of ±0.2 percent of full scale or better.

• You must measure the concentrations identified in the rule using analytical methods with an accuracy and precision of ±10 percent or better.

—*Mass-balance calculation.* To perform the mass balance calculation, you must track and measure the fluorine-containing compounds that are added to or removed from the process, including reactants, by-products and products, to determine the emissions in terms of fluorine. (Alternatively, you may track the flows of another element, such as carbon, as long as this element is contained in all of the fluorinated GHGs fed into or generated by the process.) To track the fluorine removed from the process and destroyed or recaptured, you must either speciate the contents of the streams removed from the process or you must use analytical methods that measure the total fluorine in these streams.

—To characterize emissions (i.e., divide them among reactants, products, and by-products), you must either assume that all emissions consist of the fluorinated GHG that has the highest GWP among the fluorinated GHGs that occur in more than trace concentrations in the process, or you must possess emission characterization measurements. For process vents that emit more than 25,000 $mtCO_2e$ per year, these measurements must include sampling and analysis of emitted streams. For other process vents, these measurements may also include previous measurements, provided the measurements are representative of the current operating conditions of the process, or bench-scale or pilot-scale test measurements representative of the process operating conditions.

• Emission factor (and emission calculation factor) methods.

—For each continuous process vent, perform a preliminary estimate of emissions, considering any controls, using one of the methods outlined below. For any continuous process vent with estimated emissions greater than or equal to 10,000 $mtCO_2e$, you must conduct emissions testing to develop an emission factor. For any batch process vent, and for any continuous process vent with estimated emissions less than 10,000 $mtCO_2e$, you have the option to use engineering calculations or assessments to develop an emission calculation factor.

—In the preliminary estimate, account for the demonstrated destruction efficiency and expected downtime of the destruction device, if applicable. Both the expected downtime of the device and the expected activity level for the process must be based on typical recent values unless there is a compelling reason to adopt a different value. If there is such a reason (e.g., introduction of controls for a previously uncontrolled vent), it must be documented in the facility's GHG Monitoring Plan. If your process vent emits one or more fluorinated GHGs whose GWPs are not listed in Table A–1 to subpart A, you may use a default global warming potential (GWP) of 2,000 for these fluorinated GHGs, or you may request to use provisional GWPs for these fluorinated GHGs if:

• The fluorinated GHGs 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 $mtCO_2e$ for the vent, and

• You possess data and analysis that indicate that the fluorinated GHGs have GWPs that would result in total calculated annual emissions less than 10,000 $mtCO_2e$ for the vent.

—For the preliminary estimate, facilities may use the following methods:

• Facilities may use the Emissions Inventory Improvement Process, Volume II: Chapter 16, Methods for Estimating Air Emissions from Chemical Manufacturing Facilities. U.S. Environmental Protection Agency, August 2007.

• Facilities may determine the uncontrolled fluorinated GHG emissions from any process vent within the process using the procedures specified in 40 CFR 63.1257(d)(2)(i), "National Emission Standards for Pharmaceutical Production," except as specified in 40 CFR 98.123, paragraphs (b)(1)(i)(B)(1) through (b)(1)(i)(B)(4).

• Facilities may use commercial software products that follow chemical engineering principles, including the calculation methodologies in 40 CFR 98.123, paragraphs (b)(1)(i)(A) and (B).

• Facilities may use previous test results, bench scale, or pilot-scale data, provided they are representative of the current process operating conditions.

• Facilities may use design analysis based on chemical engineering principles, measurable process parameters, or physical or chemical laws or properties.

• Facilities may use maximum flow rate, fluorinated GHG emission rate, concentration, or other relevant parameters specified or implied within a permit limit applicable to the process vent.

—*Emission and emission calculation factors for continuous processes:* For continuous process vents with emissions, considering controls, that are greater than or equal to 10,000 $mtCO_2e$, conduct emissions testing to determine the site-specific, process vent-specific emissions factor.

• If the vent is controlled and annual emissions bypassing, i.e., not venting to, the control device are less than 10,000 $mtCO_2e$, then you may conduct emissions testing after the control device.

• Otherwise, conduct emissions testing before the control device. You may conduct emissions testing for fluorinated GHG following an acid gas scrubber, if there is no appreciable fluorinated GHG reduction occurring.

—For batch process vents and for continuous process vents with annual emissions of less than 10,000 $mtCO_2e$, either conduct emissions testing or use one of the engineering calculation or assessment methods outlined above (except the approach based on maximum flow rates, concentrations, etc.) to develop the site-specific, process-vent specific emission calculation factor. If and when emissions from a continuous process vent meet or exceed 10,000 $mtCO_2e$ (e.g., due to activity increases, process changes, or destruction device malfunctions), you must conduct emissions testing and develop an emission factor for the vent by the end of the following year.

—*Emission and emission calculation factors for batch processes:* For process vents from batch processes, either perform emissions testing as described above or use one of the engineering calculation or assessment methods outlined above (except the approach based on maximum flow rates, concentrations, etc.) to develop the site-

specific, process-vent specific emission calculation factor.

—*All processes:* Determine the emissions factor or the emissions calculation factor using the fluorinated GHG emission rate and the process activity rate.

—The deadline for completing development of emission factors and emission calculation factors is February 29, 2012.

—Estimate annual fluorinated GHG emissions from each process vent using the emission factor or the emission calculation factor and the actual activity data along with the use and uptime of the destruction device.

—Sum the fluorinated GHG emission for all vents in the process.

—If using the emission factor or emission calculation factor approach, estimate emissions from equipment leaks using EPA's Protocol for Equipment Leak Emission Estimates (EPA–453/R–95–017). The equipment leak emission estimates may include use of Method 21 for appropriate fluorinated GHGs. Alternatively, use a site-specific leak detection method that you have validated for the fluorinated GHGs (or their surrogates) that occur in the process.

• To establish the destruction efficiency, conduct a performance test or use the destruction efficiency determined during a previous performance test that meets the rule requirements. For certain difficult-to-destroy fluorinated GHGs such as CF_4, SF_6, and saturated PFCs other than CF_4, a destruction efficiency must be developed specifically for that compound or for a more difficult-to-destroy surrogate (e.g., CF_4 may be used as a surrogate for SF_6). For other fluorinated GHGs, the destruction efficiency may be developed using any Class 1 compound on the Thermal Stability Rankings List.

• For destruction processes, estimate emissions using the calculation methods in the rule.

• To estimate emissions from venting of container heels in cases where the heels are not recaptured or destroyed, either:

—Weigh each container upon its return to the facility and before venting or

—Develop a representative heel factor for each fluorinated GHG and container size and type and multiply it by the number of containers of that gas and size and type vented annually.

• *Request to use a GWP other than 2,000 for fluorinated GHGs whose GWPs are not listed in Table A–1 to subpart A.* As noted above, for purposes of the preliminary emissions estimate under the emission factor approach, facilities may request to use a GWP other than 2,000 for fluorinated GHGs that do not have GWPs listed in Table A–1 to subpart A. Facilities must submit this request by February 28, 2011.

—For each fluorinated GHG that does not have a GWP listed in Table A–1 to subpart A and that constitutes more than one percent by mass of the stream emitted from the vent, the facility must provide the identity of the fluorinated GHG (including its chemical formula), the estimated GWP of the fluorinated GHG, the data and analysis that supports the facility's estimate of the GWP of the fluorinated GHG, and the engineering calculations or assessments and underlying data that demonstrate that the process vent is calculated to emit less than 10,000 $mtCO_2e$ 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.

—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 $mtCO_2e$ 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, then EPA will publish a notice including a summary of the data and analysis supporting the GWPs. 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 preliminary emissions calculations.

• *Best available monitoring methods (BAMM).* We are allowing facilities to use Best Available Monitoring Methods (BAMM) for any parameter that cannot reasonably be measured according to the monitoring and QA/QC requirements of subpart L. The owner or operator must use the calculation methodologies and equations in the "Calculating GHG emissions" section of subpart L, but may use the best available monitoring method for any parameter for which it is not reasonably feasible to achieve the following by either July 1, 2011 or March 1, 2012 (these dates are discussed further below):

—Acquire, install, or operate a required piece of monitoring equipment.

—Procure services from necessary providers (e.g., contractors specializing in stack testing to support the development of emission factors).

—Gain physical access to make required measurements (e.g., because a measurement requires the installation of a port and it is unsafe to install the port during process operation).

• *BAMM Deadlines.* Facilities may use BAMM to estimate emissions that occur through June 30, 2011 without submitting a request to EPA.

• Facilities wishing to use BAMM to estimate emissions that occur throughout 2011 for parameters other than scoping speciations, emission factors, and emission characterizations must submit a request to EPA by February 28, 2011.

• Facilities wishing to use BAMM to estimate emissions that occur throughout 2011 (or in unique or extreme circumstances, until after that date) for scoping speciations, emission factors, and emission characterizations must submit a petition to EPA by June 30, 2011.

• *Contents of BAMM Extension Requests.* Requests for BAMM extensions must include detailed explanations and supporting documentation to describe why it is not reasonably feasible for the facility to comply with the applicable monitoring requirements. In general, extension requests must include detailed descriptions and evidence that it is not reasonably feasible for the facility to acquire, install, or operate a required piece of monitoring equipment, to procure services from necessary providers, or to gain physical access to make required measurements in a facility before July 1, 2011 (for parameters other than scoping speciations, emission factors, and emission characterizations) or March 1, 2012 (for scoping speciations, emission factors, and emission characterizations). BAMM extension requests must also document the facility's efforts to comply with the requirements and explain the BAMM that the facility will use, should EPA approve the request. EPA does not anticipate approving the use of BAMM beyond December 31, 2011; however, EPA reserves the right to approve any such requests submitted by June 30, 2011 under unique and extreme circumstances which include safety, technical infeasibility, or inconsistency with other local, State or Federal regulations. Facilities requesting BAMM past December 31, 2011 would have to submit documentation to support the request similar to that required for BAMM requests in 2011. In addition, these facilities would be required to describe the unique and extreme circumstances which necessitate the extended BAMM.

• We anticipate that facilities will need to use best available monitoring methods only under limited circumstances.

• *BAMM for facilities pursuing the emission factor approach.* For facilities pursuing the emission factor approach for a given process, we expect that most activity data is already monitored using measurement devices with an accuracy and precision of ±1 percent of full scale or better. However, where this is not the case and where it is not reasonably feasible to acquire, install, or operate the measurement device by January 1, 2011 (or July 1, 2011), the facility would use the currently installed device (or would request to use it) through June 30, 2011 (or December 31, 2011).

• Facilities already have until February 29, 2012 to develop emission factors and emission characterizations; thus, they would not need to use BAMM for these parameters unless they could not complete stack testing and parameter development until after that date. In this case, if the request for extended BAMM were granted, the facility would have until February 28, 2013 to complete emissions testing and develop the emission factor or emission characterization for the affected vent and process. In the meantime, the facility would use an emission calculation factor or emission characterization developed through engineering calculations or assessments to estimate 2011 emissions. As a condition for any approval of 12-month BAMM during the development of emission factors and emission characterizations, we are requiring facilities to recalculate and re-submit their 2011 emission estimates for the affected processes to reflect the scoping speciations, emission factors, and emission characterizations that they complete or develop for those processes after February 29, 2012.

• We do not expect facilities to require BAMM for estimating emissions from equipment leaks because we are already providing a great deal of flexibility in how such leaks may be estimated, including allowing the use of default emission factors.

• *BAMM for facilities pursuing the mass-balance approach.* For facilities using the mass-balance approach for a given process, we anticipate that the main reason for using BAMM will be an inability to meet the error limit due to an inability to acquire, install, or operate measurement devices with sufficient accuracies and precisions by January 1, 2011. In such cases, facilities will have a choice regarding the monitoring method they select to estimate emissions from the process under the BAMM provisions. They may use engineering calculations or assessments to develop emission calculation factors, or they may apply the mass-balance equations to the data they acquire using their current measurement devices. Before pursuing the latter method, facilities must estimate the relative and absolute errors that would be associated with using the mass-balance method to estimate emissions based on their current monitoring data. We anticipate approving the use of BAMM with the mass-balance method only if those errors are less than 50 percent or less than 2,500 $mtCO_2e$ for 6 months of emissions from the process, respectively. If facilities cannot meet these error limits, they should use engineering calculations or assessments as their BAMM.

• *BAMM for facilities pursuing either approach.* Facilities requesting BAMM while they prepare to implement either the emission-factor or the mass-balance approach must explain and document why it is not reasonably feasible for them to apply the other approach to estimate emissions from the relevant process. Thus, facilities requesting BAMM until January 1, 2012 while they prepare to implement the mass-balance approach must explain and document why it is not reasonably feasible for them to apply the emission factor approach by July 1, 2011, and vice versa.

• *Destruction efficiencies.* We do not anticipate approving the use of BAMM for destruction efficiencies for two reasons. First, facilities have the option of not reflecting, in their reporting, the destruction of fluorinated GHGs for which destruction efficiencies have not been demonstrated. Second, it would be difficult to select or justify the selection of a provisional destruction efficiency value if the destruction efficiency had not been measured for the fluorinated GHG at issue (or for a fluorinated GHG that is more difficult to destroy according to the hierarchy laid out at § 98.124(g)(1)).

Data Reporting. In addition to the information required to be reported by the General Provisions (40 CFR 98.3(c)), reporters must submit additional data that are used to calculate GHG emissions. A list of the specific data to be reported for this source category is contained in 40 CFR 98.126.

Recordkeeping. In addition to the records required by the General Provisions (40 CFR 98.3(g)), reporters must keep records of additional data used to calculate GHG emissions. A list of specific records that must be retained for this source category is included in § 98.127.

1. Summary of Major Changes Since Proposal

The major changes since proposal are identified in the following list. The rationale for these and any other significant changes can be found below or in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart L: Fluorinated Gas Production Processes."

• We are adding a number of clarifications to assist reporters in determining when and how the initial scoping speciation must be performed. Specifically, the initial scoping speciation applicability criteria are applied on a process vent basis rather than a process basis; facilities may conduct sampling and analysis on process vents or on process streams; and testing methods specific to stack testing do not have to be used. Other validated industry sampling analysis standards may be used.

• We have added more flexibility and robustness to the mass-balance approach by:

—Allowing use of the mass-balance approach with processes that do not produce fluorinated GHGs but may nevertheless emit them (e.g., processes that transform fluorinated GHGs). The mass-balance equations no longer assume that the mass that is lost from the process is emitted in the form of the product; instead, the equations express losses as emissions of fluorine. To divide emissions among reactants, products, and by-products, facilities either must assume that all emissions consist of the fluorinated GHG that has the highest GWP among the fluorinated GHGs that occur in more than trace concentrations in the process, or they must use emission characterization measurements.

—Incorporating process variability into the error calculation.

—Providing an alternative to the error limits for facilities that do not wish to calculate these limits.

• We have added more flexibility to the emission factor approach by:

—Allowing the use of engineering calculations or assessments to develop emission calculation factors for all batch process vents, regardless of emissions.

—Changing the method for determining whether the emissions of a continuous process vent fall below the 10,000 $mtCO_2e$ cutoff that allows the use of engineering calculations rather than stack testing. First, we are allowing the use of controlled rather than uncontrolled emissions in this determination and are consequently eliminating the separate exemption for vents that are 99.9 percent controlled.

Second, where one or more fluorinated GHGs emitted from the vent do not have a GWP listed in Table A–1 to subpart A, we are allowing the use of a default GWP of 2,000 for these GHGs in the determination rather than setting a cutoff of one ton of chemical. We are also allowing facilities to request to use a provisional GWP where the facility believes that the fluorinated GHG's GWP is less than 2,000 and where the difference would reduce the calculated vent emissions from above the 10,000 $mtCO_2e$ cutoff to below it.

—Providing an additional two months (until February 29, 2012) to develop emission factors, emission calculation factors, emission characterizations, and destruction efficiencies.

—Allowing emissions testing after the control device if the vent is controlled and annual emissions bypassing (i.e., not vented to) the control device are less than 10,000 $mtCO_2e$. This change is expected to reduce the number of situations in which testing of hazardous streams on the inlet side to the control device may be required, to limit the number of potential sampling ports that may need to be installed, and to increase the number of situations in which testing of outlet emissions only will be required, i.e., without need for additional destruction efficiency testing.

—For vents from continuous processes with emissions over 10,000 $mtCO_2e$, summed across operating scenarios, requiring testing of only the largest-emitting operating scenario and any other operating scenario that (1) emits more than 10,000 $mtCO_2e$ through the vent, and (2) has an emission calculation factor that differs by 15 percent or more from the emission calculation factor of the tested operating scenario. (In the proposed rule, stack testing would have been required for each operating scenario.)

—Expanding the set of test methods that can be used for emissions testing. We are allowing industry standard sampling and analytical methods that have been validated using EPA Method 301 or other validation methods.

—Expanding the set of methods that can be used for quantifying emissions from equipment leaks. We are now allowing use of the default average emission factor approach in EPA's Protocol for Equipment Leaks and are allowing facilities to implement their own methods for detecting and quantifying fluorinated GHG emissions from equipment leaks. Site-specific leak detection methods must be validated and both the methods and their validation must be documented in the facility's GHG Monitoring Plan.

—For purposes of quantifying emissions from equipment leaks, defining "in fluorinated GHG service" as containing or contacting a feedstock, by-product, or product that contains 5 percent or more total fluorinated GHG by weight.

• We are adding a requirement to monitor and report fluorinated GHG emissions from containers when the residual fluorinated GHG (heel) is vented to the atmosphere rather than recaptured and reused or destroyed. As discussed in the proposed rule and in the technical support document, venting of residual gas from containers can have a significant impact on the overall emission rate of a fluorinated GHG production facility. Estimating such emissions is straightforward and is not expected to impose a significant burden on facilities.

• We are adding a one-time requirement to report existing data and analysis regarding the formation of products of incomplete combustion (PICs) that are fluorinated GHGs during the destruction of fluorinated gases. Studies of high-energy processes in the electronics industry indicate that PFC PICs may form in significant quantities during the destruction of fluorinated GHGs. Once formed, such PICs are likely to be very difficult to destroy. We considered requiring regular reporting of fluorinated GHG PIC generation and emissions under this rule, but we concluded that more information on the nature and magnitude of such emissions was needed to determine whether and how to craft reporting requirements. The one-time reporting requirement regarding PICs is intended to begin addressing this need.

• To clarify that PICs are excluded from reporting under this rule (except for the one-time reporting requirement), we are amending the definition of destruction efficiency in subpart A to express it in terms of the tons of a particular GHG that is fed into and exhausted from the device, rather than in terms of the tons of CO_2e of all GHGs fed into and exhausted from the device. We are also deleting the phrase "including GHGs formed during the destruction process" from the definition of the quantity exhausted from the device.

• We are modifying the proposed BAMM provision to allow fluorinated gas production facilities to use BAMM to estimate emissions through June 30, 2011 without submitting a request to EPA. In the proposal, facilities would have been allowed to use BAMM to estimate emissions only through March 31, 2011 without submitting a request. We are also reserving the right to allow, in extremely limited circumstances, facilities to use BAMM to estimate 2012 emissions. We are allowing facilities to use BAMM for 6 months rather than three and are potentially allowing the use of BAMM beyond 2011 based on comments received on the April 12, 2010 proposed rule and our experience implementing the final reporting rule issued in October 2009. For a more detailed discussion on EPA's rationale, see "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart L: Fluorinated Gas Production" (available in the docket, EPA–HQ–OAR–2009–0927).

2. Summary of Comments and Responses

This section contains a brief summary of major comments and responses. A number of comments on fluorinated GHG production were received covering numerous topics. Responses to additional significant comments received can be found in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart L: Fluorinated Gas Production Processes."

Monitoring and QA/QC Requirements

Comment: A number of commenters argued against requiring emission testing of vents from batch processes, stating that the episodic and variable nature of batch emissions make them extremely difficult to measure accurately. These commenters noted that both the flow rates and fluorinated GHG concentrations in batch emissions can change rapidly, making them difficult to characterize and quantify correctly, and that vents often consist of small diameter process piping where traditional gas flow measurement devices are not effective. Commenters specifically cited depressurizations and vapor displacements as batch events whose emissions are hard to measure because they are characterized by varying and very low flows, respectively. They also observed that batch processes can last for days, meaning that it could take weeks to complete three test cycles, or even one year or more if the process is run infrequently. The commenters concluded that due to these concerns, other regulations that required estimation of emissions from batch processes allowed estimates to be based on a broad range of engineering calculations and assessments, which yield accurate emission estimates for batch processes. They recommended that EPA provide similar flexibility for batch processes in subpart L. Rather

than requiring stack testing for high-emitting batch process vents, one commenter suggested that EPA require the verification of emission calculations using "stack gas measurements that characterize the major emission events."

Response: In response to comments describing the technical issues associated with emission testing for batch processes, we have revised the requirements for estimating fluorinated GHG emissions from batch processes. In the final rule, facilities with batch process vents are required to develop emission calculation factors rather than conduct emission testing. As several commenters noted, there are several difficulties associated with conducting emissions testing for batch processes. Many batch processes have short to moderate batch lengths, short emission episode periods, low flow rates, and intermittent flow rates, and these characteristics make emissions from batch processes difficult to measure accurately. It is generally accepted that emission calculations for batch processes yield reasonably accurate results. As commenters noted, certain other rules for batch processes in the chemical manufacturing industry require emission calculations. Emission calculations are required for batch processes in the Pharmaceutical NESHAP and in the Miscellaneous Organic NESHAP, and emission calculations for batch processes are also laid out for industry in the Emissions Inventory Improvement Program (EIIP) guidance and in the Batch CTG document. The Pharmaceutical NESHAP and Miscellaneous Organic NESHAP do not require emissions testing to determine the emission rates for individual process vents from batch processes under these rules. (However, emissions testing to demonstrate the control efficiency achieved by an add-on air pollution control device on batch processes is conducted, based on the worst-case scenario).

We considered requiring field verification of emission estimates for the largest batch emission episodes, but determined that we did not have enough information to finalize a requirement that could be consistently applied across different processes and facilities. Follow-up discussions with the commenter that suggested the verification testing (as an alternative to full emissions testing) indicated that the methods used to verify emissions would almost certainly vary from process to process and would be difficult to prescribe. Moreover, it was unclear what the criteria for a successful verification would be, and how a facility would address an unsuccessful verification. For example, if measurements indicated that emissions from a particular episode were significantly lower than expected based on engineering calculations, the discrepancy could be due either to a process-wide overestimate of emissions (perhaps due to overestimated by-product generation rates) or to a misallocation of emissions among emission episodes. Different responses would be appropriate for addressing these two possibilities. Thus, although we strongly encourage facilities to test large emissions episodes from batch processes where feasible, we are not requiring that they do so in this final rule.

Comment: Several commenters stated that the proposed Process Vent Threshold was too stringent, particularly in conjunction with a default GWP of 10,000 for compounds not listed in Table A–1 to subpart A. One commenter stated that by assigning this default GWP to all unknown fluorinated organic compounds, an emphasis is being placed on compounds that are not the focus of the rule. Another commenter noted that since many of their compounds are not included in Table A–1 to subpart A, they will not be able to use the 10,000 $mtCO_2e$ threshold. Several commenters requested that they be allowed to develop and use their own GWPs for compounds that are not listed in Table A–1 to subpart A, following the general guidance presented in various IPCC reports.

Multiple commenters expressed concern regarding the proposed destruction efficiency (DE) criterion of 99.9 percent for allowing use of engineering calculations and assessments. These commenters requested that EPA allow post-control efficiencies for vents that are controlled by DEs of less than 99.9 percent. Additionally, the commenter noted that when a very low concentration of the analyte of interest is present in a stream, a 99.9 percent DE may not be achievable.

One commenter recommended that EPA modify the threshold to reflect a sum of controlled and uncontrolled emissions to allow for situations when a destruction device is not in use. One commenter suggested that EPA establish a schedule that would require larger sources (greater than 50,000 or 100,000-$mtCO_2$/year) to report for the first two years, with smaller sources tested in subsequent years as technologies improve. Another commenter requested that EPA implement the 10,000 $mtCO_2e$ threshold and that it be applied as an additive threshold amongst all portions of a facility that are covered under Part 98. This commenter also noted that the 10,000 $mtCO_2e$ threshold is in accord with the requirements of many States and the Western Climate Initiative.

Response: EPA appreciates the comments and has modified the method for determining whether the emissions of a process vent fall below the 10,000 $mtCO_2e$ cutoff below which the facility may use engineering calculations rather than stack testing to estimate emissions. As noted in the response to the previous comment, we are allowing facilities to use engineering calculations and assessments to estimate emissions from all batch processes, regardless of emissions; thus, facilities must perform the determination only for continuous process vents.

First, we are allowing the use of controlled rather than uncontrolled emissions in the determination and are consequently eliminating the separate exemption for vents that are 99.9 percent controlled. Second, where one or more fluorinated GHGs emitted from the vent do not have a GWP listed in Table A–1 to subpart A, we are allowing the use of a default GWP of 2,000 for these GHGs in the determination rather than setting a cutoff of one ton of chemical. Third, where facilities believe that the default GWP overestimates the actual GWP and where use of the estimated actual GWP would lower the calculated emissions from the vent from above the 10,000 $mtCO_2e$ cutoff to below it, we are allowing facilities to request to use a GWP other than 2,000.

We believe that this revised approach allows reasonable flexibility and ensures that the rigor of emission calculations is proportional to the likely magnitude of the emissions. While the proposed rule would have permitted the use of engineering calculations and assessments to estimate emissions from vents that were always 99.9 percent controlled, they would have required stack testing for vents controlled below the 99.9 percent level, even if the emissions from these vents were considerably below 10,000 $mtCO_2e$. This final rule establishes a more consistent approach to accounting for destruction by permitting the use of engineering calculations and assessments where controlled emissions fall below 10,000 $mtCO_2e$.

This final rule also allows for a more sophisticated treatment of fluorinated GHGs whose GWPs are not listed in Table A–1 to subpart A. Under the proposed rule, facilities would have been required to perform stack testing on fluorinated GHG streams that exceeded one ton and that included any fluorinated GHG that did not have a

GWP listed in table A–1 to subpart A, even if this fluorinated GHG made up a small fraction of the stream. Implicitly, this assigned a GWP of 10,000 not only to the GHG without a GWP in table A–1 to subpart A, but to the rest of the stream. Assigning a default GWP of 2,000 to GHGs without GWPs in table A–1 to subpart A allows streams to be evaluated based on a reasonable estimate of the total CO_2e rather than just on total F–GHG tonnage.[34] The 2,000 value was selected based on an evaluation of all the known GWPs for fluorocarbon F–GHGs as listed in Table A–1 to subpart A.[35] It is intended to be a short-term default value. In the long run, EPA intends to establish a broader program for evaluating the GWPs of fluorinated GHGs. However, such a program will not be established in time to evaluate all of the GWPs that must be evaluated for purposes of determining whether or not to perform stack testing on process vents.

The option to request to use a provisional GWP addresses situations where the GWP of 2,000 would significantly overestimate the CO_2e emissions from a process vent and inappropriately trigger stack testing. In general, we expect such situations to be rare.

Comment: Several commenters expressed concern that the analytical methods as proposed were too limited or prescriptive. They argued that the set of proposed methods, analytical technologies, and detectors may not be appropriate for all fluorinated compounds. Commenters specifically observed that the prescribed detectors (e.g., ECD) do not work well with all fluorinated compounds. Commenters also expressed concern that the proposed rule did not address the need to adapt the methods to accommodate site-specific issues or safety concerns. The commenters recommended that EPA increase the flexibility in the testing section, include the same level of flexibility as was proposed for subpart OO, allow more methods as alternatives for use in analysis, and rely heavily on the facility GHG Monitoring Plan.

Response: EPA agrees that additional flexibility is appropriate and is allowing facilities to use alternative test methods and procedures to identify and quantify fluorinated GHGs in process and emissions streams. These alternative methods and procedures must be validated and documented in the facility's GHG Monitoring Plan. EPA has concluded that this change will provide the flexibility necessary to allow facilities to develop and apply new analytical procedures that may be required to identify and quantify all of the fluorinated GHGs in process and emissions streams. At the same time, the quality assurance, validation, and documentation requirements for analytical procedures will assure that facilities are able to obtain and report accurate emissions measurements.

Comment: Several commenters requested clarification of or changes to the error test that facilities must perform before applying the mass-balance approach to estimate emissions from a process. Some commenters requested that EPA establish an error limit in terms of the quantity of reactants fed into the process, an option on which EPA had requested comment. These commenters were concerned that the error limit that was presented in the proposed regulatory text, which would require the error to fall below either 30 percent of emissions or 3,000 $mtCO_2e$, would disadvantage fluorinated GHG production processes with low emissions for which facilities might prefer to use the mass-balance approach.

Response: EPA has carefully evaluated various options to ensure that emissions estimates developed using the mass-balance approach are reasonably accurate while avoiding placing a burden on facilities with low emissions. In our deliberations, we have considered the fact that for processes that do not pass the error test for the mass-balance approach, facilities may use the site-specific, process-vent-specific emission factor approach (PSEF), which is expected to have a relative error of less than 30 percent. The availability of the PSEF approach argues against allowing use of the mass-balance approach where relative and absolute errors are large.

The approach that EPA proposed, which would require the error to fall below either 30 percent of emissions or 3,000 $mtCO_2e$, limits the relative error of large emissions and the absolute error of small emissions. We anticipate that processes that have large throughputs, moderate to large emission rates (2 percent), and measurements with good precisions and accuracies will pass this error test, because the error will fall under 30 percent of emissions. EPA also anticipates that processes that have small to medium throughputs, small to medium emission rates, and measurements with moderate to good precisions and accuracies will pass the error test, because the error will fall either under 30 percent of emissions or under 3,000 $mtCO_2e$. However, processes with large throughputs and small emission rates may not pass the error test even if their measurements are highly accurate and precise, because the error will exceed both 3,000 $mtCO_2e$ and 30 percent of emissions.

The last set of processes described might be able to use the mass-balance approach if the error test were applied to the ratio of the absolute error (numerator) and the reactants or products of the process (denominator). In this case, the quantity to which the error test was applied would remain constant regardless of the emission rate rather than increasing as emissions decreased. However, while such an approach would maintain the mass-balance approach as an option for large processes with small emission rates, it would do so at the cost of reducing the precision and accuracy of the resulting emission estimates well below what could be achieved using the emission factor approach. For example, consider a process producing 10 million $mtCO_2e$ of product (well within the range for HFCs) and emitting one percent of this, or 100,000 $mtCO_2e$. If error was limited to 0.6 percent of the fluorinated GHG product,[36] the error of the emissions estimate for this process could be 60 percent, or 60,000 $mtCO_2e$. Using the emission factor approach, the error of the emissions estimate would be half this, 30,000 $mtCO_2e$. Thus, EPA is not adopting the alternative error test. Instead, EPA is adopting the error test that was proposed.

Comment: One commenter stated that the relative error associated with each measurement is not necessarily known. This commenter also requested clarification on when the error test must take place and how multiple measurements should be handled in the test. The commenter noted that over the reporting year, at least 12 measurements

[34] This would avoid problematic situations that could arise if facilities simply switched to a 5-ton cut-off whenever part of an emissions stream lacked a GWP. One of these would be having to use stack testing on a 6-ton vent stream that consisted mostly (e.g., 98%) of a fluorinated GHG with a GWP of 50, but consisted slightly (e.g., 2%) of a fluorinated GHG with an unknown GWP. Another problematic situation would be NOT having to use stack testing on a 4-ton vent stream that consisted mostly (98%) of a fluorinated GHG with a GWP of 3000, but slightly (2%) of a fluorinated GHG with an unknown GWP.

[35] The average for all of the fluorocarbons in this list was 2,300. For purposes of estimating the GWPs of fluorocarbons that do not appear in Table 1, this average may actually be high because it includes the GWPs of PFCs, which have an average GWP of about 7,600. EPA believes that most PFCs whose vapor pressures qualify them as fluorinated GHGs already have their GWPs listed in Table A–1. The average GWP of the fluorocarbons other than the PFCs is approximately 1,600. (HFCs have an average GWP of about 2,000, while HFEs have an average GWP of about 1,200 to 1,400).

[36] The 0.6 percent fraction was selected as an example because it equates to a 30 percent error for emissions of two percent of production.

would be made of masses and concentrations. If facilities waited until the end of the year to perform the error test and then found that the process "failed" it, they would not have time to pursue the alternative of developing and applying process-specific emission factors.

Response: EPA agrees that there may be multiple sources of error in the mass and concentration measurements used to estimate emissions under the mass balance approach. However, while some of these sources of error may not be known or easily quantifiable, the most important sources of error can be assessed and quantified. These include the error of the measurement devices and the variability of the process. In general, facilities would be expected to know the accuracies and precisions of their devices (e.g., flowmeters) for measuring mass and their analytical methods for measuring concentrations. Facilities would also be expected to know how variable their process is and, in general, what drives that variability (e.g., catalyst age). Since mass measurements are cumulative (that is, the monthly estimates of mass flowing into or out of the process should be totals for the month), process variability will generally have much more of an impact on the accuracy and precision of the concentration measurements than on those of the mass measurements.

If a facility has a record of concentration measurements that are representative of the current process (including its full variability) and analytical methods, then these concentration measurements may be used to assess the variability of the process. The variability in these measurements will also capture the random error (imprecision) of the analytical method. (The variability will not capture the systematic error or inaccuracy of the method, but this is generally expected to be smaller than the error associated with process variability.) To incorporate this variability into the error calculation, facilities must consider the fact that at least 12 concentration measurements would be taken over the course of the year.[37] As explained further in the revised technical support document, this can be accomplished using the student's distribution.

If a facility does not have a record of concentration measurements that capture the variability of the process, the facility can assess this variability by either (1) relying on engineering calculations, or (2) taking several measurements over the first month or two of the reporting year. The facility can then incorporate the results of these measurements into the mass-balance error calculation. Since these two methods for assessing variability may be less reliable than long-term monitoring, the facility may wish to pursue the process-vent-specific emission factor approach if the results show that the process barely passes the error test.

As discussed above, in response to this and other comments regarding the complexity of the mass-balance error calculation, we are including in the final rule an alternative set of requirements that are designed to ensure that emission estimates developed using the mass-balance approach are reasonably accurate and precise. Under this alternative set of requirements, which can only be used for processes that have a total annual throughput of 500,000 $mtCO_2e$ or less of fluorinated GHG reactants, products, and by-products, facilities are required to measure the masses identified in the rule with an accuracy and precision of ±0.2 percent of full scale or better, to measure the concentrations identified in the rule using analytical methods with an accuracy and precision of ±10 percent or better, and to conduct these measurements at least weekly. The rationale for this alternative approach is discussed further in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart L: Fluorinated Gas Production Processes."

Comment: Commenters also addressed the issue of the use of surrogates in determining destruction efficiency. They noted that in the destruction and removal efficiency (DRE) testing that is performed at hazardous waste combustors pursuant to 40 CFR 63.1219, facilities are allowed to test any principal organic hazardous constituent (POHC) within a thermal stability class to establish the DRE of all the other POHCs in that class. The commenters argued that EPA should take a similar approach in the requirements for determining the destruction efficiency (DE) for fluorinated GHGs, clarifying that Class 1 POHCs, such as naphthalene, are acceptable surrogates.

Response: We understand that in the destruction and removal efficiency (DRE) testing that is performed at hazardous waste combustors pursuant to part 63, subpart EEE, facilities that demonstrate 99.99 percent DRE for a POHC within a thermal stability class are allowed to assume that 99.99 percent DRE would also be achieved for the other compounds in that class and for compounds in other thermal stability classes with lower thermal stability rankings. This approach is based on the general conclusion that, for POHCs that are in the same class and that occur in significant volumes, differences in DREs tend to be small, and that compounds in other thermal stability classes with lower stability rankings are easier to destroy.

However, it would be a misapplication of the thermal stability index to conclude that a combustor that has demonstrated 99.99 percent DRE for any Class 1 compound[38] would also achieve 99.99 percent DRE for SF_6, a Class 1 compound, and for perfluoromethane (CF_4). While achieving 99.99 percent DRE for SF_6 ensures 99.99 percent DRE for other Class 1 compounds, the converse may not be true. As discussed below, SF_6 is substantially more thermally stable than other Class 1 compounds (and CF_4 is substantially more thermally stable than SF_6). Note that this does not undermine EPA's policy of assuming for purposes of the hazardous waste combustion standards that achieving 99.99 percent DRE for a Class 1 compound ensures 99.99 percent DRE for other Class 1 compounds (and, therefore, for all POHCs). Given that SF_6 is nontoxic and is not a RCRA Part 261, Appendix VIII organic compound for which 99.99 percent DRE would be required under the hazardous waste combustion standards, the fact that demonstrating 99.99 percent DRE for other Class 1 compounds may not ensure 99.99 percent DRE for SF_6 is irrelevant to that policy.

The theoretical considerations that support the conclusion that fluorinated GHGs are extremely thermally stable relate to the high energies of the C–F and S–F bonds. These energies make it difficult to break the bonds through reaction with oxygen, hydrogen, or the hydroxyl radical, the typical means of destroying other class 1 compounds. Essentially, the only path available to destroy these fully fluorinated compounds in hazardous waste combustors or thermal oxidizers is through thermal decomposition at very

[37] Facilities are required to time their monthly (or more frequent) concentration measurements so that they obtain a representative set of these measurements over the course of the year. For example, if the catalyst is renewed on the first of every month, facilities should take measurements at the beginning, middle, and end of the month, even if this means that three weeks or five weeks rather than one month may elapse between measurements.

[38] Class 1 is the group of POHCs and surrogates with the highest thermal stability, meaning they are the most difficult compounds to destroy.

high temperatures.[39] These temperatures are significantly higher than those required for the thermal decomposition of most other class 1 compounds. For SF_6, the thermal stability index indicates that the temperature to achieve 99 percent destruction with a two-second residence time is 1,090°C; for CF_4, we project that the temperature would be on the order of 1,380°C.[40] Researchers have suggested that CF_4 may break down only in the flame zone.[41]

Experimental evidence supports the idea that SF_6 and CF_4 are difficult to destroy. Due in part to the theoretical considerations outlined above, several studies have evaluated the use of SF_6 as a possible surrogate for POHCs in evaluating DREs. Most studies have verified that the DRE measured for SF_6 is likely to be lower than that for POHCs, i.e., that it is likely to yield a conservative estimate of the DREs for POHCs under most conditions. In one experiment at a full-scale hazardous waste incinerator, the investigators found that even at high-temperature conditions, SF_6 had a DRE that led to emissions approximately an order of magnitude higher than those of other POHCs, including both class 1 and class 2 compounds. At lower-temperature conditions, SF_6 had a DRE that was over 100 times lower than those of other POHCs.[42] As noted above, CF_4 is even more difficult to destroy than SF_6. This has been confirmed in testing of point-of-use thermal abatement devices used in electronics manufacturing, which destroyed CF_4 with an efficiency that was significantly lower (sometimes orders of magnitude lower) than the efficiency with which they destroyed SF_6.[43]

Sulfur hexafluoride is ranked fourth in the POHC Thermal Stability Index; CF_4 is not ranked. Three compounds are ranked higher than SF_6 (i.e., ranked as having higher thermal stability). Hydrogen cyanide and cyanogen are ranked first and second in the thermal stability Index, but these POHCs are rarely present at levels that qualify them as POHCs. Benzene is ranked third, but it frequently occurs as a product of incomplete combustion (PIC) and is therefore rarely selected as a POHC for DRE testing. For these reasons, the compounds above SF_6 in the Index have not been used to measure the performance of most hazardous waste combustors.[44] [45] However, at fluorinated gas production sites that vent SF_6, CF_4, or other perfluorocarbons to destruction devices, these high-GWP compounds have the potential to profoundly affect the actual, CO_2-weighted destruction efficiencies of those devices. The long atmospheric lifetimes of CF_4 (50,000 years) and SF_6 (3,000 years) amplify the desirability of accurate measurements of their destruction. Thus, using these compounds themselves to measure their DEs, rather than compounds that may overestimate their DEs (and underestimate their emissions) by an order of magnitude or more, is critical.

Other fluorinated compounds are not likely to be as stable as CF_4 and SF_6 because they can be dissociated at C–H and C–C bonds (which are weaker than C–F and S–F bonds). Nevertheless, higher molecular weight perfluorocarbons such as C_2F_6 are still expected to be relatively difficult to incinerate.[46] As is true for CF_4, the mechanism of destruction is expected to be thermal decomposition rather than attack by radicals, although the decomposition temperature will be lower than for CF_4 due to the fact that the C–C bond is weaker than the C–F bond.

For these reasons, EPA is requiring that facilities that destroy CF_4, SF_6, and other PFCs test the DE of their destruction devices with the most difficult-to-destroy compound in this set that they actually destroy. (This requirement applies if the facility wishes to reflect the destruction in its emissions estimates; the facility has the option of forgoing testing if it does not wish to reflect the destruction.) Specifically, facilities that destroy CF_4 must test the DE of their destruction device with CF_4 to be able to apply an efficiency to this compound. Facilities that destroy SF_6 must test the DE of their destruction device with SF_6 or CF_4 to be able to apply an efficiency to this compound. Facilities that destroy higher molecular weight PFCs must test the DE of their destruction device with the lowest molecular weight saturated PFC that they destroy, a lower molecular weight saturated PFC, or SF_6 to apply an efficiency to these compounds. Facilities that destroy other fluorinated GHGs, such as HFCs, may test the DE of their destruction device using any class 1 compound in the POHC Thermal Stability Index.

Comment: Commenters stated that the methods proposed for detecting and quantifying equipment leaks are burdensome and as currently written, are inappropriate for many fluorinated GHGs. The commenters noted that, in their experience in monitoring emissions of VOCs or HAP from equipment leaks, such leaks typically make up only a small percentage of facility emissions. Several commenters noted that the proposed methods are drawn from EPA's Protocol for Equipment Leak Estimates and would be used in conjunction with Method 21. Method 21 was developed to detect and quantify emissions of volatile organic compounds (VOCs) from various sources. The technologies that are commonly used for quantifying leaks of VOCs do not detect many fluorinated GHGs at the sensitivity required by Method 21, and detectors that are capable of quantifying leaks of a range of these fluorinated GHGs do not meet all of the specifications for detectors set forth in Method 21, including, for example, probe diameter and sampling rate.

Several commenters requested that EPA allow the use of alternative methods to detect and quantify fluorinated GHG equipment leaks. Some of these alternatives addressed the inability of Method-21-compliant technology to detect fluorinated GHGs. Others addressed the cost of screening large equipment sets for leaks, and some addressed both. The alternative methods included alternative detection technologies that did not meet all of the specifications of Method 21, any EPA monitoring approach in use in regulations, soap bubble testing either as

[39] W. Tsang et al make this case for perfluoromethane in Tsang, W., Burgess Jr., D. R., and Babushok, V. (1998) "On the Incinerability of Highly Fluorinated Organic Compounds," *Combustion Science and Technology,* 139:1, 385–402. An analogous argument can be made for sulfur hexafluoride.

[40] SF_6 temperature is from Appendix VIII ranking of POHCs; CF_4 temperature is estimated based on the rate constant provided in Tsang, p. 393.

[41] Tsang, p. 387.

[42] A. Trenholm, C. Lee, and H. Jermyn, "Full-Scale POHC Incinerability Ranking and Surrogate Testing," 17th Annual RREL Hazardous Waste Research Symposium, EPA Office of Research and Development, EPA/600/9–91/002 April, 1991, pp. 79–88.

[43] USEPA, "Developing a Reliable Fluorinated Greenhouse Gas (F–GHG) Destruction or Removal Efficiency (DRE) Measurement Method for Electronics Manufacturing: A Cooperative Evaluation with Qimonda," March 2008, EPA 430–R–08–017; USEPA, "Developing a Reliable Fluorinated Greenhouse Gas (F–GHG) Destruction or Removal Efficiency (DRE) Measurement Method for Electronics Manufacturing: A Cooperative Evaluation with IBM," June 2009, EPA 430–R–10–004; and USEPA, "Developing a Reliable Fluorinated Greenhouse Gas (F–GHG) Destruction or Removal Efficiency (DRE) Measurement Method for Electronics Manufacturing: A Cooperative Evaluation with NEC Electronics, Inc.," December 2008, EPA 430–R–10–005.

[44] Nonetheless, if a combustor has demonstrated 99.995 DRE for any of these three compounds, it is reasonable to assume that it would also achieve 99.99% DRE for SF_6.

[45] If hydrogen cyanide or cyanogens were present in a hazardous waste at levels high enough to consider them as principal organic hazardous compounds (POHCs), the regulatory authority would likely ensue that they were tested as POHCs given that they are substantially more thermally stable than other Class 1 compounds.

[46] Tsang, p. 401.

a screening approach to be followed up with leak quantification or as a leak designator in itself, pressure and vacuum tests on batch process equipment, various sampling regimens, and alternative equipment counting approaches (for example, approaches that focus on rotating but not static equipment). One commenter suggested that EPA permit monitoring of room exhaust to quantify leaks from process equipment inside the room where the facility successfully completes an EPA Method 204 capture efficiency demonstration. Commenters requested that EPA allow facilities to establish and modify their own methods to provide appropriate equipment leak estimates for fluorinated GHG emissions, provided the methodology is documented in the GHG Monitoring Plan.

Response: EPA agrees that it is appropriate to give facilities flexibility in designing and conducting their leak monitoring. In this final rule, we are expanding the set of methods that can be used for quantifying emissions from equipment leaks. We are now allowing use of the default Average Emission Factor approach in EPA's Protocol for Equipment Leak Estimates and are allowing facilities to implement their own methods for detecting and quantifying fluorinated GHG emissions from equipment leaks. Site-specific leak detection methods must be validated, e.g., through comparison with other methods, and both the methods and their validation must be documented in the facility's GHG Monitoring Plan.

Three considerations have persuaded us to allow this flexibility. First, the equipment and methods for detecting and quantifying emissions of fluorinated GHGs from equipment leaks have not advanced as far as those for monitoring emissions of VOC from equipment leaks. While some fluorinated GHGs can be detected using instruments that meet EPA Method 21 specifications, many others cannot. Although instruments for detecting leaks of HFCs and SF_6 from air-conditioning, refrigeration, and electrical equipment have existed for some time, most of these instruments do not quantify emissions and/or detect only one or two gases. In many cases, therefore, these instruments are not capable of quantifying emissions of the broad range of fluorinated GHGs that can leak from process equipment in fluorinated gas production facilities. For some fluorinated GHGs, the only instruments that are capable of detecting and quantifying emissions do not meet all of the Method 21 specifications or reach their maximum ("peg") at relatively low concentrations. Thus, EPA is permitting use of monitoring equipment that departs from Method 21 specifications.

Second, information submitted by several fluorinated gas producers indicates that equipment leaks account for a very small share of facility-wide fluorinated GHG emissions. Although this generalization is largely based on experience with VOCs and HAP, two fluorinated gas producers have surveyed at least some of their process equipment with detectors sensitive to fluorinated GHGs and have found a similar, very low, level of emissions. Consequently, if some leak quantification methods used to monitor equipment leak emissions under this rule, despite initial validation efforts, are later found to have relatively poor precisions or accuracies, these errors are unlikely to have had a large impact on facility emissions estimates in the meantime. The potential costs of experimentation in this area are relatively low.

Third, the goal of this rule is to quantify fluorinated GHG emissions from leaks rather than to regulate them. Hence, leak quantification approaches that yield unbiased, if imprecise, estimates are preferable to approaches that yield biased (e.g., conservatively high) estimates (e.g., the Average Emission Factor Approach). Also, approaches that quantify leaks without locating them (i.e., the room exhaust test suggested by one commenter) are acceptable in this context.

One area where we are setting a quantitative monitoring standard is in sampling fractions and frequencies. In addition to requiring the sampled equipment to be representative of the equipment used in the process (e.g., in terms of proportions of rotating equipment, etc.), we are requiring that at least one third of the equipment for each process be monitored each year. (There is an exception for equipment that is difficult-to-monitor and unsafe-to-monitor.) This requirement sets a consistent standard across facilities and ensures that all equipment is sampled over a three-year period.

One option that we considered and rejected was to require facilities to use the Average Emission Factor Approach in the Protocol for Equipment Leak Estimates.[47] This approach requires facilities to count the number of pieces of equipment of each type in a process and multiply the number of each type by a default emission factor. Fluorinated gas producers noted that this approach tends to grossly overestimate emissions from leaks, e.g., by a factor of 100 to 1000. As noted above, unbiased estimates, even if they are imprecise, are preferable to extremely conservative estimates in the context of a reporting rule. Thus, although we are giving facilities the option to use the Average Emission Factor Approach (which may be desirable in a facility for which even this approach will yield an equipment leak estimate that is a tiny percentage of overall facility emissions), we are not requiring it.

We are requiring facilities to include brief descriptions of their leak detection methods in their annual GHG report. After facilities have gained experience designing and implementing leak detection approaches, we may revisit this issue to identify the approaches that are most effective.

F. Electrical Transmission and Distribution Equipment Use (Subpart DD)

1. Summary of the Final Rule

Source Category Definition. The electrical transmission and distribution equipment use source category consists of all electric transmission and distribution equipment and servicing inventory insulated with or containing SF_6 or PFCs used within electric power systems. Such equipment includes all gas-insulated substations, circuit breakers, switchgear (including both closed-pressure and hermetically sealed-pressure equipment) electric power transformers, gas-insulated lines containing SF_6 or PFCs, and new equipment owned but not yet installed. Servicing inventory includes pressurized cylinders, gas carts, and other containers of SF_6 or PFC.

Reporting Threshold. EPA is finalizing a reporting threshold based on nameplate capacity of equipment. Electric power systems must report if the total nameplate capacity of SF_6 and PFC containing equipment located within the facility, when added to the total nameplate capacity of SF_6 and PFC containing equipment that is not located within the facility but is under common ownership or control, exceeds 17,820 pounds. Hermetically sealed-pressure equipment is excluded from the reporting threshold. Electricity generating units that have SF_6 and PFC containing equipment onsite do not need to report GHG emissions from this source category unless the total nameplate capacity of SF_6 and PFC containing equipment located within the Subpart D facility exceeds 17,820 pounds.

GHGs to Report. Electrical Equipment Users must report the total SF_6 and PFC

[47] This approach was not proposed but is less burdensome than the other three methods in the Protocol, which were proposed.

emissions (including emissions from fugitive equipment leaks, installation, servicing, equipment decommissioning and disposal, and from storage cylinders) resulting from the transmission and distribution equipment and servicing inventory listed in § 98.300(a). For equipment installation, you must report emissions from new equipment or equipment being installed at your facility once the title to the equipment is transferred to the electric power transmission or distribution entity.

GHG Emissions Calculation and Monitoring. Reporters must calculate emissions using the following system-level mass-balance approach:

• User Emissions = Decrease in SF_6 Inventory + Acquisitions of SF_6 + Disbursements of SF_6 − Net Increase in Total Nameplate Capacity of Equipment

Where:

—Decrease in SF_6 Inventory is pounds of SF_6 stored in containers (but not in equipment) at the beginning of the year minus pounds of SF_6 stored in containers (but not in equipment) at the end of the year.

—Acquisitions of SF_6 is pounds of SF_6 purchased from chemical producers or distributors in bulk + pounds of SF_6 purchased from equipment manufacturers or distributors with or inside of equipment, including hermetically sealed-pressure switchgear + pounds of SF_6 returned to site after off-site recycling.

—Disbursements of SF_6 is pounds of SF_6 in bulk and contained in equipment that is sold to other entities + pounds of SF_6 returned to suppliers + pounds of SF_6 sent off-site for recycling + pounds of SF_6 sent off-site for destruction.

–Net Increase in Total Nameplate Capacity of Equipment is the nameplate capacity of new equipment, in pounds, including hermetically sealed-pressure switchgear, in pounds, minus nameplate capacity of retiring equipment, in pounds, including hermetically sealed-pressure switchgear. (Note that nameplate capacity refers to the full and proper charge of equipment rather than to the actual charge, which may reflect leakage.)

The same method must be used to estimate emissions of PFCs.

Data Reporting. In addition to the information required to be reported by the General Provisions (40 CFR 98.3(c)) and summarized in Section II.A of this preamble, reporters must submit additional data that are used to calculate GHG emissions. A list of the specific data to be reported for this source category is contained in § 98.306.

Recordkeeping. In addition to the records required by the General Provisions (40 CFR 98.3(g)) and summarized in Section II.A of this preamble, reporters must keep records of additional data used to calculate GHG emissions. A list of specific records that must be retained for this source category is included in 40 CFR 98.307.

2. Summary of Major Changes Since Proposal

Major changes in this source category since proposal are identified in the following list. The rationale for these and other additional significant changes can be found below or in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Electric Transmission and Distribution Equipment Use—2009 proposal" and "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Electric Transmission and Distribution Equipment Use—2010 proposal."

• We are providing a definition of *facility* for subpart DD that is based on the system-wide physical collection of transmission and distribution equipment between the point at which electricity is obtained by an electric power system and the point at which electricity is provided to the customer or another electric power transmission or distribution entity not under common ownership.

• We are clarifying that the term *operator,* when applied to this source category, does not include entities whose sole responsibility is to balance load or otherwise address electricity flow. As specified in the General Provisions for part 98, the term *Operator* does include any other person who operates or supervises an electric power transmission or distribution facility.

• We are requiring scales to be accurate within +/− 2 pounds of true weight. This absolute accuracy requirement is less stringent than the 1 percent relative accuracy requirement that was originally proposed.

• We are requiring scales to be recalibrated at the frequency recommended by the manufacturer rather than annually as originally proposed.

3. Summary of Comments and Responses

This section contains a brief summary of major comments and responses. A large number of comments on this subpart were received covering numerous topics. Responses to significant comments received can be found in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart DD: Electrical Transmission and Distribution Equipment Use" (available in the docket, EPA–HQ–OAR–2009–0927).

Definition of Source Category.

Comment: Nearly all commenters stated that the proposed definition of an electric power transmission and distribution facility was generally appropriate and consistent with current industry practice of system-wide servicing equipment and tracking data. Several commenters suggested that the definition of a facility for this subpart could be further modified to more clearly define where an electric power systems begins and ends as well as who is responsible for reporting emissions that occur from electrical equipment that might be owned and serviced by multiple entities.

A few commenters recommended that the term "facility" for this source category be defined on the basis of corporate-level ownership. These commenters stated that a corporate-based facility boundary would help ensure that potential emitters of SF_6 are covered by the rule (by their aggregate emissions falling above the threshold) and ensure more accurate emissions reporting while minimizing the burden on owners and operators of electric power systems in figuring out how to define facility boundaries. One commenter stated that a corporate-level facility definition would allow the most accurate and quickest determination of whether an entity is above the reporting threshold by enabling the entity to review the service and maintenance records for equipment that it owns. This commenter also expressed concern over who should be considered an operator of an electric power transmission and distribution facility, stating that the "operation" of an electric system relates to entities that coordinate operations across company lines to ensure reliability, balance load, and address congestion through generation dispatch and system planning.

Two additional commenters from the electric power industry were supportive of defining the boundaries of a facility on the basis of equipment operation and thought this would be the most straightforward method for determining which equipment to include in their emission estimates.

Response: In developing the proposed definition of a facility for this source category, EPA carefully considered definitions based on numerous concepts, including corporate-level

ownership as well as equipment collectively operated by a single entity.

A definition of a facility that mandated corporate-level boundaries was not considered optimal in the context of the facility definition for this source category. First, there are many non-corporate entities in the electric power industry, including municipalities and federal government agencies, that do not fit into a corporate-based definition of a facility.

Second, a corporate-based facility definition is not well-suited to cases where there are multiple owners and operators of equipment that is interconnected or located within the same substation. The monitoring methods for subpart DD are designed to measure system-wide emissions from groups of equipment and SF_6 storage stocks that are serviced and maintained together rather than emissions from individual pieces of equipment or individual cylinders. Some commenters expressed that they service and maintain equipment that they do not own using their centralized SF_6 gas stocks, which are also used to service equipment they do own. In this example, a facility definition based on corporate ownership would require emissions for a few pieces of the equipment to be estimated separately from the rest of the equipment, which would not be a good fit with the system-wide mass-balance monitoring methods required by subpart DD.

Instead, EPA has defined facility for this source category to mean the electric power system, which comprises all electric transmission and distribution equipment insulated with or containing SF_6 or PFCs which is linked through electric power transmission or distribution lines, functions as an integrated unit, is owned, serviced, or maintained by a single electric power transmission or distribution entity (or multiple entities with a common owner), and is located between: (1) The point(s) at which electric energy is obtained by the facility from an electricity generating unit or a different electric power transmission or distribution entity that does not have a common owner and (2) the point(s) at which the customer(s) or another electric power transmission or distribution entity that does not have a common owner receives the electric energy. The facility also includes all servicing inventory for this equipment that contains SF_6 or PFCs.

In addition, EPA has defined Electric Power Transmission or Distribution Entity as any entity that transmits, distributes, or supplies electricity to a consumer or other user, including any company, electric cooperative, public electric supply corporation, a similar Federal department (including the Bureau of Reclamation or the Corps of Engineers), a municipally owned electric department offering service to the public, an electric public utility district, or a jointly owned electric supply project.

Per the General Provisions (40 CFR 98.2–98.4) summarized in Section II.A of this preamble, although the reporting requirements are applicable to both the owners and operators of a facility, each facility must have one and only one designated representative who will be responsible for certifying, signing, and submitting GHG emissions reports to EPA. The designated representative is to be selected by an agreement binding on the owners and operators of the facility. Since the definition of *operator* in the General Provisions (40 CFR 98.6) is ambiguous in the context of the electric transmission and distribution equipment use source category, EPA has provided a clarification of *operator* for this source category, which is the following: "Operator excludes entities whose sole responsibility is to ensure reliability, balance load or otherwise address electricity flow."

Definition of Source Category.

Comment: EPA received comments stating that electrical generating units (EGUs) (Subpart D) should not be required to report SF_6 emissions from electrical equipment located within the boundary of their generating facilities as part of the EGUs' facility emission reports. This comment is in reference to the requirement in 40 CFR 98.2(a)(1) requirement that reports for facilities that contain any source category (as defined in subparts C through JJ) must cover all source categories and GHGs for which calculation methodologies are provided in those subparts. Commenters noted that since the mass-balance monitoring methods in subpart DD are designed to monitor emissions at the system-wide level, it would be very difficult and time-consuming for an integrated electric power entity that operates electrical equipment at both generation facilities and across transmission and distribution systems (using the same SF_6 gas stocks) to estimate emissions only for the generation facilities. Furthermore, commenters noted that since the definition of an electric power system for subpart DD is already inclusive of any equipment operated by the electric power system at a generation facility, there could be double-counting of emissions for both the electric power system and the electricity generation facility.

Response: EPA considered the potential for double-counting emissions from Subpart D electricity generating units and Subpart DD electrical transmission and distribution equipment use as well as the challenge of estimating SF_6 emissions solely from an electricity generating unit that is part of a larger integrated electric power system. EPA is confirming that an electricity generating unit would be required to report emissions associated with the Electric Transmission and Distribution Equipment Use source category, but only if SF_6 and PFC-insulated equipment within the Subpart D facility exceeded the reporting threshold for Subpart DD. EPA expects that in general, the Subpart DD facility will not independently meet this threshold and thus is unlikely to incur the reporting obligation. Therefore, EPA does not anticipate double counting as a significant issue for electricity generating units covered by other subparts and Subparts DD Electrical Transmission and Distribution Equipment Use.

Monitoring and QA/QC requirements.

Comment: Several commenters were critical of the requirement for weighing SF_6 cylinders each time they enter and leave storage (40 CFR 98.306(b)2)). Commenters noted the high burden associated with such frequent weighing of cylinders and also the lack of a perceived benefit since the cylinders already must be weighed at the beginning and end of each year for the beginning and end-of-year storage inventory.

Response: EPA agrees that the benefit of weighing SF_6 gas cylinders as they enter and leave inventory does not justify the costs of performing this activity. EPA has removed this requirement from 40 CFR 98.306(b)(2) and clarified that the QA/QC requirements for scale accuracy and calibration apply to cylinders returned to the gas supplier and cylinders weighed at the beginning and end of each year for the beginning and end-of-year storage inventory.

Monitoring and QA/QC requirements.

Comment: Commenters generally expressed agreement that it was excessively burdensome to require scales used to weigh cylinders to be accurate and precise to within 1 percent of the true weight and to be recalibrated at least annually or at the minimum frequency specified by the manufacturer, whichever is more frequent (40 CFR 98.304(b)). Numerous commenters stated that the recalibration frequency specified by the manufacturer would be sufficient, thereby making the annual recalibration minimum

unnecessary. Some commenters also stated that purchasing 1 percent accuracy scales would be expensive. One commenter suggested requiring scales with accuracies of +/− 2 pounds of full scale, which provides an accuracy within or close to 1 percent for the cylinder weights typically measured by electric power entities (i.e., between 105 and 225 pounds including tare weight).

Response: The 1 percent accuracy requirement was proposed by EPA because the mass-balance method for measuring emissions requires accurate inputs, and the overall uncertainty of the emission estimate rises as the potential inaccuracy of each input increases. However, EPA also recognizes that the price of scales does increase as the accuracy of the scale increases and that many facilities containing electrical transmission and distribution equipment use do not currently use scales that are accurate to within 1 percent of the true weight.

In order to balance the reporting burden with the need for accurate mass-balance inputs, this final rule requires the accuracy and precision of scales used to weigh cylinders to be based on pounds, specifically, to be within 2 pounds of true weight. In addition, scale recalibration is required in accordance with manufacturer specifications, with no requirement that scale recalibration occur at least annually. As discussed further in EPA's Response to Public Comments for Subpart DD, EPA believes these adjustments still provide data of sufficient accuracy and certainty.

Data Reporting Requirements.

Comment: EPA received many comments regarding the inclusion of sealed-pressure equipment—which is not intended to leak during its lifetime—into the facility-wide nameplate capacity estimates that must be reported to EPA under 40 CFR 98.306(a). Commenters recommended either (1) A minimum threshold be established to exclude sealed-pressure electrical equipment from the nameplate capacity estimation or (2) alternative methods should be allowed for estimating the nameplate capacity of sealed-pressure equipment (rather than performing a bottom-up inventory of the equipment). The most commonly cited rationale for these recommendations was the high burden associated with determining the nameplate capacity for each piece of sealed-pressure equipment within electric power systems, which can contain thousands of pieces of sealed-pressure equipment. Most commenters correctly acknowledged that even if a minimum threshold was established for reporting total facility-wide nameplate capacity, emissions from sealed-pressure equipment would still be captured in the mass-balance monitoring methods in 40 CFR 98.304, and therefore establishing a minimum threshold for the nameplate capacity inventory would not exclude sealed-pressure equipment from reported emissions.

Response: EPA agrees that the burden associated with performing a bottom-up assessment to determine the nameplate capacity of each piece of sealed-pressure equipment within an electric power transmission and distribution facility is unnecessarily high when compared to the benefits of performing such an assessment. As a result, EPA has excluded sealed-pressure equipment from the data reporting requirement for total facility-wide nameplate capacity existing as of the beginning of the year. (Sealed-pressure equipment is also excluded in the determination of the reporting threshold.)

However, the potential for emissions from sealed-pressure equipment due to catastrophic events or equipment disposal still makes it important to document emissions from sealed-pressure equipment, especially for facilities that specialize in electricity distribution. EPA has clarified that SF_6 arriving inside newly acquired sealed-pressure equipment must still be considered as part of the SF_6 acquisitions input of the mass-balance equation, and sealed-pressure equipment that is new or retired must still be considered as a change to the nameplate capacity in the mass-balance equation. This will ensure that emissions from sealed-pressure equipment are still included in the overall emissions estimate.

Since sealed-pressure equipment is no longer required to be included in the total facility-wide nameplate capacity estimate, EPA is including distribution miles in 40 CFR 98.306 Data Reporting Requirements because distribution miles provide an approximate indication of how much sealed-pressure equipment is within an electric power transmission and distribution system.

G. Importers and Exporters of Fluorinated GHGs Inside Pre-Charged Equipment or Closed-Cell Foams (Subpart QQ)

1. Summary of the Final Rule

Source Category Definition. This source category consists of any entity that is importing or exporting pre-charged equipment that contains a fluorinated GHG and also consists of any entity that is importing or exporting closed-cell foams that contain a fluorinated GHG.

Any importer or exporter of fluorinated GHGs contained in pre-charged equipment or closed-cell foams that meets the applicability criteria in the General Provisions (40 CFR 98.2(a)(4)) must report their GHG emissions.

GHGs to Report. Importers and exporters of fluorinated GHGs inside pre-charged equipment and closed-cell foam report the quantity of each fluorinated GHG contained in pre-charged equipment or closed-cell foams imported or exported during the calendar year. For importers and exporters of closed-cell foams that are not the manufacturers of the foams and do not know the identity and mass of the fluorinated GHG within the closed-cell foams, the report may be limited to the mass in CO_2e of the fluorinated GHGs imported or exported in closed-cell foams.

GHG Emissions Calculation and Monitoring. The total mass of each fluorinated GHG imported and exported inside equipment or foams must be estimated by multiplying the mass of flourinated GHG per unit of equipment or foam type by the number of units of equipment or foam type imported or exported annually, as presented in Equation QQ–1 in 40 CFR 98.433. For importers and exporters of closed-cell foams that do not know the identity and mass of the fluorinated GHG within the closed-cell foams, the mass in CO_2e of the fluorinated GHGs must be estimated by multiplying the mass in CO_2e of flourinated GHGs per unit of equipment or foam type by the number of units of equipment or foam type imported or exported annually, as presented in Equation QQ–2 in 40 CFR 98.433.

Data Reporting. In addition to the information required to be reported by the General Provisions (40 CFR 98.3(c)), reporters must submit additional data that are used to calculate GHG emissions. A list of the specific data to be reported for this source category is contained in 40 CFR 98.436.

Recordkeeping. In addition to the records required by the General Provisions (40 CFR 98.3(g)), reporters must keep records of additional data used to calculate GHG emissions. A list of specific records that must be retained for this source category is included under 40 CFR 98.437.

2. Summary of Major Changes Since Proposal

The major changes in this rule since the April 2010 proposal are identified in the following list. The rationale for these and any other significant changes

to the proposed rule can be found below or in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart QQ: Importers and Exporters of Fluorinated GHGs Inside Pre-charged Equipment or Closed-cell Foams (available in the docket, EPA–HQ–OAR–2009–0927).

- EPA has revised the reporting requirements for closed-cell foams such that, in cases where the importer or exporter does not know the identity and amount of fluorinated GHGs inside the closed-cell foam, they can report the amount of fluorinated GHGS imported or exported on a Co_2e basis, based on information from the manufacturer.
- EPA has revised the definition of closed-cell foams to exclude packaging foam.
- EPA has revised the requirements for importers such that the port of entry and country of origin are no longer listed under data reporting requirements. These two data elements are now listed under recordkeeping requirements.
- EPA has revised the requirement for exporters such that the port of exit and countries to which items were exported are no longer listed under data reporting requirements. These are two data elements are now listed under recordkeeping requirements.
- EPA has clarified that importers and exporters must report the number of pieces of pre-charge equipment and closed-cell foam imported with each unique combination of charge size and charge type. Importers and exporters cannot report the average charge size or most common fluorinated GHG used for a particular type of equipment.

3. Summary of Comments and Responses

This section contains a brief summary of major comments and responses. A number of comments on this subpart were received covering numerous topics. Responses to additional significant comments received can be found in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart QQ: Importers and Exporters of Fluorinated GHGs Inside Pre-charged Equipment or Closed-cell Foams" (available in the docket, EPA–HQ–OAR–2009–0927).

Comment: Commenters stated that data on fluorinated GHGs contained in pre-charged equipment or closed-cell foams does not constitute emissions data and is thus outside EPA's authority to collect under this rulemaking. Commenters also stated that any emissions from these equipment types would depend upon "the ultimate end-use and disposal" of the equipment, activities beyond the reporter's control.

Response: In this final rule, EPA is issuing reporting requirements for importers and exporters of fluorinated GHGs inside pre-charged equipment or closed-cell foams. EPA notes that this source category is added as a supplier source category under 98.2(4).

As discussed in the preamble to the October 2009 Final Part 98 (74 FR 56260), that rule (as well as this action) responds to a specific request from Congress to collect data on GHG emissions from both upstream production and downstream sources, as appropriate. Therefore, EPA has developed reporting requirements for direct emitters of GHGs as well as for suppliers of fuels and industrial gases. For fluorinated GHGs in particular, the U.S. supply is impacted by the production, import, and export of fluorinated GHGs in bulk as well as by the import and export of fluorinated GHGs in pre-charged equipment or closed-cell foams. EPA has already finalized reporting requirements for suppliers of industrial gases (40 CFR 98 Subpart OO) which include importers and exporters of fluorinated GHGs in bulk. This action supplements EPA's previous action by requiring reporting from importers and exporters of fluorinated GHGs in equipment and closed-cell foams.

In many cases, the fluorinated GHGs contained in equipment and closed-cell foams are ultimately emitted by a large number of small sources. To cover these direct emissions would require reporting by hundreds of thousands of small entities, such as individual homes with leaking air conditioning units. To avoid this impact, the rule does not include all of those emitters but instead requires reporting by importers and exporters of fluorinated GHGs in equipment and closed-cell foams. For further discussion of the need for upstream reporting, see the preamble to the October 2009 Final Part 98 (74 FR 56271).

EPA has the legal authority to collect data from suppliers, including importers and exporters of fluorinated GHGS contained in equipment and closed-cell foams. Section 114 of the CAA authorizes EPA to gather information from any person who is subject to a requirement of the CAA (other than engine manufacturers) or who may have information the Administrator believes is necessary for purposes of CAA section 114(a) (which in turn references carrying out any provision of the CAA). Information from suppliers of industrial greenhouse gases is relevant to understanding the quantities and types of gases being supplied to the economy, in particular those that could be emitted downstream, which will aid in evaluating action under CAA section 111, as well as various sections of title VI (e.g., CAA sections 609 and 612) that address substitutes to ozone depleting substances. A complete discussion of these issues, including a discussion of EPA's legal basis for collecting information from upstream reporters, can be found in Section I.C of the preamble to the October 2009 Final Part 98 (74 FR 56271) and Volume 9 of the Response to Comments to the Mandatory Reporting of Greenhouse Gases Rule (HQ–OAR–2008–0508).

EPA notes that some commenters appear to associate comments on whether EPA has authority to collect subpart QQ data, comments on whether subpart QQ data is "emission data," and comments on whether data collected under QQ should be protected as CBI. EPA's authority to collect subpart QQ data is addressed above. This action does not address whether data reported under this subpart are "emission data" or whether these data will be treated as confidential business information (CBI). EPA published a proposed confidentiality determination on July 7, 2010 (75 FR 39094) which addressed these issues. See Section II.B of this preamble for more information.

Comment: Some commenters stated that this subpart is a minor source of GHG emissions. These commenters stated that the quantities of fluorinated GHGs inside individual pieces of equipment are small, ranging from ounces to pounds, and that emissions from such equipment are "de minimis" because the systems are hermetically sealed.

Response: In this final rule, EPA is issuing reporting requirements for importers and exporters of fluorinated GHGs inside pre-charged equipment or closed-cell foams. Despite small charge sizes, the quantities of fluorinated GHGs imported in pre-charged equipment and closed-cell foams are significant because of the high GWP (up to 12,000) of these refrigerants. EPA estimates that approximately 22 $MMTCO_2e$ are imported by entities subject to this subpart, which together comprise the eleventh most significant source of GHGs (in carbon dioxide equivalent terms) covered under the Greenhouse Gas Reporting Program. (More information on these estimates can be found in subpart QQ TSD, EPA–HQ–OAR–2009–0927). Imports of fluorinated GHGs from entities subject to this subpart are estimated to account for seven to 10 percent of the U.S. fluorinated GHG supply, while exports

are estimated to account for one to two percent.

A portion of fluorinated GHGs consumed in the U.S. are eventually emitted into the atmosphere, as these gases leak from the equipment or are vented during service and disposal events. By accounting for all chemical flows into and out of the U.S., including in pre-charged equipment or closed-cell foams, EPA's approach results in an estimate of consumption and ultimately emissions that is more accurate than are estimates that do not account for these flows. As commenters note, these equipment are purchased and used by a diffuse variety of entities. Upstream data gathering is thus the most effective and accurate method to obtain this important data. For further discussion of the need for upstream reporting, see the preamble to the October 2009 Final Part 98 (74 FR 56271).

Comment: EPA received comments from an association representing some motor vehicle manufacturers concerning the reporting of fluorinated GHGs contained in motor vehicle air conditioners (MVACs). The commenter recommended delaying the reporting requirements for MVACs or exempting them altogether. The commenter noted that the Final Rule on Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards (75 FR 25324) (light duty vehicle rule) includes incentives for low-GWP refrigerants. The commenter also noted that manufacturers are contemplating the use of lower GWP refrigerants in MVACs due to the ability to voluntarily generate credits under the light duty vehicle rule and EU regulations. Commenters stated that exempting or delaying the applicability of the reporting requirements would conserve public resources and harmonize existing incentives. The commenter also stated that EPA should modify reporting requirements for MVAC imports and exports to allow reporting of data by model year, that reporting of certain data elements would require reconfiguration of existing systems, and that these particular reporting requirements should be developed off-line for verification purposes.

Response: In this final rule, EPA is not exempting importers and exporters of MVACs or delaying the applicability of the reporting requirements to them. MVACs are a significant source of fluorinated GHGs; EPA estimates that currently approximately 18 percent of fluorinated GHGs (in carbon dioxide equivalent terms) imported under this subpart are contained within MVACs. EPA recognizes there is significant interest and research into new low-GWP refrigerants; however, the timing and the extent of the MVAC market to make such a transition are uncertain. Under CAA section 612, EPA has proposed to find the low-GWP refrigerant HFO–1234yf acceptable, subject to use conditions, in MVACs (75 FR 53445); however, this rule has not been finalized. In addition, although the light duty vehicle rule allows automakers to earn additional leakage credits if they use a low GWP refrigerant, EPA actually predicted that automakers would meet the standards in the Model Year 2012 through 2016 timeframe by reducing refrigerant leakage, not by switching to lower-GWP alternatives (see the Regulatory Impact Analysis for the Final Rule on Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards, EPA–HQ–OAR–2009–0472). Based on these factors, EPA concluded there is not sufficient evidence that the transition to low GWP refrigerants in MVACs is underway such that the importers and exporters of MVACs should be exempt or that the reporting requirements should be delayed.

Reporting imports and exports of MVACs on a model year basis would be inconsistent with the reporting requirements for all other subparts under 40 CFR Part 98 where EPA is collecting information on a calendar year basis. EPA plans to use data collected under Part 98 to support analyses of various GHG policy options; therefore, EPA requires the data on a calendar year basis to allow meaningful comparison of data across and within subparts. Model year reporting for new vehicle and engine manufacturers was included under the Final Mandatory Reporting of Greenhouse Gases Rule, but those reporting requirements were not developed to fit into Part 98. Instead, they were created to fit into the existing reporting framework for long-established EPA vehicle and engine programs as discussed in Section V.QQ of the preamble to the April 2009 Mandatory Reporting of Greenhouse Gases Proposed Rule (74 FR 16586). The data collected under subpart QQ of part 98 is needed on a calendar year basis, in particular, because EPA intends to analyze and compare the data on imports and exports of fluorinated GHGs in MVACs with data on fluorinated GHGs imported and exported in other types of pre-charged equipment and closed-cell foams. EPA also intends to compare this data with data on fluorinated GHGs collected under other subparts, all of which is collected on a calendar year basis.

In developing these requirements, EPA recognized that some reporting requirements may require the reconfiguration of existing tracking systems or the development of new tracking systems. In fact, EPA included the development of tracking system as an implementation cost in the "Economic Impact Analysis for the Mandatory Reporting of Greenhouse Gas Emissions F–Gases: Subparts I, L, QQ, SS Draft Report" (EPA–HQ–OAR–2009–0927). EPA did not receive any comments related to these implementation costs for subpart QQ developed under the Economic Impact Analysis. This commenter, in particular, did not provide specific information related to the burden of reporting data on a calendar year basis. Therefore, given the utility of the data and the need for meaningful annual analysis, EPA is finalizing the requirement to report the imports and exports of fluorinated GHGs within pre-charged equipment or closed-cell foams on an annual basis.

Finally, the commenter suggested that the port of entry (or exit), the country from which (or to which) items were shipped, and the date of import (or export) could be developed off-line for verification purposes. These three reporting requirements are similar to those for importers and exporters of industrial gases under 40 CFR subpart OO, which involves imports and exports of bulk chemicals. However this subpart involves more detailed reporting requirements regarding the contents of each particular shipment (such as the number of units, charge size, and charge type) and not just the amount of the particular industrial gas imported and exported. Some types of equipment, such as refrigerators, may hold a refrigerant charge of fluorinated GHGs and include fluorinated GHG within the closed-cell foams, which will further complicate reporting on this shipment. Given these additional reporting requirements under this subpart, EPA agrees that the port of entry (or exit) and the country from which (or to which) items were shipped can be maintained as records and has therefore moved these two items to record keeping requirements. However, EPA is maintaining the date of import (or export) as a reporting requirement as the date of import (or export) is necessary for verification activities. EPA can use the date of import or export in combination with other information to conduct verification activities. For example, EPA can crosswalk information collected under this rule with records maintained by U.S. Customs and Border Protection to

ensure importers and exporters are properly reporting imports and exports of pre-charged equipment and closed-cell foams.

Comment: EPA received comments regarding the calculation of fluorinated GHGs within closed-cell foams. One commenter stated that fluorinated GHGs are emitted from closed-cell foams at varying rates, and therefore, the best way to determine the amount of fluorinated GHGs contained in closed-cell foams is to require reporting on the total amount of fluorinated GHGs consumed by the foreign manufacture at the point of manufacture. One commenter stated that the proposed reporting requirements would result in a cumbersome process between appliance manufacturers and foam suppliers where the foam suppliers would be required to disclose proprietary information on the closed-cell foam composition to equipment manufacturers. The commenter stated that EPA should therefore allow reporting on a $C0_2e$ basis.

Response: EPA has finalized the requirement to report only the amount of fluorinated GHGs imported or exported within closed-cell foams. EPA has added an alternative reporting method for instances when the type and mass of fluorinated GHGs within the closed-cell foams are not known by the importers and exporters.

The intent of this rule is to better understand U.S. GHG emissions in order to inform policy decisions. This rule does not attempt to quantify emissions that occur during the production of materials that are eventually imported into the U.S. such as emissions that occur during the manufacture of closed-cell foams. Therefore, EPA is finalizing the requirement to report only the amount of fluorinated GHGs contained in the closed-cell foams that are imported or exported, not the total amount of fluorinated GHGs consumed during the manufacture of these products. EPA notes that the identity and mass of the fluorinated GHGs within closed-cell foams impact the foams' ability to insulate and that these parameters are known to the entities that manufacture and market these products.

EPA recognizes the unique situation that may arise when an importer of closed-cell foams is not the same entity that manufactured the closed-cell foam. In such cases, the importer may not know the mass and identity of the fluorinated GHG within the closed-cell foam. Therefore, EPA has added an alternative reporting provision that allows reporting by CO_2e basis for closed-cell foams under these circumstances.

EPA is requiring importers and exporters to report the identity and mass of the fluorinated GHG within closed-cell foams when it is known. This is consistent with EPA's approach for pre-charged equipment, where EPA requires importers and exporters to report the identity and amount of fluorinated GHGs within equipment. EPA will use this information to better understand the types and amounts of fluorinated GHGs imported and exported into the U.S. This information will support analysis under this subpart as well as analysis across subparts, particularly subparts that collect data on fluorinated GHGs.

For importers and exporters that are unable to obtain detailed information on the closed-cell foams from the manufacturer, EPA is requiring that the importers and exporters identify the foam manufacturer and to certify that they were unable to obtain this information from them. These importers and exporters are also required to document the communications with the foam manufacturer and retain the information in their records. When verifying data collected under this rule, EPA may contact foam manufacturers independently to obtain more detailed information on the identity and mass of the fluorinated GHGs contained within these closed-cell foams.

Further discussion of issues related reporting requirements for closed-cell foams can be found in the "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart QQ: Importers and Exporters of Fluorinated GHGs Inside Pre-charged Equipment or Closed-cell Foams" (EPA–HQ–OAR–2009–0927).

Comment: EPA also received comments as to whether packaging foams would be included under this subpart.

Response: EPA has excluded packaging foam from this subpart. EPA's original analysis of this source category identified only imports and exports of closed-cell foams used to insulate, such as closed-cell foams used in refrigeration equipment, as a significant source of fluorinated GHGs. In subsequent conversation with industry, EPA learned that closed-cell foams can sometimes be used in general packaging. EPA never intended to include these sources. Packaging foams are widely used when shipping materials, and EPA anticipates it would be too burdensome for entities to ascertain the type of packaging foam and the blowing agent used in that foam when shipping materials, particularly as the packaging foam is incidental to the items being imported or exported. Therefore, EPA has clarified the definition of closed-cell foams to explicitly exclude packaging foam.

H. Electrical Equipment Manufacture or Refurbishment (Subpart SS)

1. Summary of the Final Rule

Source Category Definition. This source category consists of electrical equipment manufacturers and refurbishers of SF_6 or PFC-insulated closed-pressure equipment and sealed-pressure equipment including gas-insulated substations, circuit breakers and other switchgear, gas-insulated lines, or power transformers containing sulfur-hexafluoride (SF_6) or perfluorocarbons (PFCs).

Reporting Threshold. Reporters must submit annual GHG reports for facilities that meet the applicability criteria in the General Provisions of 40 CFR 98.2(a)(1). Facilities undertaking electrical equipment manufacturing and refurbishing are covered by this rule if total annual purchases of SF_6 and PFCs exceed 23,000 pounds.

GHGs to Report. For electrical equipment manufacturers and refurbishers of SF_6 or PFC-insulated closed-pressure equipment and sealed-pressure equipment, report the following emissions:

- SF_6 and PFC emissions from electrical equipment manufacturing.
- SF_6 and PFC emissions from electrical equipment refurbishing.
- SF_6 and PFCs emissions from electrical equipment testing.
- SF_6 and PFCs emissions from electrical equipment decommissioning and disposal.
- SF_6 and PFCs emissions from storage cylinders and other containers.
- SF_6 and PFC emissions from electrical equipment installation that occurs before title to the equipment is transferred to the customer.

In addition, report GHG emissions for other source categories at the facility for which calculation methods are provided in the rule, as applicable. For example, report CO_2, N_2O and CH_4 combustion-related emissions from each stationary combustion unit on site under 40 CFR part 98, subpart C (General Stationary Fuel Combustion Sources).

GHG Emissions Calculation and Monitoring. Reporters must calculate SF_6 and PFC emissions using a mass-balance approach, which includes the following inputs (For brevity, the inputs refer only to SF_6; however, the method also applies PFCs):

- The decrease in SF_6 Inventory must be determined by subtracting SF_6, in

pounds, stored in containers at the end of the year from SF_6, in pounds, stored in containers at the beginning of the year.

• Acquisitions of SF_6 must be determined by summing pounds of SF_6 purchased from chemical producers or distributors in bulk, pounds of SF_6 returned by equipment users or distributors with or inside equipment, and pounds of SF_6 returned to site after off-site recycling.

• Disbursements of SF_6 must be determined by summing pounds of SF_6 contained in new equipment delivered to customers, pounds of SF_6 delivered to equipment users in containers, pounds of SF_6 returned to suppliers, pounds of SF_6 sent off-site for recycling, and pounds of SF_6 sent off-site for destruction.

Reporters also must calculate SF_6 and PFC emissions from the equipment being installed on the electric power system's premises when the installation occurs before the title to the equipment is transferred to the electric power entity. Reporters may use a mass-balance approach or an engineering calculation to estimate installation losses.

Data Reporting. In addition to the information required to be reported by the General Provisions (40 CFR 98.3(c)) and summarized in Section II.A of this preamble, reporters must submit additional data that are used to calculate GHG emissions. A list of the specific data to be reported for this source category is contained in 40 CFR 98.456.

Recordkeeping. In addition to the records required by the General Provisions (40 CFR 98.3(g)) and summarized in Section II.A of this preamble, reporters must keep records of additional data used to calculate GHG emissions. A list of specific records that must be retained for this source category is included in 40 CFR 98.457.

2. Summary of Major Changes Since Proposal

The major changes in this rule since the proposal are identified in the following list. The rationale for additional significant changes to subpart SS can be found below or in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart SS: Sulfur Hexafluoride and Perfluorocarbons from Electrical Equipment Manufacture or Refurbishment."

• EPA is modifying the accuracy and precision requirements for scales and flowmeters used to measure mass for the mass-balance equation. Specifically, rather than requiring flowmeters and scales to have an accuracy and precision of ±1 percent of the true mass or weight, we are requiring them to have an accuracy and precision of ±1 percent of either full scale (for flowmeters) or the maximum weight of the containers typically weighed on the scale (for scales). For scales that are used to weigh cylinders containing 115 pounds of gas when full, this equates to ±1 percent of the sum of 115 pounds and approximately 120 pounds tare, or slightly more than ±2 pounds. This absolute accuracy requirement, expressed as a percentage of the filled weight of the container that is weighed on the scale, is less stringent than the 1 percent (of true weight) relative accuracy requirement in the proposed rule.

• To reduce burden and increase flexibility, EPA is allowing use of a calculated emission factor for determining emissions downstream of the flow meter measuring the mass of SF_6 being transferred from the storage container to the equipment being filled. A value must be determined for each combination of hose and valve of a given sized diameter. The calculated emission factor must be multiplied by the number of annual fill operations that uses the hose and valve combination. The calculation must be performed annually to account for changes to the specifications of the valves or hoses that may occur throughout the year.

• To increase flexibility, EPA is providing an additional option for determining the mass of SF_6 or the PFCs disbursed to customers in new equipment. EPA is allowing the equipment's nameplate capacity or, in cases where equipment is shipped with a partial charge, the equipment's partial shipping charge to be assumed as equal to the disbursement. A sufficiently precise estimate of the nameplate capacity for each make and model of equipment must be determined through a number of measurements. The number of measurements required must be calculated to achieve a precision of one percent of the true mean, using a 95 percent confidence interval.

• To improve data accuracy, the quantity of gas charged into delivered equipment and added during installation by the manufacturer must be certified by the manufacturer and expressed in pounds of SF_6 or PFC.

• To clarify the reporting boundary between subparts DD and SS, EPA is requiring electrical equipment manufacturers to estimate and report the annual SF_6 and PFC emissions from the equipment being installed on the electric power system's premises until the title of the equipment has transferred to the electric power transmission or distribution entity. An equipment installation mass balance equation must be used.

3. Summary of Comments and Responses

This section contains a brief summary of major comments and responses. A small number of comments which covered several topics were received on this subpart. Responses to additional significant comments received can be found in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Subpart SS: Electrical Equipment Manufacture or Refurbishment" (available in the docket, EPA–HQ–OAR–2009–0927).

Selection of Reporting Threshold

Comment: EPA received comment that gas cylinders which are sealed and unused should not count toward the reporting threshold. These cylinders are purchased by the electrical equipment manufacturer for shipment to customers. According to the commenter, since these cylinders are never opened and their seals remain intact, no leakages can occur. The commenter explained that the 10 percent leak rate used to determine the threshold is based upon losses during testing, manufacturing, and commissioning. Activities such as storage should not count toward the leak rate.

Response: EPA disagrees that sealed and unused cylinders should not count toward the reporting threshold. EPA recognizes that sealed cylinders are unlikely to be a major source of emissions and that it has been the standard practice by some manufacturers to deliver sealed cylinders with new equipment. However, EPA is concerned that not including these cylinders could introduce complications in tracking gas in cylinders and other containers because of the need to differentiate those cylinders that are sealed and destined for the customer and those cylinders that are sealed and destined for use by the electrical equipment manufacturer. Further it would be virtually impossible for an audit of threshold and cylinder record keeping requirements to distinguish the different use of cylinders at the beginning and end of the year. Therefore, EPA is finalizing the requirement that sealed and unused cylinders count toward the determination of the reporting threshold.

Monitoring and QA/QC Requirements

Comment: EPA received comment that measuring residual gas amounts to within 1 percent of accuracy is not

attainable in practice. Scales currently in use have an accuracy of ± 2 pounds; a 1 percent measurement of "new or residual gas amounts" would require a scale with an accuracy of ± 0.1 pounds, or 200 times more precise than currently in use. The commenter suggested that the required accuracy be no stricter than 10 percent for residual gas amounts.

Response: EPA has reviewed this commenter's concern as well as similar concerns of several commenters on the accuracy requirement of scales for Subpart DD, Electric Transmission and Distribution Equipment Uses.

After further evaluation of the types of scales available, the range of accuracies and precisions, and the effect of those accuracies and precisions on the accuracy and precision of facility-level emissions estimates, we have eased the requirements for scale accuracy and precision. As noted above, we proposed that scales be accurate and precise to within ± 1 percent of the true mass or weight or better. When the mass being weighed on the scale is small, as is the case for the residual gas being returned to the supplier, this requires a very good absolute precision and accuracy, e.g., better than ± 0.1 pounds. EPA conducted an analysis that examined the impact of different scale accuracies on the relative uncertainty of emission estimates from two hypothetical electrical equipment manufacturer facilities; the findings indicate that the incremental increase in relative uncertainty from a requirement of ± 1 percent of true mass or weight scale accuracy to ± 2 pounds scale accuracy was not enough to justify a more stringent accuracy of 1 percent and its associated burden.

This final rule requires the accuracy and precision of scales used to weigh cylinders to be ± 1 percent of full scale or better of the filled weight (gas plus tare) of the containers of SF_6 or PFCs that are weighed on the scale. This absolute error would be allowed for container heels as well as for the full container. For scales that are generally used to weigh cylinders containing 115 pounds of gas when full, this equates to ± 1 percent of the sum of 115 pounds and approximately 120 pounds tare, or slightly more than ± 2 pounds. EPA concluded this change will lower the burden on reporters without significant compromise to data quality.

Comment: EPA received comment regarding the administrative burden of the proposed method to determine emissions downstream of the flowmeter measuring the mass of SF_6 (or PFC) being transferred from the storage container to the equipment being filled. The commenter asserted that accurately determining emissions downstream of the flowmeter (to subtract from the disbursement total) could require an inordinate administrative burden associated with recording the numerous parameters for individual fill operations. The commenter suggested that the entity be explicitly permitted to apply a statistical calculation to a subset of individual fill operations, such as a midpoint or average loss rates, to use as the loss rates associated with all fill operations. The statistical calculation would be based on the factors outlined in the proposed rule, but the proposed approach would relieve the burden of rerecording the measurements for each individual operation.

Response: EPA recognizes that developing a representative loss factor that can be used for all filling events is more practical than performing measurements for each individual fill operation. EPA agrees with the commenters that direct measurement is unnecessarily burdensome. Consequently, rather than requiring actual measurements as proposed, EPA is allowing reporters to account for variability in the diameters and fittings of hoses supplied by various manufacturers and applied under varying conditions and requiring an emission factor be calculated for each hose and valve, or fitting, combination. For each hose-valve combination, the calculated emission factor must be multiplied by the number of annual fill operations that use that hose-valve arrangement. The calculation must be recalculated annually to account for changes to the specifications of the valves or hoses that may occur throughout the year. In addition, EPA is requiring electrical equipment manufacturers to account for SF_6 or PFC emissions that occur as a result of unexpected events or accidental losses, such as a malfunctioning hose or leak in the flow line, during the filling of equipment or containers for disbursement. If there is a sudden rise in the quantity of SF_6 or PFC gas that is needed to fill a certain make and model to its shipping charge, or nameplate capacity, this may be indicative of a leak in the lines. It is good practice to note unusual changes to the quantities used to fill equipment.

Comment: Several entities provided comment as to whether manufacturers should be required to certify to equipment users the actual quantity of SF_6 or PFCs charged into equipment at the manufacturing facility as well as the actual quantity of SF_6 or PFCs charged into equipment at installation. In general, users of electric power equipment supported both certifying requirements as they would provide more accurate acquisitions inputs needed for the mass-balance method required for estimating emissions from electric power equipment use.

Response: EPA had requested comment on whether manufacturers should be required to certify the actual quantity (mass) of SF_6 or PFCs charged into equipment at installation. EPA concludes that the electrical equipment manufacturer should certify the quantity of gas provided in delivered equipment as it represents two inputs to two mass balance equations—the disbursements input (i.e., sales of SF_6 to other entities, including gas in equipment that is sold) of the mass-balance equation used by manufacturers and the acquisitions input (i.e., gas with or alongside equipment) of the mass-balance equation used by electric power systems. Additionally, EPA concludes that the electrical equipment manufacturer should certify the quantity of gas charged into the equipment at installation as it represents the acquisition input to the electric power systems' mass balance equation. The validity of the mass-balance approach is dependent on precise inputs, consequently, inaccuracies of even two or three percent could lead to unacceptably large inaccuracies in emissions estimates. The final rule includes a requirement for electrical equipment manufacturers to maintain such certifications as records and to express the quantity in pounds of SF_6 or PFC gas. Electrical equipment manufacturers should provide copies of the certifications to electric power systems upon request.

Installation of Electrical Equipment at Electric Power Systems

Comment: EPA received comments from electric power systems and electrical equipment manufacturers regarding whether the manufacturer should be responsible for emissions during installation or whether those emissions should become the customer's responsibility. Equipment manufacturers and electric power systems commented that the reporting requirement should be the responsibility of the electric power system at the point in time when the equipment title is transferred.

Response: EPA recognizes that some equipment, namely gas insulated substations, is typically manufactured by the manufacturer onsite and can take several months to complete assembly, inspection, and final acceptance and commissioning. For these projects, gas accounting is best done by the manufacturer that is assembling the

equipment and handling the gas that will be installed into the equipment. Based on EPA's review of these comments, the final rule specifies that the responsibility of reporting emissions from installation practices is dependent upon the point at which the title is transferred to the electric power transmission or distribution entity. In instances when the title to the equipment has not yet been transferred even though the equipment is at the electric power transmission or distribution facility, the equipment manufacturer must estimate and report emissions from equipment installation using the equipment installation mass balance equation or an engineering calculation. In instances when the title of the equipment has been transferred to the electric power transmission or distribution facility, the electric power transmission or distribution facility must estimate and report emissions during installation by accounting for the amount of gas inside the equipment, upon the date of the title transfer to the electric power transmission or distribution entity, in the mass balance acquisition input. If the title is transferred to the electric power transmission or distribution entity and the installation is conducted by a third party, the electric power transmission or distribution facility would be required to report emissions during installation. The role and responsibility of reporters with respect to use of contractors or third parties is elaborated in more detail in the Response to Comment Document for this subpart.

III. Economic Impacts of the Final Rule

This section of the preamble examines the costs and economic impacts of this rule and the estimated economic impacts of the rule on affected entities, including estimated impacts on small entities. Complete detail of the economic impacts of the rule can be found in the text of the economic impact analysis (EIA) in the docket for this rulemaking (EPA–HQ–OAR–2009–0927).

A number of comments on economic impacts of the rule were received regarding the estimation of compliance costs for subparts covered by the rule. A summary of burden related comments can be found in the preamble for each subpart. Complete responses to significant comments received can be found in "Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments, Additional Sources of Fluorinated GHGs (EPA–HQ–OAR–2009–0927).

A. How were compliance costs estimated?

1. Summary of Method Used To Estimate Compliance Costs

EPA used available industry and EPA data to characterize conditions at affected sources. Incremental monitoring, recordkeeping, and reporting activities were then identified for each type of facility and the associated costs were estimated. The annual costs are reported in 2006$. EPA's estimated costs of compliance are discussed below and in greater detail in Section 4 of the economic impact analysis (EIA).

Labor Costs. The vast majority of the reporting costs include the time of managers, technical, and administrative staff in both the private sector and the public sector. Staff hours are estimated for activities, including:

- Monitoring (private): Staff hours to operate and maintain emissions monitoring systems.
- Recordkeeping and Reporting (private): Staff hours to gather and process available data and report it to EPA through electronic systems.
- Assuring and releasing data (public): Staff hours to quality assure, analyze, and release reports.

Staff activities and associated labor costs will potentially vary over time. Thus, cost estimates are developed for start-up and first-time reporting, and subsequent reporting. Wage rates to monetize staff time are obtained from the Bureau of Labor Statistics (BLS).

Equipment Costs. Equipment costs include both the initial purchase price and any facility modification that may be required. Based on expert judgment, the engineering costs analyses annualized capital equipment costs with appropriate lifetime and interest rate assumptions. One-time capital costs are amortized over a 10-year cost recovery period at a rate of 7 percent.

B. What are the costs of the rule?

1. Summary of Costs

The total annualized costs incurred under the fluorinated GHG reporting rule will be approximately $6.8 million in the first year and $7.4 million in subsequent years ($2006). This includes a public sector burden estimate of $384,000 for program implementation and verification activities. Table 12 of this preamble shows the first year and subsequent year costs by subpart. In addition, it presents the cost per ton reported, and the relative share of the total cost represented by each subpart.

TABLE 12—NATIONAL ANNUALIZED MANDATORY REPORTING COSTS ESTIMATES (2008$): SUBPARTS I, L, OO AND SS

Subpart	First year			Subsequent years		
	Millions 2006$	$/ton	Share (percent)	Millions 2006$	$/ton	Share (percent)
Subpart I—Electronics Industry	$2.9	$0.33	38	$5.4	$0.33	76
Subpart L—Fluorinated Gas Production	3.0	0.28	40	0.2	0.02	2
Subpart DD—Electric Transmission and Distribution Equipment Use	0.6	0.19	7	0.6	0.05	8
Subpart QQ—Imports and Exports of Fluorinated GHGs	0.7	0.03	9	0.6	0.02	9
Subpart SS—Electrical Equipment Manufacture and Refurbishment and Manufacturing of Electrical Components	0.02	0.01	0.3	0.02	0.01	0
Private Sector, Total	7.2	.....	95	6.8	.....	95
Public Sector, Total	0.4	.....	5	0.4	.....	5
Total	7.6	.....	100	7.2	.....	100

C. What are the economic impacts of the rule?

1. Summary of Economic Impacts

EPA prepared an economic analysis to evaluate the impacts of this rule on affected industries. To estimate the economic impacts, EPA first conducted a screening assessment, comparing the estimated total annualized compliance costs by industry, where industry is defined in terms of North American Industry Classification System (NAICS) code, with industry average revenues. Average cost-to-sales ratios for establishments in affected NAICS codes are typically less than 2 percent.

These low average cost-to-sales ratios indicate that the rule is unlikely to result in significant changes in firms' production decisions or other behavioral changes, and thus unlikely to result in significant changes in prices or quantities in affected markets. Thus, EPA followed its Guidelines for Preparing Economic Analyses (EPA, 2002, p.124–125) and used the engineering cost estimates to measure the social cost of the rule, rather than modeling market responses and using the resulting measures of social cost. Table 13 of this preamble summarizes cost-to-sales ratios for affected industries.

TABLE 13—ESTIMATED COST-TO-SALES RATIOS FOR AFFECTED ENTITIES

[First Year, 2006$]

2007 NAICS	NAICS description	Sub-part	Average cost per entity ($/entity)	All enterprises (percent)
334413	Semiconductor and Related Device Manufacturing	I (Semis)	$19,980	0.03
334413	Semiconductor and Related Device Manufacturing	I (Non-Semis)	16,046	0.02
334119	Other Computer Peripheral Equipment Manufacturing	I (Non-Semis)	16,046	0.06
325120	Industrial Gas Manufacturing	L	126,523	1.08
221121	Electrical Power Systems	DD	2,213	0.00
326140	Polystyrene Foam Product Manufacturing	QQ	3,364	0.03
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing.	QQ	3,364	0.03
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.	QQ	3,364	0.01
335313	Switchgear and Switchboard Apparatus Manufacturing	QQ	3,364	0.02
336391	Motor Vehicle Air-Conditioning Manufacturing	QQ	3,364	0.01
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers.	QQ	3,364	0.05
423620	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers.	QQ	3,364	0.02
423720	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers.	QQ	3,364	0.05
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers.	QQ	3,364	0.07
423740	Refrigeration Equipment and Supplies Merchant Wholesalers	QQ	3,364	0.09
443111	Household Appliance Stores	QQ	3,364	0.24
443112	Radio, Television and Other Electronics Stores	QQ	3,364	0.14
422610	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers	QQ	3,364	0.03
33361	Engine, Turbine, and Power Transmission Equipment Manufacturing	SS	2,213	0.00
33531	Electrical Equipment Manufacturing	SS	2,213	0.02

D. What are the impacts of the rule on small businesses?

1. Summary of Impacts on Small Businesses

As required by the RFA and Small Business Regulatory Enforcement Fairness Act (SBREFA), EPA assessed the potential impacts of the rule on small entities (small businesses, governments, and non-profit organizations). (See Section IV.C of this preamble for definitions of small entities.)

EPA conducted a screening assessment comparing compliance costs for affected industry sectors to industry-specific receipts data for establishments owned by small businesses. This ratio constitutes a "sales" test that computes the annualized compliance costs of this rule as a percentage of sales and determines whether the ratio exceeds some level (e.g., 1 percent or 3 percent).

The cost-to-sales ratios were constructed at the establishment level (average reporting program costs per establishment/average establishment receipts) for several business size ranges. This allowed EPA to account for receipt differences between establishments owned by large and small businesses and differences in small business definitions across affected industries. The results of the screening assessment are shown in Table 14 of this preamble.

As shown, the cost-to-sales ratios are typically less than 1 percent for establishments owned by small businesses that EPA considers most likely to be covered by the reporting program (e.g., establishments owned by businesses with 20 or more employees).

TABLE 14—ESTIMATED COST-TO-SALES RATIOS BY INDUSTRY AND ENTERPRISE SIZE (FIRST YEAR, 2006$) [a]

NAICS	NAICS Description	Sub-part	SBA Size standard (effective March 11, 2008)	Average cost per entity ($/entity)	All enterprises (percent)	Owned by Enterprises with:					
						1 to 20 Employees (percent)	20 to 99 Employees (percent)	100 to 499 Employees (percent)	500 to 749 Employees (percent)	750 to 999 Employees (percent)	1,000 to 1,499 Employees (percent)
334413	Semiconductor and Related Device Manufacturing.	I (Semis)	500	$19,980	0.03	1.16	0.22	0.07	0.04	0.01	0.02
334413	Semiconductor and Related Device Manufacturing.	I (Non-Semis).	500	16,046	0.02	0.94	0.18	0.05	0.04	0.01	0.02
334119	Other Computer Peripheral Equipment Manufacturing.	I (Non-Semis).	500	16,046	0.06	0.92	0.14	0.04	0.02	0.04	0.01
325120	Industrial Gas Manufacturing	L	1,000	126,523	1.08	23.19	0.77	3.19	NA	NA	NA
221121	Electrical Power Systems	DD	([c])	2,213	0.00	0.10	0.01	0.01	NA	NA	NA
326140	Polystyrene Foam Product Manufacturing.	QQ	500	3,364	0.03	0.25	0.06	0.04	NA	NA	0.01
326150	Urethane and Other Foam Product (except Polystyrene). Manufacturing	QQ	500	3,364	0.03	0.19	0.05	0.02	0.02	NA	NA
333415	Air-Conditioning and Warm Air Heating Equipment. and Commercial and Industrial Refrigeration. Equipment Manufacturing	QQ	750	3,364	0.01	0.22	0.04	0.01	0.01	0.01	0.01
335313	Switchgear and Switchboard Apparatus Manufacturing.	QQ	750	3,364	0.02	0.24	0.05	0.02	NA	NA	NA
336391	Motor Vehicle Air-Conditioning Manufacturing.	QQ	750	3,364	0.01	0.33	0.07	NA	NA	NA	NA
423610	Electrical Apparatus and Equipment, Wiring Supplies,. and Related Equipment Merchant Wholesalers.	QQ	100	3,364	0.05	0.10	0.03	0.03	0.05	0.03	0.03
423620	Electrical and Electronic Appliance, Television, and. Radio Set Merchant Wholesalers	QQ	100	3,364	0.02	0.07	0.02	0.01	0.00	0.01	0.01
423720	Plumbing and Heating Equipment and Supplies. (Hydronics) Merchant Wholesalers	QQ	100	3,364	0.05	0.10	0.02	0.03	0.06	0.03	0.09
423730	Warm Air Heating and Air-Conditioning Equipment. and Supplies Merchant Wholesalers	QQ	100	3,364	0.07	0.13	0.05	0.06	0.10	0.03	NA
423740	Refrigeration Equipment and Supplies Merchant. Wholesalers	QQ	100	3,364	0.09	0.16	0.05	0.10	0.08	0.04	NA
443111	Household Appliance Stores	QQ	$9 M	3,364	0.24	0.42	0.09	0.07	NA	NA	NA
443112	Radio, Television and Other Electronics Stores.	QQ	$9 M	3,364	0.14	0.53	0.15	0.23	NA	NA	NA
422610	Plastics Materials and Basic Forms and Shapes. Merchant Wholesalers	QQ	100	3,364	0.03	0.09	0.03	0.02	0.01	0.01	0.05
33361	Engine, Turbine, and Power Transmission Equipment Manufacturing.	SS	500–1,000	2,213	0.00	0.17	0.03	0.01	0.01	0.01	0.01
33531	Electrical Equipment Manufacturing	SS	750–1,000	2,213	0.02	0.19	0.04	0.01	0.01	0.00	0.01

[a] The Census Bureau defines an enterprise as a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The enterprise and the establishment are the same for single-establishment firms. Each multi-establishment company forms one enterprise—the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size designations are determined by the summed employment of all associated establishments. Since the SBA's business size definitions (*http://www.sba.gov/size*) apply to an establishment's ultimate parent company, we assume in this analysis that the Census Bureau definition of enterprise is consistent with the concept of ultimate parent company that is typically used for Small Business Regulatory Enforcement Fairness Act (SBREFA) screening analyses.

[b] The 2002 SUSB data uses 1997 NAICS codes. For this industry, the relevant code is NAICS 422610.

[c] <4 Million MWh.

EPA acknowledges that several enterprise categories have ratios that exceed this threshold (e.g., enterprise with one to 20 employees). The Industrial Gas Manufacturing industry (NAICS 325120) has sales test results over 1 percent for all enterprises and for most size categories. The following enterprise categories have sales test results over 1 percent and for entities with less than 20 employees: Industrial Gas Manufacturing (325120) and Semiconductor and Related Device Manufacturing (334413).

EPA took a more detailed look at the categories noted above as having sales test ratios above 1 percent. EPA collected information on the entities likely to be covered by the rule as part of the expert sub-group process.

Industrial Gas Manufacturing (325120). Subpart L covers facilities included in NAICS codes for Industrial Gas Manufacturing (NAICS 325120). Within this subpart, EPA identified 13 ultimate parent company names covered by this action. Using publicly available sources (e.g., Hoovers.com), we collected parent company sales and employment data and found that only one company could be classified as a small entity. Using the cost data for a representative entity (see Section 4 of the EIA), EPA determined the small entity's cost-to-sales ratio is below one percent.

Electronic Computer Manufacturing (334111) and Semiconductor and

Related Device Manufacturing (334413). Data on the number of electronics facilities comes from the World Fab Watch and the Flat Panel Display Fabs on Disk datasets. The census data categories cover more establishments than just those facilities covered in the rule. Subpart I covers facilities included in NAICS codes for Semiconductor and Related Device Manufacturing (334413) and Other Computer Peripheral Equipment Manufacturing (334119). The World Fab Watch dataset includes 216 facilities (94 of which exceed the 25,000 ton threshold), while the sum of the two NAICS codes include 1,903 establishments. Covered facilities with emissions greater than 25,000 $mtCO_2e$ per year are unlikely to be included in the 1 to 20 employee size category. Emissions are roughly proportional to production, and establishments with 1 to 20 employees total only 1.6 percent of total receipts, while the threshold excludes 6 percent of industry emissions from the least-emitting facilities.

Although this rule will not have a significant economic impact on a substantial number of small entities, EPA nonetheless took several steps to reduce the impact of this rule on small entities. The first and most important step is the establishment of reporting thresholds. As described in Sections II.D through II.H of this preamble, these thresholds exclude hundreds of small entities from the reporting requirements. In addition, EPA is allowing semiconductor manufacturing facilities whose emissions exceed the reporting threshold but whose capacity is equal to or less than 10,500 m^2 of substrate to use default emission factors for their etch processes rather than measuring those factors. Moreover, EPA is requiring annual reporting instead of more frequent reporting.

In addition to the public hearing that EPA held, EPA has an open door policy, similar to the outreach conducted during the development of the proposed and final Part 98. Details of these meetings are available in the docket (EPA–HQ–OAR–2009–0927).

E. What are the benefits of the rule for society?

1. Benefits of the Rule for Society

EPA examined the potential benefits of the Fluorinated GHG Reporting Rule. EPA's previous analysis of the GHG reporting rule discussed the benefits of a reporting system with respect to policy making relevance, transparency issues, and market efficiency. Instead of a quantitative analysis of the benefits, EPA conducted a systematic literature review of existing studies including government, consulting, and scholarly reports.

A mandatory reporting system will benefit the public by increased transparency of facility emissions data. Transparent, public data on emissions allows for accountability of polluters to the public stakeholders who bear the cost of the pollution. Citizens, community groups, and labor unions have made use of data from Pollutant Release and Transfer Registers to negotiate directly with polluters to lower emissions, circumventing greater government regulation. Publicly available emissions data also will allow individuals to alter their consumption habits based on the GHG emissions of producers.

The greatest benefit of mandatory reporting of industry GHG emissions to government will be realized in developing future GHG policies.

Benefits to industry of GHG emissions monitoring include the value of having independent, verifiable data to present to the public to demonstrate appropriate environmental stewardship, and a better understanding of their emission levels and sources to identify opportunities to reduce emissions. Such monitoring allows for inclusion of standardized GHG data into environmental management systems, providing the necessary information to achieve and disseminate their environmental achievements.

Standardization will also be a benefit to industry: Once facilities invest in the institutional knowledge and systems to report emissions, the cost of monitoring should fall and the accuracy of the accounting should improve. A standardized reporting program will also allow for facilities to benchmark themselves against similar facilities to understand better their relative standing within their industry.

IV. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review

Under Executive Order 12866 (58 FR 51735, October 4, 1993), this action is a "significant regulatory action" because it may raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order. Accordingly, EPA submitted this action to the Office of Management and Budget (OMB) for review under Executive Order 12866 and any changes made in response to OMB recommendations have been documented in the docket for this action.

EPA prepared an analysis of the potential costs associated with this action. This analysis is contained in the Economic Impact Analysis (EIA), *Economic Impact Analysis for the Mandatory Reporting of Greenhouse Gas Emissions F-Gases Subparts I, L, DD, QQ, and SS* (EPA–HQ–OAR–2009–0927). A copy of the analysis is available in the docket for this action and the analysis is briefly summarized here. In this report, EPA has identified the regulatory options considered, their costs, the emissions that will likely be reported under each option, and explained the selection of the option chosen for the rule. Overall, EPA has concluded that the costs of the F-Gases Rule are outweighed by the potential benefits of more comprehensive information about GHG emissions. The total annualized cost of the rule will be approximately $7.6 million (in 2006$) during the first year of the program and $7.2 million in subsequent years (including $0.4 million of programmatic costs to the Agency).

B. Paperwork Reduction Act

The information collection requirements in this rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* The Information Collection Request (ICR) document prepared by EPA has been assigned EPA ICR number 2373.02.

EPA has identified the following goals of the mandatory GHG reporting system:

- Obtain data that is of sufficient quality that it can be used to analyze and inform the development of a range of future climate change policies and potential regulations.
- Balance the rule's coverage to maximize the amount of emissions reported while excluding small emitters.
- Create reporting requirements that are, to the extent possible and appropriate, consistent with existing GHG reporting programs in order to reduce reporting burden for all parties involved.

The information from fluorinated GHG facilities will allow EPA to make well-informed decisions about whether and how to use the CAA to regulate these facilities and encourage voluntary reductions. Because EPA does not yet know the specific policies that will be adopted, the data reported through the mandatory reporting system should be of sufficient quality to inform policy and program development. Also, consistent with the Appropriations Act, the reporting rule covers a broad range of sectors of the economy.

This information collection is mandatory and will be carried out under CAA section 114. Information identified and marked as Confidential Business Information (CBI) will not be disclosed except in accordance with procedures set forth in 40 CFR Part 2. However, emission information collected under CAA section 114 generally cannot be claimed as CBI and will be made public.[48]

The projected cost and hour respondent burden in the ICR, averaged over the first three years after promulgation, is $6.87 million and 76,701 hours per year. The estimated average burden per response is 183.93 hours; the frequency of response is annual for all respondents that must comply with the rule's reporting requirements; and the estimated average number of likely respondents per year is 417. The cost burden to respondents resulting from the collection of information includes the total capital and start-up cost annualized over the equipment's expected useful life (averaging $2.70 million per year), a total operation and maintenance component (averaging $9.5 thousand per year), and a labor cost component (averaging $4.15 million per year). Burden is defined at 5 CFR Part 1320.3(b).

These cost numbers differ from those shown elsewhere in the EIA because ICR costs represent the average cost over the first three years of the rule, but costs are reported elsewhere in the EIA for the first year of the rule. Also, the total cost estimate of the rule in the EIA includes the cost to the Agency to administer the program. The ICR differentiates between respondent burden and cost to the Agency, estimated to be $384,000.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations in 40 CFR are listed in 40 CFR part 9. When this ICR is approved by OMB, the Agency will publish a technical amendment to 40 CFR part 9 in the **Federal Register** to display the OMB control number for the approved information collection requirements contained in the final rule.

C. Regulatory Flexibility Act (RFA)

The RFA generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions.

For purposes of assessing the impacts of the Fluorinated GHG Reporting Rule on small entities, small entity is defined as a small business as defined by the Small Business Administration's regulations at 13 CFR 121.201; according to these size standards, criteria for determining if ultimate parent companies owning affected facilities are categorized as small vary by NAICS. Table 15 of this preamble presents small business criteria for affected NAICS.

TABLE 15—SMALL BUSINESS CRITERIA FOR AFFECTED NAICS

2007 NAICS	NAICS Description	Subpart	SBA Size standard (effective August 22, 2008)
334413	Semiconductor and Related Device Manufacturing	I	500
334119	Other Computer Peripheral Equipment Manufacturing	I	1,000
325120	Industrial Gas Manufacturing	L	1,000
221121	Electrical Power Systems	DD	([1])
326140	Polystyrene Foam Product Manufacturing	QQ	500
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	QQ	500
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.	QQ	750
335313	Switchgear and Switchboard Apparatus Manufacturing	QQ	750
336391	Motor Vehicle Air-Conditioning Manufacturing	QQ	750
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers.	QQ	100
423620	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers	QQ	100
423720	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers	QQ	100
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers	QQ	100
423740	Refrigeration Equipment and Supplies Merchant Wholesalers	QQ	100
443111	Household Appliance Stores	QQ	$9 M
443112	Radio, Television and Other Electronics Stores	QQ	$9 M
422610	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers	QQ	100
33361	Engine, Turbine, and Power Transmission Equipment Manufacturing	SS	500–1,000
33531	Electrical Equipment Manufacturing	SS	750–1,000

[1] 4 Million MWh.

EPA assessed the potential impacts of this rule on small entities using a sales test, defined as the ratio of total annualized compliance costs to firm sales. Details are provided in Section 5.3 of the EIA. These sales tests compare the average establishment's total annualized mandatory reporting costs to the average establishment receipts for enterprises within several employment categories.[49] The average entity costs used to compute the sales test are the same across all of these enterprise size categories. As a result, the sales test will overstate the cost-to-sales ratio for

[48] Although CBI determinations are usually made on a case-by-case basis, EPA has issued guidance in an earlier **Federal Register** notice on what constitutes emission data that cannot be considered CBI (956 FR 7042–7043, February 21, 1991). As discussed in Section II.B of this preamble, EPA has initiated a separate notice and comment process to make CBI determinations for the data collected under this rule. See 75 FR 39094.

[49] For the one to 20 employee category, we exclude SUSB data for enterprises with zero employees. These enterprises did not operate the entire year.

establishments owned by small businesses, because the reporting costs are likely lower than average entity estimates provided by the engineering cost analysis.

The results of the screening analysis show that for most NAICS, the costs are estimated to be less than 1 percent of sales in all firm size categories. For two NAICS, however, some size categories (especially those with 1–20 employees) show costs exceeding 1 percent of sales. These sectors are Industrial Gas Manufacturing (NAICS 325120) and Semiconductor and Related Device Manufacturing (NAICS 334413). A more careful examination of impacts on small firms in these NAICS codes was conducted.

Analysis of firms in NAICS 334413 shows that firms with fewer than 20 employees produce less than 2 percent of output; firms below the 25,000 Mt CO_2e threshold release approximately 6 percent of emissions. Because emissions and production levels are highly correlated, firms fewer than 20 employees are generally not expected to be affected by the final rule; if they are, their costs are likely to be lower than the overall average costs used in the screening analysis. Thus, EPA does not expect the final rule to impose significant costs to a substantial number of small entities in NAICS 334413.

Subpart L covers facilities included in NAICS codes for Industrial Gas Manufacturing (NAICS 325120). Within this subpart, EPA identified 13 ultimate parent company names covered by the final rule. Using publicly available sources (such as Hoovers.com), EPA collected parent company sales and employment data and found that only one company could be classified as a small entity. Using the cost data for a representative entity (see Section 4 of the EIA), EPA determined the small entity's cost-to-sales ratio is below 1 percent.

After considering the economic impacts of this action on small entities, I therefore certify that this rule will not have a significant economic impact on a substantial number of small entities.

Although this rule will not have a significant economic impact on a substantial number of small entities, the Agency nonetheless tried to reduce the impact of this rule on small entities, including seeking input from a wide range of private- and public-sector stakeholders. When developing the rule, the Agency took special steps to ensure that the burdens imposed on small entities were minimal. The Agency conducted several meetings with industry trade associations to discuss regulatory options and the corresponding burden on industry, such as recordkeeping and reporting. The Agency investigated alternative thresholds and analyzed the marginal costs associated with requiring smaller entities with lower emissions to report.

Through comprehensive outreach activities after proposal of the rule, EPA held meetings and/or conference calls with representatives of the primary audience groups. After proposal, EPA posted a general fact sheet for the rule, information sheets for every source category, and an FAQ document. We continued to meet with stakeholders and entered documentation of all meetings into the docket. One public hearing was held on April 12, 2010, which included three speakers from industry and one non-governmental environmental group. In addition, 20 outreach meetings were held. We considered public comments in developing the final rule.

During rule implementation, EPA will maintain an "open door" policy for stakeholders to ask questions about rule or provide suggestions to EPA about the types of compliance assistance that would be useful to small businesses. EPA intends to develop a range of compliance assistance tools and materials and conduct extensive outreach for the final rule.

D. Unfunded Mandates Reform Act (UMRA)

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Public Law 104–4, establishes requirements for federal agencies to assess the effects of their regulatory actions on State, local, and Tribal governments and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for final rules with "federal mandates" that may result in expenditures to State, local, and Tribal governments, in the aggregate, or to the private sector, of $100 million or more in any one year.

This rule does not contain a Federal mandate that may result in expenditures of $100 million or more for State, local, and Tribal governments, in the aggregate, or the private sector in any one year. Overall, EPA estimates that the total annualized costs of this rule are approximately $7.6 million in the first year, and $7.2 million per year in subsequent years. Thus, this rule is not subject to the requirements of sections 202 or 205 of UMRA.

This rule is also not subject to the requirements of section 203 of UMRA because it contains no regulatory requirements that might significantly or uniquely affect small governments. Facilities subject to the rule include electronics manufacturers, fluorinated gas producers, electric power systems, electrical equipment manufacturers and refurbishers, as well as importers and exporters of pre-charged equipment and closed-cell foams. None of the facilities currently known to undertake these activities are owned by small government.

E. Executive Order 13132: Federalism

This action does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. This regulation applies to electronics manufacturing, fluorinated gas production, electrical equipment use, electrical equipment manufacture or refurbishment, as well as importers and exporters of pre-charged equipment and closed-cell foams. Few State or local government facilities will be affected. This regulation also does not limit the power of States or localities to collect GHG data and/or regulate GHG emissions. Thus, Executive Order 13132 does not apply to this action.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

Executive Order 13175, entitled "Consultation and Coordination with Indian Tribal Governments" (59 FR 22951, November 6, 2000), requires EPA to develop an accountable process to ensure "meaningful and timely input by Tribal officials in the development of regulatory policies that have Tribal implications."

This action does not have Tribal implications, as specified in Executive Order 13175 (65 FR 67249, November 9, 2000). This regulation applies to facilities that manufacture electronic devices, produce fluorinated gases, use electrical equipment in electric power systems, import or export fluorinated GHGs inside pre-charged equipment and closed-cell foams, or manufacture electrical equipment. The only facilities among these that might be owned by Tribal governments are facilities that use electrical equipment in electric power systems. EPA contacted the National Rural Electric Cooperative Association (NRECA) and asked whether any electric power systems owned or operated by Tribal governments were likely to exceed the threshold for reporting emissions from electrical equipment use. NRECA stated

that they did not expect any Tribally-owned or operated electric power systems would trip the threshold. (There are a small number of distribution cooperatives owned by tribes but no transmission or generation.) Thus, Executive Order 13175 does not apply to this action.

Although Executive Order 13175 does not apply to this rule, EPA sought opportunities to provide information to Tribal governments and representatives during development of the MRR rule. In consultation with EPA's American Indian Environment Office, EPA's outreach plan included tribes. During the proposal phase, EPA staff provided information to tribes through conference calls with multiple Indian working groups and organizations at EPA that interact with tribes and through individual calls with two Tribal board members of TCR. In addition, EPA prepared a short article on the GHG reporting rule that appeared on the front page of a Tribal newsletter—*Tribal Air News*—that was distributed to EPA/OAQPS's network of Tribal organizations. EPA gave a presentation on various climate efforts, including Part 98, at the National Tribal Conference on Environmental Management in June, 2008. In addition, EPA had copies of a short information sheet distributed at a meeting of the National Tribal Caucus. EPA participated in a conference call with Tribal air coordinators in April 2009 and prepared a guidance sheet for Tribal governments on the proposal. It was posted on the MRR Web site and published in the Tribal Air Newsletter. For a complete list of Tribal contacts, see the "Summary of EPA Outreach Activities for Developing the Greenhouse Gas Reporting Rule," in the Docket for the initial proposed Part 98 (April, 2009) (EPA–HQ–OAR–2008–0508–055).

G. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

EPA interprets Executive Order 13045 (62 FR 19885, April 23, 1997) as applying only to those regulatory actions that concern health or safety risks, such that the analysis required under section 5–501 of the Executive Order has the potential to influence the regulation. This action is not subject to Executive Order 13045 because it does not establish an environmental standard intended to mitigate health or safety risks.

H. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

This rule is not a "significant energy action" as defined in Executive Order 13211 (66 FR 28355, May 22, 2001) because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. Further, we have concluded that this rule is not likely to have any adverse energy effects. This rule relates to monitoring, reporting and recordkeeping at facilities that manufacture, sell, use, import, or export fluorinated GHG related products and does not impact energy supply, distribution or use. Therefore, we conclude that this rule is not likely to have any adverse effects on energy supply, distribution, or use.

I. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA), Public Law 104–113 (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This rule involves technical standards. EPA will use voluntary consensus standards from at least three different voluntary consensus standards bodies, including the following: ASTM, ASME, and International SEMATECH Manufacturing Initiative. These voluntary consensus standards will help facilities monitor, report, and keep records of GHG emissions. No new test methods were developed for this rule. Instead, from existing rules for source categories and voluntary greenhouse gas programs, EPA identified existing means of monitoring, reporting, and keeping records of greenhouse gas emissions. The existing methods (voluntary consensus standards) include a broad range of measurement techniques, such as methods to measure gas or liquid flow and methods to identify the contents of vented or exhausted streams. The test methods are incorporated by reference into the rule and are available as specified in 40 CFR 98.7.

By incorporating voluntary consensus standards into this rule, EPA is both meeting the requirements of the NTTAA and presenting multiple options and flexibility in complying with this rule.

J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 12898 (59 FR 7629, February 16, 1994) establishes Federal executive policy on environmental justice. Its main provision directs Federal agencies, to the greatest extent practicable and permitted by law, to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States.

EPA has determined that this rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it does not affect the level of protection provided to human health or the environment. This rule does not affect the level of protection provided to human health or the environment because it is a rule addressing information collection and reporting procedures.

K. Congressional Review Act

The Congressional Review Act, 5 U.S.C. 801 *et seq.,* as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the U.S. prior to publication of the rule in the **Federal Register**. A major rule cannot take effect until 60 days after it is published in the **Federal Register**. This action is not a "major rule" as defined by 5 U.S.C. 804(2). This rule will be effective December 31, 2010.

List of Subjects in 40 CFR Part 98

Environmental protection, Administrative practice and procedure, Greenhouse gases, Incorporation by reference, Suppliers, Reporting and recordkeeping requirements.

Dated: November 8, 2010.

Lisa P. Jackson,

Administrator.

■ For the reasons stated in the preamble, title 40, chapter I, of the Code of Federal Regulations is amended as follows:

PART 98—[AMENDED]

■ 1. The authority citation for part 98 continues to read as follows:

Authority: 42 U.S.C. 7401, *et seq.*

Subpart A—[Amended]

■ 2. Section 98.3 is amended as follows:

■ a. By adding paragraph (c)(4)(vi).

■ b. By revising paragraphs(c)(5)(i) and (c)(5)(ii).

§ 98.3 What are the general monitoring, reporting, and recordkeeping and verification requirements of this part?

* * * * *

(c) * * *

(4) * * *

(vi) When applying paragraph (c)(4)(i) of this section to fluorinated GHGs, calculate and report CO_2e for only those fluorinated GHGs listed in Table A–1 of this subpart.

(5) * * *

(i) Total quantity of GHG aggregated for all GHG from all applicable supply categories in Table A–5 of this subpart and expressed in metric tons of CO_2e calculated using Equation A–1 of this subpart.

(ii) Quantity of each GHG from each applicable supply category in Table A–5 of this subpart, expressed in metric tons of each GHG. For fluorinated GHG, report emissions of all fluorinated GHG, including those not listed in Table A–1 of this subpart.

* * * * *

■ 3. Section 98.6 is amended by revising the definition of "Destruction efficiency" to read as follows:

§ 98.6 Definitions.

* * * * *

Destruction efficiency means the efficiency with which a destruction device reduces the mass of a greenhouse gas fed into the device. Destruction efficiency, or flaring destruction efficiency, refers to the fraction of the gas that leaves the flare partially or fully oxidized. The destruction efficiency is expressed in Equation A–2 of this section:

$$DE = 1 - \frac{tGHG_{iOUT}}{tGHG_{iIN}} \quad \text{(Eq. A-2)}$$

Where:

DE = Destruction Efficiency

$tGHG_{iIN}$ = The mass of GHG i fed into the destruction device

$tGHG_{iOUT}$ = The mass of GHG i exhausted from the destruction device

* * * * *

■ 4. Section 98.7 is amended as follows:

■ a. By revising paragraphs (d)(1) through (d)(8) and paragraph (e)(30).

■ b. By adding paragraph (e)(46) and (e)(47).

■ c. By adding paragraphs (m)(3) through (m)(7).

■ d. By adding paragraph (n).

§ 98.7 What standardized methods are incorporated by reference into this part?

* * * * *

(d) * * *

(1) ASME MFC–3M–2004 Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi, incorporation by reference (IBR) approved for § 98.34(b), § 98.124(m)(1), § 98.244(b), § 98.254(c), § 98.324(e), § 98.344(c), § 98.354(d), § 98.354(h), and § 98.364(e).

(2) ASME MFC–4M–1986 (Reaffirmed 1997) Measurement of Gas Flow by Turbine Meters, IBR approved for § 98.34(b), § 98.124(m)(2), § 98.244(b), § 98.254(c), § 98.324(e), § 98.344(c), § 98.354(h), and § 98.364(e).

(3) ASME MFC–5M–1985 (Reaffirmed 1994) Measurement of Liquid Flow in Closed Conduits Using Transit-Time Ultrasonic Flowmeters, IBR approved for § 98.34(b), § 98.124(m)(3), § 98.244(b), and § 98.354(d).

(4) ASME MFC–6M–1998 Measurement of Fluid Flow in Pipes Using Vortex Flowmeters, IBR approved for § 98.34(b), § 98.124(m)(4), § 98.244(b), § 98.254(c), § 98.324(e), § 98.344(c), § 98.354(h), and § 98.364(e).

(5) ASME MFC–7M–1987 (Reaffirmed 1992) Measurement of Gas Flow by Means of Critical Flow Venturi Nozzles, IBR approved for § 98.34(b), § 98.124(m)(5), § 98.244(b), § 98.254(c), § 98.324(e), § 98.344(c), § 98.354(h), and § 98.364(e).

(6) ASME MFC–9M–1988 (Reaffirmed 2001) Measurement of Liquid Flow in Closed Conduits by Weighing Method, IBR approved for § 98.34(b), § 98.124(m)(6), and § 98.244(b).

(7) ASME MFC–11M–2006 Measurement of Fluid Flow by Means of Coriolis Mass Flowmeters, IBR approved for § 98.124(m)(7), § 98.244(b), § 98.254(c), § 98.324(e), § 98.344(c), and § 98.354(h).

(8) ASME MFC–14M–2003 Measurement of Fluid Flow Using Small Bore Precision Orifice Meters, IBR approved for § 98.124(m)(8), § 98.244(b), § 98.254(c), § 98.324(e), § 98.344(c), § 98.354(h), and § 98.364(e).

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(e) * * *

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(30) ASTM D6348–03 Standard Test Method for Determination of Gaseous Compounds by Extractive Direct Interface Fourier Transform Infrared (FTIR) Spectroscopy (ASTM D6348), IBR approved for § 98.54(b), § 98.124(e)(2), and § 98.224(b).

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(46) ASTM D2879–97 (Reapproved 2007) Standard Test Method for Vapor Pressure-Temperature Relationship and Initial Decomposition Temperature of Liquids by Isoteniscope (ASTM D2879), approved May 1, 2007, IBR approved for § 98.128.

(47) ASTM D7359–08 Standard Test Method for Total Fluorine, Chlorine and Sulfur in Aromatic Hydrocarbons and Their Mixtures by Oxidative Pyrohydrolytic Combustion followed by Ion Chromatography Detection (Combustion Ion Chromatography-CIC) (ASTM D7359), approved October 15, 2008, IBR approved for § 98.124(e)(2).

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(m) * * *

(3) Protocol for Measuring Destruction or Removal Efficiency (DRE) of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing, Version 1, EPA–430–R–10–003, March 2010 (EPA 430–R–10–003), *http://www.epa.gov/semiconductor-pfc/documents/dre_protocol.pdf*, IBR approved for § 98.94(f)(4)(i), § 98.94(g)(3), § 98.97(d)(4), § 98.98, and § 98.124(e)(2).

(4) Emissions Inventory Improvement Program, Volume II: Chapter 16, Methods for Estimating Air Emissions from Chemical Manufacturing Facilities, August 2007, Final, *http://www.epa.gov/ttnchie1/eiip/techreport/volume02/index.html*, IBR approved for § 98.123(c)(1)(i)(A).

(5) Protocol for Equipment Leak Emission Estimates, EPA–453/R–95–017, November 1995 (EPA–453/R–95–017), *http://www.epa.gov/ttnchie1/efdocs/equiplks.pdf*, IBR approved for § 98.123(d)(1)(i), § 98.123(d)(1)(ii), § 98.123(d)(1)(iii), and § 98.124(f)(2).

(6) Tracer Gas Protocol for the Determination of Volumetric Flow Rate Through the Ring Pipe of the Xact Multi-Metals Monitoring System, also known as Other Test Method 24 (Tracer Gas Protocol), Eli Lilly and Company Tippecanoe Laboratories, September 2006, *http://www.epa.gov/ttn/emc/prelim/otm24.pdf*, IBR approved for § 98.124(e)(1)(ii).

(7) Approved Alternative Method 012: An Alternate Procedure for Stack Gas Volumetric Flow Rate Determination (Tracer Gas) (ALT–012), U.S. Environmental Protection Agency Emission Measurement Center, May 23, 1994, *http://www.epa.gov/ttn/emc/approalt/alt-012.pdf*, IBR approved for § 98.124(e)(1)(ii).

* * * * *

(n) The following material is available from the International SEMATECH Manufacturing Initiative, 2706 Montopolis Drive, Austin, Texas 78741, (512) 356–3500, *http://ismi.sematech.org*.

(1) Guideline for Environmental Characterization of Semiconductor Process Equipment, International SEMATECH Manufacturing Initiative Technology Transfer #06124825A–ENG, December 22, 2006 (International SEMATECH #06124825A–ENG), IBR approved for § 98.94(d), § 98.94(d)(1), § 98.94(e), § 98.94(e)(1), § 98.94(g)(1), § 98.96(f)(4), and § 98.97(b)(1).

(2) Guidelines for Environmental Characterization of Semiconductor Equipment, International SEMATECH Technology Transfer #01104197A–XFR, December 4, 2001 (International SEMATECH #01104197A–XFR), IBR approved for § 98.94(d), § 98.94(d)(1), § 98.94(e), § 98.94(e)(1), § 98.94(g)(2), § 98.96(f)(4), and § 98.97(b)(1).

* * * * *

■ 5. Table A–3 to subpart A is amended by adding entries for "Electrical Transmission and Distribution Equipment Use" and "Electrical Transmission Distribution Equipment Manufacture or Refurbishment" to read as follows:

TABLE A–3 TO SUBPART A—SOURCE CATEGORY LIST FOR § 98.2(a)(1)

Source Categories [a] Applicable in 2010 and Future Years
* * * * * * *
Additional Source Categories [a] Applicable in 2011 and Future Years
* * * * * * *
Electrical transmission and distribution equipment use (subpart DD).
Electrical transmission and distribution equipment manufacture or refurbishment (subpart SS).

[a] Source categories are defined in each applicable subpart.

■ 6. Table A–4 to subpart A is amended by adding entries for "Electronics manufacturing" and "Fluorinated gas production" to read as follows:

TABLE A–4 TO SUBPART A—SOURCE CATEGORY LIST FOR § 98.2(a)(2)

Source Categories [a] Applicable in 2010 and Future Years
* * * * * * *
Additional Source Categories [a] Applicable in 2011 and Future Years
* * * * * * *
Electronics manufacturing (subpart I)
Fluorinated gas production (subpart L)

[a] Source categories are defined in each applicable subpart.

■ 7. Table A–5 to subpart A is amended by adding entries for "Importers and exporters of fluorinated greenhouse gases contained in pre-charged equipment or closed-cell foams" to read as follows:

TABLE A–5 TO SUBPART A—SUPPLIER CATEGORY LIST FOR § 98.2(a)(4)

Supplier Categories [a] Applicable in 2010 and Future Years
* * * * * * *
Additional Supplier Categories [a] Applicable in 2011 and Future Years
* * * * * * *
Importers and exporters of fluorinated greenhouse gases contained in pre-charged equipment or closed-cell foams (subpart QQ):
(A) Importers of an annual quantity of fluorinated greenhouse gases contained in pre-charged equipment or closed-cell foams that is equivalent to 25,000 metric tons CO_2e or more.
(B) Exporters of an annual quantity of fluorinated greenhouse gases contained in pre-charged equipment or closed-cell foams that is equivalent to 25,000 metric tons CO_2e or more.

[a] Suppliers are defined in each applicable subpart.

■ 8. Add subpart I to read as follows:

Subpart I—Electronics Manufacturing

Sec.
98.90 Definition of the source category.
98.91 Reporting threshold.
98.92 GHGs to report.
98.93 Calculating GHG emissions.
98.94 Monitoring and QA/QC requirements.
98.95 Procedures for estimating missing data.
98.96 Data reporting requirements.
98.97 Records that must be retained.
98.98 Definitions.
Tables
Table I–1 to Subpart I of Part 98—Default Emission Factors for Threshold Applicability Determination
Table I–2 to Subpart I of Part 98—Examples of Fluorinated GHGs Used by the Electronics Industry
Table I–3 to Subpart I of Part 98—Default Emission Factors ($1–U_{ij}$) for Gas Utilization Rates (U_{ij}) and By-Product Formation Rates (B_{ijk}) for Semiconductor Manufacturing for 150 mm and 200 mm Wafer Sizes
Table I–4 to Subpart I of Part 98—Default Emission Factors ($1–U_{ij}$) for Gas Utilization Rates (U_{ij}) and By-Product Formation Rates (B_{ijk}) for Semiconductor Manufacturing for 300 mm Wafer Size
Table I–5 to Subpart I of Part 98—Default Emission Factors ($1–U_{ij}$) for Gas Utilization Rates (U_{ij}) and By-Product Formation Rates (B_{ijk}) for MEMS Manufacturing
Table I–6 to Subpart I of Part 98—Default Emission Factors ($1–U_{ij}$) for Gas Utilization Rates (U_{ij}) and By-Product Formation Rates (B_{ijk}) for LCD Manufacturing
Table I–7 to Subpart I of Part 98—Default Emission Factors ($1–U_{ij}$) for Gas Utilization Rates (U_{ij}) and By-Product Formation Rates (B_{ijk}) for PV Manufacturing
Table I–8 to Subpart I of Part 98— Default Emission Factors ($1–U_{N2O,j}$) for N_2O Utilization ($U_{N2O,j}$)

Subpart I—Electronics Manufacturing

§ 98.90 Definition of the source category.

(a) The electronics manufacturing source category consists of any of the production processes listed in paragraphs (a)(1) through (a)(5) of this section that use fluorinated GHGs or N_2O. Facilities that may use these processes include, but are not limited to, facilities that manufacture micro-electro-mechanical systems (MEMS), liquid crystal displays (LCDs), photovoltaic cells (PV), and semiconductors (including light-emitting diodes (LEDs)).

(1) Any electronics production process in which the etching process uses plasma-generated fluorine atoms and other reactive fluorine-containing fragments, that chemically react with exposed thin-films (e.g., dielectric, metals) or substrate (e.g., silicon) to selectively remove portions of material.

(2) Any electronics production process in which chambers used for depositing thin films are cleaned periodically using plasma-generated fluorine atoms and other reactive fluorine-containing fragments.

(3) Any electronics production process in which wafers are cleaned using plasma generated fluorine atoms or other reactive fluorine-containing fragments to remove residual material from wafer surfaces, including the wafer edge.

(4) Any electronics production process in which the chemical vapor deposition (CVD) process or other manufacturing processes use N_2O.

(5) Any electronics manufacturing production process in which fluorinated GHGs are used as heat transfer fluids to cool process equipment, to control temperature during device testing, to clean substrate surfaces and other parts, and for soldering (e.g., vapor phase reflow).

§ 98.91 Reporting threshold.

(a) You must report GHG emissions under this subpart if electronics manufacturing production processes, as defined in § 98.90, are performed at your facility and your facility meets the requirements of either § 98.2(a)(1) or (a)(2). To calculate total annual GHG emissions for comparison to the 25,000 metric ton CO_2e per year emission threshold in § 98.2(a)(2), follow the requirements of § 98.2(b), with one exception. Rather than using the calculation methodologies in § 98.93 to calculate emissions from electronics manufacturing production processes, calculate emissions of each fluorinated GHG from electronics manufacturing production processes by using paragraphs (a)(1), (a)(2), or (a)(3) of this section, as appropriate, and then sum the emissions of each fluorinated GHG by using paragraph (a)(4) of this section.

(1) If you manufacture semiconductors or MEMS you must calculate annual production process emissions of each input gas i for threshold applicability purposes using the default emission factors shown in Table I–1 to this subpart and Equation I–1 of this subpart.

$$E_i = S * EF_i * GWP_i * 0.001 \quad \text{(Eq. I-1)}$$

Where:

E_i = Annual production process emissions of input gas i for threshold applicability purposes (metric tons CO_2e).

S = 100 percent of annual manufacturing capacity of a facility as calculated using Equation I–5 of this subpart (m^2).

EF_i = Emission factor for input gas i (kg/m^2).

GWP_i = Gas-appropriate GWP as provided in Table A–1 to subpart A of this part.

0.001 = Conversion factor from kg to metric tons.

i = Input gas.

(2) If you manufacture LCDs, you must calculate annual production process emissions of each input gas i for threshold applicability purposes using the default emission factors shown in Table I–1 to this subpart and Equation I–2 of this subpart.

$$E_i = S * EF_i * GWP_i * 0.000001 \quad \text{(Eq. I-2)}$$

Where:

E_i = Annual production process emissions of input gas i for threshold applicability purposes (metric tons Co_2e).

S = 100 percent of annual manufacturing capacity of a facility as calculated using Equation I–5 of this subpart (m^2).

EF_i = Emission factor for input gas i (g/m^2).

GWP_i = Gas-appropriate GWP as provided in Table A–1 to subpart A of this part.

0.000001 = Conversion factor from g to metric tons.

i = Input gas.

(3) If you manufacture PVs, you must calculate annual production process emissions of each input gas i for threshold applicability purposes using gas-appropriate GWP values shown in Table A–1 to subpart A of this part and Equation I–3 of this subpart.

$$E_i = C_i * GWP_i * 0.001 \quad \text{(Eq. I-3)}$$

Where:

E_i = Annual production process emissions of input gas i for threshold applicability purposes (metric tons Co_2e).

C_i = Annual fluorinated GHG (input gas i) purchases or consumption (kg). Only gases used in PV manufacturing that have listed GWP values in Table A–1 to subpart A of this part must be considered for threshold applicability purposes.

GWP_i = Gas-appropriate GWP as provided in Table A–1 to subpart A of this part.

0.001 = Conversion factor from kg to metric tons.

i = Input gas.

(4) You must calculate total annual production process emissions for threshold applicability purposes using Equation I–4 of this subpart.

$$E_T = \delta * \sum_i E_i \quad \text{(Eq. I-4)}$$

Where:

E_T = Annual production process emissions of all fluorinated GHGs for threshold applicability purposes (metric tons Co_2e).

δ = Factor accounting for heat transfer fluid emissions, estimated as 10 percent of total annual production process emissions at a semiconductor facility. Set equal to 1.1 when Equation I–4 of this subpart is used to calculate total annual production process emissions from semiconductor manufacturing. Set equal to 1 when Equation I–4 of this subpart is used to calculate total annual production process emissions from MEMS, LCD, or PV manufacturing.

E_i = Annual production process emissions of input gas i for threshold applicability purposes (metric tons Co_2e), as calculated in Equations I–1, I–2 or I–3 of this subpart.

i = Input gas.

(b) You must calculate annual manufacturing capacity of a facility using Equation I–5 of this subpart.

$$S = \sum_x^{12} W_x \quad \text{(Eq. I-5)}$$

Where:

S = 100 percent of annual manufacturing capacity of a facility (m^2).

W_x = Maximum designed substrate starts of a facility in month x (m^2 per month).

x = Month.

§ 98.92 GHGs to report.

(a) You must report emissions of fluorinated GHGs (as defined in § 98.6) and N_2O. The fluorinated GHGs that are emitted from electronics manufacturing production processes include, but are not limited to, those listed in Table I–2 to this subpart. You must individually report, as appropriate:

(1) Fluorinated GHGs emitted from plasma etching.

(2) Fluorinated GHGs emitted from chamber cleaning.

(3) Fluorinated GHGs emitted from wafer cleaning.

(4) N_2O emitted from chemical vapor deposition and other electronics manufacturing processes.

(5) Fluorinated GHGs emitted from heat transfer fluid use.

(6) All fluorinated GHGs and N_2O consumed, including gases used in manufacturing processes other than those listed in paragraphs (a)(1) through (a)(5) of this section.

(b) 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 of this part.

§ 98.93 Calculating GHG emissions.

(a) You must calculate total annual facility-level emissions of each fluorinated GHG used in electronics manufacturing production processes at your facility, for each process type, using Equations I–6 and I–7 of this subpart according to the procedures in paragraphs (a)(1), (a)(2), (a)(3), (a)(4), (a)(5), or (a)(6) of this section, as appropriate. Facilities to which the procedures in paragraphs (a)(1) of this section or (a)(2) of this section apply may elect to use the procedures in paragraph (a)(3) as an alternative. If your facility uses less than 50 kg of a fluorinated GHG in one reporting year, you may calculate emissions as equal to your facility's annual consumption for that specific gas as calculated in Equation I–11 of this subpart. Where your facility is required to perform calculations using default emission factors for gas utilization and by-product formation rates according to the procedures in paragraphs (a)(1) or (a)(2) of this section, and default values are not available for a particular input gas and process type or sub-type combination in Tables I–3, I–4, I–5, I–6, or I–7, you must follow the procedures in paragraph (a)(6) of this section.

$$ProcesstypeE_i = \sum_{j=1}^{N} E_{ij} \quad \text{(Eq. I-6)}$$

Where:

$ProcesstypeE_i$ = Annual emissions of input gas i from the processes type (metric tons).

E_{ij} = Annual emissions of input gas i from recipe, process sub-type, or process type j as calculated in Equation I–8 of this subpart (metric tons).

N = The total number of recipes or process sub-types j that depends on the electronics manufacturing facility and emission calculation methodology. If E_{ij} is calculated for a process type j in Equation I–8 of this subpart, N = 1.

i = Input gas.

j = Recipe, process sub-type, or process type.

$$ProcesstypeBE_k = \sum_{j=1}^{N} \sum_i BE_{ijk} \quad \text{(Eq. I-7)}$$

Where:

$ProcesstypeBE_k$ = Annual emissions of by-product gas k from the processes type (metric tons).

BE_{ijk} = Annual emissions of by-product gas k formed from input gas i used for recipe, process sub-type, or process type j as calculated in Equation I–9 of this subpart (metric tons).

N = The total number of recipes or process sub-types j that depends on the electronics manufacturing facility and emission calculation methodology. If BE_{kij} is calculated for a process type j in Equation I–9 of this subpart, N = 1.

i = Input gas.

j = Recipe, process sub-type, or process type.

k = By-product gas.

(1) If you manufacture MEMS, LCDs, or PVs, you must, except as provided in § 98.93(a)(3), calculate annual facility-level emissions of each fluorinated GHG used for the plasma etching and chamber cleaning process types using default utilization and by-product formation rates as shown in Table I–5, I–6, or I–7 of this subpart, as appropriate, and by using Equations I–8 and I–9 of this subpart.

(2) If you manufacture semiconductors on wafers measuring 300 mm or less in diameter, except as provided in § 98.93(a)(3), you must adhere to the procedures in paragraphs (a)(2)(i) or (a)(2)(ii) of this section.

(i) If your facility has an annual manufacturing capacity, as calculated using Equation I–5 of this subpart, of less than or equal to 10,500 m^2 of substrate, you must adhere to the procedures in paragraphs (a)(i)(A) through (a)(i)(C) of this section.

(A) You must calculate annual facility-level emissions of each fluorinated GHG used for the plasma etching process type using default utilization and by-product formation rates as shown in Table I–3 or I–4 of this subpart, and by using Equations I–8 and I–9 of this subpart.

(B) You must calculate annual facility-level emissions of each fluorinated GHG used for each of the process sub-types associated with the chamber cleaning process type, including in-situ plasma chamber clean, remote plasma chamber clean, and in-situ thermal chamber clean, using default utilization and by-product formation rates as shown in Table I–3 or I–4 of this subpart, and by using Equations I–8 and I–9 of this subpart.

(C) You must calculate annual facility-level emissions of each fluorinated GHG used for the wafer cleaning process type using default utilization and by-product formation rates as shown in Table I–3 or I–4 of this subpart and by using Equations I–8 and I–9 of this subpart.

(ii) If your facility has an annual manufacturing capacity of greater than 10,500 m^2 of substrate, as calculated using Equation I–5 of this subpart, you must adhere to the procedures in paragraphs (a)(ii)(A) through (a)(ii)(C) of this section.

(A) You must calculate annual facility-level emissions of each fluorinated GHG used for the plasma etching process type using recipe-specific utilization and by-product formation rates determined as specified in § 98.94(d), and by using Equations I–8 and I–9 of this subpart. You must develop recipe-specific utilization and by-product formation rates for each individual recipe or set of similar recipes as defined in § 98.98. Recipe-specific utilization and by-product formation rates must be developed each reporting year only for recipes which are not similar to any recipe used in a previous reporting year, as defined in § 98.98.

(B) You must calculate annual facility-level emissions of each fluorinated GHG used for each of the process sub-types associated with the chamber cleaning process type, including in-situ plasma chamber clean, remote plasma chamber clean, and in-situ thermal chamber clean, using default utilization and by-product formation rates as shown in Table I–3 or I–4 to this subpart, and by using Equations I–8 and I–9 of this subpart.

(C) You must calculate annual facility-level emissions of each fluorinated GHG used for the wafer cleaning process type using default utilization and by-product formation rates as shown in Table I–3 or I–4 to this subpart, and by using Equations I–8 and I–9 of this subpart.

(3) If you do not adhere to procedures as specified in paragraphs (a)(1) and (a)(2) of this section, you must calculate annual facility-level emissions of each fluorinated GHG for all fluorinated GHG-emitting production processes using recipe-specific utilization and by-product formation rates determined as specified in § 98.94(d) and by using Equations I–8 and I–9 of this subpart. You must develop recipe-specific utilization and by-product formation rates for each individual recipe or set of similar recipes as defined in § 98.98. Recipe-specific utilization and by-product formation rates must be developed each reporting year only for recipes which are not similar to any recipe used in a previous reporting year, as defined in § 98.98.

(4) If you manufacture semiconductors on wafers measuring greater than 300 mm in diameter, you must calculate annual facility-level emissions of each fluorinated GHG used for all fluorinated GHG emitting production processes using recipe-specific utilization and by-product formation rates as specified in § 98.94(d), and by using Equations I–8 and I–9 of this subpart. You must develop recipe-specific utilization and by-product formation rates for each individual recipe or set of similar recipes as defined in § 98.98. Recipe-specific utilization and by-product formation rates must be developed each reporting year only for recipes that are not similar to any recipe used in a previous reporting year, as defined in § 98.98.

(5) To be included in a set of similar recipes for the purposes of this subpart, a recipe must be similar to the recipe in the set for which recipe-specific utilization and by-product formation rates have been measured.

(6) Where your facility is required to perform calculations using default emission factors for gas utilization and by-product formation rates according to the procedures in paragraphs (a)(1) or (a)(2) of this section, and default values are not available for a particular input gas and process type or sub-type combination in Tables I–3, I–4, I–5, I–6, or I–7, you must follow the procedures in either paragraph (a)(6)(i) or (a)(6)(ii) of this section and use Equations I–8 and I–9 of this subpart.

(i) You must use utilization and by-product formation rates of 0.

(ii) You must develop recipe-specific utilization and by-product formation rates determined as specified in § 98.94(d) for each individual recipe or set of similar recipes as defined in § 98.98. Recipe-specific utilization and by-product formation rates must be developed each reporting year only for recipes that are not similar to any recipe used in a previous reporting year, as defined in § 98.98.

$$E_{ij} = C_{ij} * (1 - U_{ij}) * (1 - a_{ij} * d_{ij}) * 0.001 \qquad \text{(Eq. I-8)}$$

Where:

E_{ij} = Annual emissions of input gas i from recipe, process sub-type, or process type j (metric tons).

C_{ij} = Amount of input gas i consumed for recipe, process sub-type, or process type j, as calculated in Equation I–13 of this subpart (kg).

U_{ij} = Process utilization rate for input gas i for recipe, process sub-type, or process type j (expressed as a decimal fraction).

a_{ij} = Fraction of input gas i used in recipe, process sub-type, or process type j with abatement systems (expressed as a decimal fraction).

d_{ij} = Fraction of input gas i destroyed or removed in abatement systems connected to process tools where recipe, process sub-type, or process type j is used, as calculated in Equation I–14 of

this subpart (expressed as a decimal fraction).

0.001 = Conversion factor from kg to metric tons.

i = Input gas.

j = Recipe, process sub-type, or process type.

$$BE_{ijk} = B_{ijk} * C_{ij} * (1 - a_{ij} * d_{jk}) * 0.001 \quad \text{(Eq. I-9)}$$

Where:

BE_{ijk} = Annual emissions of by-product gas k formed from input gas i from recipe, process sub-type, or process type j (metric tons).

B_{ijk} = By-product formation rate of gas k created as a by-product per amount of input gas i (kg) consumed by recipe, process sub-type, or process type j (kg).

C_{ij} = Amount of input gas i consumed for recipe, process sub-type, or process type j, as calculated in Equation I–13 of this subpart (kg)).

a_{ij} = Fraction of input gas i used for recipe, process sub-type, or process type j with abatement systems (expressed as a decimal fraction).

d_{jk} = Fraction of by-product gas k destroyed or removed in abatement systems connected to process tools where recipe, process sub-type, or process type j is used, as calculated in Equation I–14 of this subpart (expressed as a decimal fraction).

0.001 = Conversion factor from kg to metric tons.

i = Input gas.

j = Recipe, process sub-type, or process type.

k = By-product gas.

(b) You must calculate annual facility-level N_2O emissions from each chemical vapor deposition process and other electronics manufacturing production processes using Equation I–10 of this subpart and the methods in paragraphs (b)(1) and (b)(2) of this section. If your facility uses less than 50 kg of N_2O in one reporting year, you may calculate emissions as equal to your facility's annual consumption for N_2O as calculated in Equation I–11 of this subpart.

(1) You must use a factor for N_2O utilization for chemical vapor deposition processes pursuant to either paragraph (b)(1)(i) or (b)(1)(ii) of this section.

(i) You must develop a facility-specific N_2O utilization factor averaged over all N_2O-using chemical vapor deposition processes determined as specified in § 98.94(e).

(ii) If you do not use a facility-specific N_2O utilization factor for chemical vapor deposition processes, you must use the default utilization factor as shown in Table I–8 to this subpart for N_2O from chemical vapor deposition processes.

(2) You must use a factor for N_2O utilization for other manufacturing processes pursuant to either paragraph (b)(2)(i) or (b)(2)(ii) of this section.

(i) You must develop a facility-specific N_2O utilization factor averaged over all N_2O-using electronics manufacturing production processes other than chemical vapor deposition processes determined as specified in § 98.94(e).

(ii) If you do not use a facility-specific N_2O utilization factor for manufacturing production processes other than chemical vapor deposition, you must use the default utilization factor in as shown in Table I–8 to this subpart for N_2O from manufacturing production processes other than chemical vapor deposition.

$$E(N_2O)_j = C_{N_2O,j} * (1 - U_{N_2O,j}) * (1 - a_{N_2O,j} * d_{N_2O,j}) * 0.001 \quad \text{(Eq. I-10)}$$

Where:

$E(N_2O)_j$ = Annual emissions of N_2O for N_2O-using process j (metric tons).

$C_{N2O,j}$ = Amount of N_2O consumed for N_2O-using process j, as calculated in Equation I–13 of this subpart and apportioned to N_2O process j (kg).

$U_{N2O,j}$ = Process utilization factor for N_2O-using process j (expressed as a decimal fraction).

$a_{N2O,j}$ = Fraction of N_2O used in N_2O-using process j with abatement systems (expressed as a decimal fraction).

$d_{N2O,j}$ = Fraction of N_2O for N_2O-using process j destroyed or removed in abatement systems connected to process tools where process j is used, as calculated in Equation I–14 of this subpart (expressed as a decimal fraction).

0.001 = Conversion factor from kg to metric tons.

j = Type of N_2O-using process, either chemical vapor deposition or other N_2O-using manufacturing processes.

(c) You must calculate total annual input gas i consumption for each fluorinated GHG and N_2O using Equation I–11 of this subpart. Pursuant to § 98.92(a)(6), for all fluorinated GHGs and N_2O used at your facility for which you do not calculate emissions using Equations I–6, I–7, I–8, I–9, and I–10 of this subpart, calculate consumption of these fluorinated GHGs and N_2O using Equation I–11 of this subpart.

$$C_i = (I_{Bi} - I_{Ei} + A_i - D_i) \quad \text{(Eq. I-11)}$$

Where:

C_i = Annual consumption of input gas i (kg per year).

I_{Bi} = Inventory of input gas i stored in containers at the beginning of the reporting year, including heels (kg). For containers in service at the beginning of a reporting year, account for the quantity in these containers as if they were full.

I_{Ei} = Inventory of input gas i stored in containers at the end of the reporting year, including heels (kg). For containers in service at the end of a reporting year, account for the quantity in these containers as if they were full.

A_i = Acquisitions of input gas i during the year through purchases or other transactions, including heels in containers returned to the electronics manufacturing facility (kg).

D_i = Disbursements of input gas i through sales or other transactions during the year, including heels in containers returned by the electronics manufacturing facility to the chemical supplier, as calculated using Equation I–12 of this subpart (kg).

i = Input gas.

(d) You must calculate disbursements of input gas i using facility-wide gas-specific heel factors, as determined in § 98.94(b), and by using Equation I–12 of this subpart.

$$D_i = \sum_{l=1}^{M} \left(h_{il} * N_{il} * F_{il} \right) + X_i \quad \text{(Eq. I-12)}$$

Where:

D_i = Disbursements of input gas i through sales or other transactions during the reporting year, including heels in containers returned by the electronics manufacturing facility to the gas distributor (kg).

h_{il} = Facility-wide gas-specific heel factor for input gas i and container size and type l (expressed as a decimal fraction), as determined in § 98.94(b). If your facility uses less than 50 kg of a fluorinated GHG or N_2O in one reporting year, you may assume that any h_{il} for that fluorinated GHG or N_2O is equal to zero.

N_{il} = Number of containers of size and type l returned to the gas distributor containing the standard heel of input gas i.

F_{il} = Full capacity of containers of size and type l containing input gas i (kg).

X_i = Disbursements under exceptional circumstances of input gas i through sales or other transactions during the year (kg). These include returns of containers whose contents have been weighed due to an exceptional circumstance as specified in § 98.94(b)(4).

i = Input gas.

l = Size and type of gas container.

M = The total number of different sized container types. If only one size and container type is used for an input gas i, M=1.

(e) You must calculate the amount of input gas i consumed for each individual recipe (including those in a set of similar recipes) process sub-type, or process type j, using Equation I–13 of this subpart.

$$C_{ij} = f_{ij} * C_i \quad \text{(Eq. I-13)}$$

Where:

$C_{i,j}$ = The annual amount of input gas i consumed for recipe, process sub-type, or process type j (kg).

$f_{i,j}$ = Recipe-specific, process sub-type-specific, or process type-specific input gas i apportioning factor (expressed as a decimal fraction), as determined in accordance with § 98.94(c).

C_i = Annual consumption of input gas i as calculated using Equation I–11 of this subpart (kg).

i = Input gas.

j = Recipe, process sub-type, or process type.

(f) If you report controlled emissions pursuant to § 98.94(f), you must calculate the fraction of input gas i destroyed in abatement systems for each individual recipe (including those in a set of similar recipes) process sub-type, or process type j by using Equation I–14 of this subpart.

$$d_{i,j} = \frac{\sum_p C_{ijp} * d_{ijp} * u_p}{\sum_p C_{ijp}} \quad \text{(Eq. I-14)}$$

Where:

d_{ij} = Fraction of input gas i destroyed or removed in abatement systems connected to process tools where recipe, process sub-type, or process type j is used (expressed as a decimal fraction).

C_{ijp} = The amount of input gas i consumed for recipe, process sub-type, or process type j fed into abatement system p (kg).

d_{ijp} = Destruction or removal efficiency for input gas i in abatement system p connected to process tools where recipe, process sub-type, or process type j is used (expressed as a decimal fraction). This is zero unless the facility adheres to requirements in § 98.94(f).

u_p = The uptime of abatement system p as calculated in Equation I–15 of this subpart (expressed as a decimal fraction).

i = Input gas.

j = Recipe, process sub-type, or process type.

p = Abatement system.

(g) If you report controlled emissions pursuant to § 98.94(f), you must calculate the uptime by using Equation I–15 of this subpart.

$$u_p = \frac{t_p}{T_p} \quad \text{(Eq. I-15)}$$

Where:

u_p = The uptime of abatement system p (expressed as a decimal fraction).

t_p = The total time in which abatement system p is in an operational mode when fluorinated GHGs or N_2O are flowing through production process tool(s) connected to abatement system p (hours).

T_p = Total time in which fluorinated GHGs or N_2O are flowing through production process tool(s) connected to abatement system p (hours).

p = Abatement system.

(h) If you use fluorinated heat transfer fluids, you must report the annual emissions of fluorinated GHG heat transfer fluids using the mass balance approach described in Equation I–16 of this subpart.

$$EH_i = density_i * (I_{iB} + P_i - N_i + R_i - I_{iE} - D_i) * 0.001 \quad \text{(Eq. I-16)}$$

Where:

EH_i = Emissions of fluorinated GHG heat transfer fluid i, (metric tons/year).

$Density_i$ = Density of fluorinated heat transfer fluid i (kg/l).

I_{iB} = Inventory of fluorinated heat transfer fluid i in containers other than equipment at the beginning of the reporting year (in stock or storage) (l). The inventory at the beginning of the reporting year must be the same as the inventory at the end of the previous reporting year.

P_i = Acquisitions of fluorinated heat transfer fluid i during the reporting year (l), including amounts purchased from chemical suppliers, amounts purchased from equipment suppliers with or inside of equipment, and amounts returned to the facility after off-site recycling.

N_i = Total nameplate capacity (full and proper charge) of equipment that uses fluorinated heat transfer fluid i and that

is newly installed during the reporting year (l).

R_i = Total nameplate capacity (full and proper charge) of equipment that uses fluorinated heat transfer fluid i and that is removed from service during the reporting year (l).

I_{iE} = Inventory of fluorinated heat transfer fluid i in containers other than equipment at the end of the reporting year (in stock or storage)(l).

D_i = Disbursements of fluorinated heat transfer fluid i during the reporting year, including amounts returned to chemical suppliers, sold with or inside of equipment, and sent off-site for verifiable recycling or destruction (l). Disbursements should include only amounts that are properly stored and transported so as to prevent emissions in transit.

0.001 = Conversion factor from kg to metric tons.

i = Heat transfer fluid.

§ 98.94 Monitoring and QA/QC requirements.

(a) For calendar year 2011 monitoring, you may follow the provisions in paragraphs (a)(1) through (a)(3) of this section for best available monitoring methods.

(1) *Best available monitoring methods.* From January 1, 2011 through June 30, 2011, owners or operators may use best available monitoring methods for any parameter that cannot reasonably be measured according to the monitoring and QA/QC requirements of this subpart. The owner or operator must use the calculation methodologies and equations in § 98.93, but may use the best available monitoring method for any parameter for which it is not reasonably feasible to acquire, install, or operate a required piece of monitoring equipment in a facility, or to procure necessary measurement services by January 1, 2011. Starting no later than July 1, 2011, the owner or operator must discontinue using best available monitoring methods and begin following all applicable monitoring and QA/QC requirements of this part, except as provided in paragraphs (a)(2), (a)(3), or (a)(4) of this section. Best available monitoring methods means any of the following methods specified in this paragraph:

(i) Monitoring methods currently used by the facility that do not meet the specifications of this subpart.

(ii) Supplier data.

(iii) Engineering calculations.

(iv) Other company records.

(2) *Requests for extension of the use of best available monitoring methods in 2011 for parameters other than recipe-specific utilization and by-product formation rates for the plasma etching process type.* With respect to any provision of this subpart except § 98.93(a)(2)(ii)(A), the owner or operator may submit a request to the Administrator under this paragraph (a)(2) to use one or more best available monitoring methods to estimate emissions that occur between July 1, 2011 and December 31, 2011.

(i) *Timing of request.* The extension request must be submitted to EPA no later than February 28, 2011.

(ii) *Content of request.* Requests must contain the following information:

(A) A list of specific items of monitoring instrumentation and measuring services for which the request is being made and the locations where each piece of monitoring instrumentation will be installed and where each measurement service will be provided.

(B) Identification of the specific rule requirements for which the instrumentation or measurement service is needed.

(C) A description of the reasons why the needed equipment could not be obtained, installed, or operated or why the needed measurement service could not be provided before July 1, 2011.

(D) If the reason for the extension is that the equipment cannot be purchased, delivered, or installed before July 1, 2011, include supporting documentation such as the date the monitoring equipment was ordered, investigation of alternative suppliers, and the dates by which alternative vendors promised delivery or installation, backorder notices or unexpected delays, descriptions of actions taken to expedite delivery or installation, and the current expected date of delivery or installation.

(E) If the reason for the extension is that service providers were unable to provide necessary measurement services, include supporting documentation demonstrating that these services could not be acquired before July 1, 2011. This documentation must include written correspondence to and from at least three service providers stating that they will not be available to provide the necessary services before July 1, 2011.

(F) A detailed description of the specific best available monitoring methods that the facility will use in place of the required methods.

(G) A description of the specific actions the owner or operator will take to comply with monitoring requirements by January 1, 2012.

(iii) *Approval criteria.* To obtain approval, the owner or operator must demonstrate to the Administrator's satisfaction that by July 1, 2011, it is not reasonably feasible to acquire, install, or operate the required piece of monitoring equipment, or procure necessary measurement services to comply with the requirements of this subpart. As a condition for allowing the use of best available monitoring methods through December 31, 2011, facilities must recalculate and resubmit their 2011 estimated emissions using the requirements of this subpart. Where a facility is allowed to use best available monitoring methods for apportioning gas consumption under § 98.94(c), it is not required to verify its 2011 engineering model with its recalculated report. The facility's recalculated emissions must be reported with its report for the 2012 reporting year (to be submitted in 2013) unless the facility receives an additional extension under paragraph (a)(4) of this section.

(3) Requests for extension of the use of best available monitoring methods in 2011 for recipe-specific utilization and by-product formation rates for the plasma etching process type under § 98.93(a)(2)(ii)(A). The owner or operator may submit a request to the Administrator under this paragraph (a)(3) to use one or more best available monitoring methods to estimate emissions that occur between July 1, 2011 and December 31, 2011 for recipe-specific utilization and by-product formation rates for the etching process type under § 98.93(a)(2)(ii)(A).

(i) *Timing of request.* The extension request must be submitted to EPA no later than June 30, 2011.

(ii) *Content of request.* Requests must contain the following information:

(A) The information outlined in paragraphs (a)(2)(ii)(A) through (a)(2)(ii)(F) of this section, substituting December 31, 2011 for July 1, 2011.

(B) A description of the specific actions the owner or operator will take to comply with monitoring requirements by January 1, 2012.

(iii) *Approval criteria.* To obtain approval, the owner or operator must demonstrate to the Administrator's satisfaction that by December 31, 2011 it is not reasonably feasible to acquire, install, or operate the required piece of monitoring equipment or procure necessary measurement services to comply with the requirements of this subpart. As a condition for allowing the use of best available monitoring methods through December 31, 2011, facilities must recalculate and resubmit their 2011 estimated emissions using the requirements of this subpart. The facility's recalculated emissions must be reported with its report for the 2012 reporting year (to be submitted in 2013) unless the facility receives an additional

extension under paragraph (a)(4) of this section.

(4) *Requests for extension of the use of best available monitoring methods beyond 2011.* EPA does not anticipate approving the use of best available monitoring methods beyond December 31, 2011; however, EPA reserves the right to approve any such requests submitted for unique and extreme circumstances, which include safety, technical infeasibility, or inconsistency with other local, State or Federal regulations.

(i) *Timing of request.* The extension request must be submitted to EPA no later than June 30, 2011.

(ii) *Content of request.* Requests must contain the following information:

(A) A list of parameters for which the owner or operator is seeking use of best available monitoring methods beyond 2011.

(B) A description of the specific rule requirements that the owner or operator cannot meet, including a detailed explanation as to why the requirements can not be met.

(C) Detailed description of the unique circumstances necessitating an extension, including specific data collection issues that do not meet safety regulations, technical infeasibility, or specific laws or regulations that conflict with data collection.

(D) A detailed explanation and supporting documentation of how and when the owner or operator will receive the required data and/or services to comply with the reporting requirements of this subpart in the future.

(E) A detailed description of the specific best available monitoring methods that the facility will use in place of the required methods.

(F) The Administrator reserves the right to require that the owner or operator provide additional documentation.

(iii) *Approval criteria.* To obtain approval, the owner or operator must demonstrate to the Administrator's satisfaction that by December 31, 2011 (or in the case of facilities that are required to calculate and report emissions in accordance with § 98.93(a)(2)(ii)(A), December 31, 2012), it is not reasonably feasible to acquire, install, or operate the required piece of monitoring equipment according to the requirements of this subpart. As a condition for allowing the use of best available monitoring methods through December 31, 2012, facilities must recalculate and resubmit their 2012 estimated emissions using the requirements of this subpart. Where a facility is allowed to use best available monitoring methods for apportioning gas consumption under § 98.94(c), it is not required to verify its 2012 engineering model with its recalculated report. The facility's recalculated emissions must be reported with its report for the 2013 reporting year (to be submitted in 2014).

(b) For purposes of Equation I–12 of this subpart, you must estimate facility-wide gas-specific heel factors for each container type for each gas used, except for fluorinated GHGs or N_2O which your facility uses in quantities less than 50 kg in one reporting year, according to the procedures in paragraphs (b)(1) through (b)(5) of this section.

(1) Base your facility-wide gas-specific heel factors on the trigger point for change out of a container for each container size and type for each gas used. Facility-wide gas-specific heel factors must be expressed as the ratio of the trigger point for change out, in terms of mass, to the initial mass in the container, as determined by paragraphs (b)(2) and (b)(3) of this section.

(2) The trigger points for change out you use to calculate facility-wide gas-specific heel factors in § 98.94(b)(1) must be determined by monitoring the mass or the pressure of your containers. If you monitor the pressure, convert the pressure to mass using the ideal gas law, as displayed in Equation I–17 of this subpart, with the appropriate Z value selected based upon the properties of the gas.

$$pV = ZnRT \quad \text{(Eq. I-17)}$$

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).

(3) The initial mass you use to calculate a facility-wide gas-specific heel factor in § 98.94(b)(1) may be based on the weight of the gas provided to you in gas supplier documents; however, you remain responsible for the accuracy of these masses and weights under this subpart.

(4) If a container is changed in an exceptional circumstance, you must weigh that container or measure the pressure of that container with a pressure gauge, in place of using a heel factor to determine the residual weight of gas. An exceptional circumstance is a change out point that differs by more than 20 percent from the trigger point for change out used to calculate your facility-wide gas-specific heel factor for that gas and container type. When using mass-based trigger points for change out, you must determine if an exceptional circumstance has occurred based on the net weight of gas in the container, excluding the tare weight of the container.

(5) You must re-calculate a facility-wide gas-specific heel factor if you use a trigger point for change out for a gas and container type that differs by more than 5 percent from the previously used trigger point for change out for that gas and container type.

(c) You must develop apportioning factors for fluorinated GHG and N_2O consumption to use in Equation I–13 of this subpart for each input gas i, as appropriate, using a facility-specific engineering model that is documented in your site GHG Monitoring Plan as required under § 98.3(g)(5). This model must be based on a quantifiable metric, such as wafer passes or wafer starts. To verify your model, you must demonstrate its precision and accuracy by adhering to the requirements in paragraphs (c)(1) and (c)(2) of this section.

(1) You must demonstrate that the fluorinated GHG and N_2O apportioning factors are developed using calculations that are repeatable, as defined in § 98.98.

(2) You must demonstrate the accuracy of your facility-specific model by comparing the actual amount of input gas i consumed and the modeled amount of input gas i consumed for the plasma etching and chamber cleaning process types, as follows:

(i) You must analyze at least a 30-day period of operation during which the capacity utilization equals or exceeds 60 percent of its design capacity. In the event your facility operates below 60 percent of its design capacity during the reporting year, you must use the period during which the facility experiences its highest 30-day average utilization for model verification.

(ii) You must compare the actual gas consumed of input gas i to the modeled gas consumed of input gas i for one fluorinated GHG reported under this subpart under the plasma etching process type and the chamber cleaning

process type. You must certify that the fluorinated GHGs selected for comparison correspond to the largest quantities, on a mass basis, of fluorinated GHGs used at your facility during the reporting year for the plasma etching process type and the chamber cleaning process type.

(iii) You must demonstrate that the comparison performed for the largest quantity of gas, on a mass basis, consumed under the plasma etching process type in paragraph (c)(2)(ii) of this section, does not result in a difference between the actual and modeled gas consumption that exceeds five percent relative to actual gas consumption, reported to one significant figure using standard rounding conventions.

(d) If you use factors for fluorinated GHG process utilization and by-product formation rates other than the defaults provided in Tables I–3, I–4, I–5, I–6, and I–7 to this subpart, you must use utilization and by-product formation rates that are developed with measurements made using the International SEMATECH #06124825A–ENG (incorporated by reference, see § 98.7). You may use recipe-specific utilization and by-product formation rates that were measured using the International SEMATECH #01104197A–XFR (incorporated by reference, see § 98.7) provided the measurements were made prior to January 1, 2007. You may use recipe-specific utilization and by-product formation rates measured by a third party, such as a manufacturing equipment supplier, if the conditions in paragraphs (d)(1) and (d)(2) of this section are met.

(1) The third party has measured recipe-specific utilization and by-product formation rates using the International SEMATECH #06124825A–ENG (incorporated by reference, see § 98.7,) or the International SEMATECH #01104197A–XFR (incorporated by reference, see § 98.7) provided the measurements were made prior to January 1, 2007.

(2) Measurements made by a third party to develop recipe-specific utilization and by-product formation rates must have been made for recipes that are similar recipes to those used at your facility, as defined in § 98.98.

(e) If you use N_2O utilization factors other than the defaults provided in Table I–8 to this subpart, you must use factors developed with measurements made using the International SEMATECH #06124825A–ENG (incorporated by reference, see § 98.7). You may use measurements made using the International SEMATECH #01104197A–XFR (incorporated by reference, see § 98.7) provided the measurements were made prior to January 1, 2007. You may use N_2O utilization factors measured by a third party, such as a manufacturing equipment supplier, if the conditions in paragraphs (e)(1) and (e)(2) of this section are met.

(1) The third party has measured N_2O utilization factors using the International SEMATECH #06124825A–ENG (incorporated by reference, see § 98.7,) or the International SEMATECH #01104197A–XFR (incorporated by reference, see § 98.7) provided the measurements were made prior to January 1, 2007.

(2) The conditions under which the measurements were made are representative of your facility's N_2O emitting production processes.

(f) If your facility employs abatement systems and you wish to reflect emission reductions due to these systems in calculations in § 98.93, you must adhere to the procedures in paragraphs (f)(1) and (f)(2) of this section. If you use the default destruction or removal efficiency of 60 percent, you must adhere to procedures in paragraph (f)(3) of this section. If you use either a properly measured destruction or removal efficiency as defined in § 98.98, or a class average of properly measured destruction or removal efficiencies during a reporting year, you must adhere to procedures in paragraph (f)(4) of this section.

(1) You must certify and document that the abatement systems are properly installed, operated, and maintained according to manufacturers' specifications by adhering to the procedures in paragraphs (1)(i) and (1)(ii) of this section.

(i) You must certify and document proper installation by verifying your systems were installed in accordance with the manufacturers' specifications.

(ii) You must certify and document your systems are operated and maintained in accordance with the manufacturers' specifications.

(2) You must calculate and report the uptime of abatement systems using Equation I–15 of this subpart.

(3) To report emissions using the default destruction or removal efficiency of 60 percent, you must certify and document that the abatement systems at your facility are specifically designed for fluorinated GHG and N_2O abatement.

(4) If you do not use the default destruction or removal efficiency value to calculate and report controlled emissions, you must use either a properly measured destruction or removal efficiency, or a class average of properly measured destruction or removal efficiencies, determined in accordance with procedures in paragraphs (f)(4)(i) through (f)(4)(v) of this section.

(i) A properly measured destruction or removal efficiency value must be determined in accordance with EPA 430–R–10–003 (incorporated by reference, see § 98.7).

(ii) You must annually select and properly measure the destruction or removal efficiency for a random sample of abatement systems to include in a random sampling abatement system testing program (RSASTP) in accordance with procedures in paragraphs (f)(4)(ii)(A) and (f)(4)(ii)(B) of this section.

(A) Each reporting year for each abatement system class a random sample of three or 20 percent of installed abatement systems, whichever is greater, must be tested. If 20 percent of the total number of abatement systems in each class does not equate to a whole number, the number of systems to be tested must be determined by rounding up to the nearest integer.

(B) You must select the random sample each reporting year for the RSASTP without repetition of previously-measured systems in the sample, until all systems in each class are properly measured in a 5-year period.

(iii) If you have measured the destruction or removal efficiency of a particular abatement system during the previous 2-year period, you must calculate emissions from that system using the most recently measured destruction or removal efficiency for that particular system.

(iv) If the destruction or removal efficiency of an individual abatement system has not been properly measured during the previous 2-year period, you may use a simple average of the properly measured destruction or removal efficiencies for systems of that class, in accordance with the RSASTP. Your facility must maintain or exceed the RSASTP schedule if you wish to apply class average destruction or removal efficiency factors to abatement systems that have not yet been properly measured.

(v) If your facility uses redundant abatement systems, you may account for the total abatement system uptime calculated for a specific exhaust stream during the reporting year.

(g) You must adhere to the QA/QC procedures of this paragraph when calculating fluorinated GHG and N_2O emissions from electronics manufacturing production processes:

(1) Follow the QA/QC procedures in the International SEMATECH #06124825A–ENG (incorporated by reference, see § 98.7) when measuring and calculating facility-specific, recipe-specific fluorinated GHG and N_2O utilization and by-product formation rates.

(2) Where you use facility-specific, recipe-specific fluorinated GHG and N_2O utilization and by-product formation rates measured prior to January 1, 2007, verify that the QA/QC procedures in the International SEMATECH #01104197A–XFR (incorporated by reference, see § 98.7) were followed during measurement and calculation of the factors.

(3) Follow the QA/QC procedures in accordance with those in EPA 430–R–10–003 (incorporated by reference, see § 98.7) when calculating abatement systems destruction or removal efficiencies.

(4) Demonstrate that as part of normal facility operations the inventory of gas stored in containers at the beginning of the reporting year is the same as the inventory of gas stored in containers at the end of the previous reporting year.

(h) You must adhere to the QA/QC procedures of this paragraph (h) when calculating annual gas consumption for each fluorinated GHG and N_2O used at your facility and fluorinated GHG emissions from heat transfer fluid use.

(1) Review all inputs to Equations I–11 and I–16 of this subpart to ensure that all inputs and outputs are accounted for.

(2) Do not enter negative inputs into the mass balance Equations I–11 and I–16 of this subpart and ensure that no negative emissions are calculated.

(3) Ensure that the inventory at the beginning of one reporting year is identical to the inventory reported at the end of the previous reporting year.

(4) Ensure that the total quantity of gas i in containers in service at the end of a reporting year is accounted for as if the in-service containers were full for Equation I–11 of this subpart. Ensure also that the same quantity is accounted for in the inventory of input gas i stored in containers at the beginning of the subsequent reporting year.

(i) All flowmeters, weigh scales, pressure gauges, and thermometers used to measure quantities that are monitored under this section or used in calculations under § 98.93 must have an accuracy and precision of one percent of full scale or better.

§ 98.95 Procedures for estimating missing data.

(a) Except as provided in paragraph (b) of this section, a complete record of all measured parameters used in the fluorinated GHG and N_2O emissions calculations in § 98.93 and § 98.94 is required.

(b) If you use heat transfer fluids at your facility and are missing data for one or more of the parameters in Equation I–16 of this subpart, you must estimate heat transfer fluid emissions using the arithmetic average of the emission rates for the reporting year immediately preceding the period of missing data and the months immediately following the period of missing data. Alternatively, you may estimate missing information using records from the heat transfer fluid supplier. You must document the method used and values used for all missing data values.

§ 98.96 Data reporting requirements.

In addition to the information required by § 98.3(c), you must include in each annual report the following information for each electronics manufacturing facility:

(a) Annual manufacturing capacity of your facility as determined in Equation I–5 of this subpart.

(b) For facilities that manufacture semiconductors, the diameter of wafers manufactured at your facility (mm).

(c) Annual emissions of:

(1) Each fluorinated GHG emitted from each process type for which your facility is required to calculate emissions as calculated in Equations I–6 and I–7 of this subpart.

(2) Each fluorinated GHG emitted from each individual recipe (including those in a set of similar recipes), or process sub-type as calculated in Equations I–8 and I–9 of this subpart, as applicable.

(3) N_2O emitted from each chemical vapor deposition process and from other N_2O-using manufacturing processes as calculated in Equation I–10 of this subpart.

(4) Each heat transfer fluid emitted as calculated in Equation 1–16 of this subpart.

(d) The method of emissions calculation used in § 98.93.

(e) Annual production in terms of substrate surface area (e.g., silicon, PV-cell, glass).

(f) When you use factors for fluorinated GHG process utilization and by-product formation rates other than the defaults provided in Tables I–3, I–4, I–5, I–6, and I–7 to this subpart and/or N_2O utilization factors other than the defaults provided in Table I–8 to this subpart, you must report the following, as applicable:

(1) The recipe-specific utilization and by-product formation rates for each individual recipe (or set of similar recipes) and/or facility-specific N_2O utilization factors.

(2) For recipe-specific utilization and by-product formation rates, the film or substrate that was etched/cleaned and the feature type that was etched, as applicable.

(3) Certification that the recipes included in a set of similar recipes are similar, as defined in § 98.98.

(4) Certification that the measurements for all reported recipe-specific utilization and by-product formation rates and/or facility-specific N_2O utilization factors were made using the International SEMATECH #06124825A–ENG (incorporated by reference, see § 98.7), or the International SEMATECH #01104197A–XFR (incorporated by reference, see § 98.7) if measurements were made prior to January 1, 2007.

(5) Source of the recipe-specific utilization and by-product formation rates and/or facility-specific-N_2O utilization factors.

(6) Certification that the conditions under which the measurements were made for facility-specific N_2O utilization factors are representative of your facility's N_2O emitting production processes.

(g) Annual gas consumption for each fluorinated GHG and N_2O as calculated in Equation I–11 of this subpart, including where your facility used less than 50 kg of a particular fluorinated GHG or N_2O during the reporting year. For all fluorinated GHGs and N_2O used at your facility for which you have not calculated emissions using Equations I–6, I–7, I–8, I–9, and I–10 of this subpart, the chemical name of the GHG used, the annual consumption of the gas, and a brief description of its use.

(h) All inputs used to calculate gas consumption in Equation I–11 of this subpart, for each fluorinated GHG and N_2O used.

(i) Disbursements for each fluorinated GHG and N_2O during the reporting year, as calculated using Equation I–12 of this subpart.

(j) All inputs used to calculate disbursements for each fluorinated GHG and N_2O used in Equation I–12 of this subpart, including all facility-wide gas-specific heel factors used for each fluorinated GHG and N_2O. If your facility used less than 50 kg of a particular fluorinated GHG during the reporting year, facility-wide gas-specific heel factors do not need to be reported for those gases.

(k) Annual amount of each fluorinated GHG consumed for each recipe, process sub-type, or process type, as appropriate, and the annual amount of

N_2O consumed for each chemical vapor deposition and other electronics manufacturing production processes, as calculated using Equation I–13 of this subpart.

(l) All apportioning factors used to apportion fluorinated GHG and N_2O consumption.

(m) For the facility-specific apportioning model used to apportion fluorinated GHG and N_2O consumption under § 98.94(c), the following information to determine it is verified in accordance with procedures in § 98.94(c)(1) and (2):

(i) Identification of the quantifiable metric used in your facility-specific engineering model to apportion gas consumption.

(ii) The start and end dates selected under § 98.94(c)(2)(i).

(iii) Certification that the gases you selected under § 98.94(c)(2)(ii) correspond to the largest quantities consumed on a mass basis, at your facility in the reporting year for the plasma etching process type and the chamber cleaning process type.

(iv) The result of the calculation comparing the actual and modeled gas consumption under § 98.94(c)(2)(iii).

(n) Fraction of each fluorinated GHG or N_2O fed into a recipe, process sub-type, or process type that is fed into tools connected to abatement systems.

(o) Fraction of each fluorinated GHG or N_2O destroyed or removed in abatement systems connected to process tools where recipe, process sub-type, or process type j is used, as well as all inputs and calculations used to determine the inputs for Equation I–14 of this subpart.

(p) Inventory and description of all abatement systems through which fluorinated GHGs or N_2O flow at your facility, including the number of devices of each manufacturer, model numbers, manufacturer claimed fluorinated GHG and N_2O destruction or removal efficiencies, if any, and records of destruction or removal efficiency measurements over their in-use lives. The inventory of abatement systems must describe the tools with model numbers and the recipe(s), process sub-type, or process type for which these systems treat exhaust.

(q) For each abatement system through which fluorinated GHGs or N_2O flow at your facility, for which you are reporting controlled emissions, the following:

(1) Certification that each abatement system has been installed, maintained, and operated in accordance with manufacturers' specifications.

(2) All inputs and results of calculations made accounting for the uptime of abatement systems used during the reporting year, in accordance with Equations I–14 and I–15 of this subpart.

(3) The default destruction or removal efficiency value or properly measured destruction or removal efficiencies for each abatement system used in the reporting year.

(4) Where the default destruction or removal efficiency value is used to report controlled emissions, certification that the abatement systems for which emissions are being reported were specifically designed for fluorinated GHG and N_2O abatement. You must support this certification by providing abatement system supplier documentation stating that the system was designed for fluorinated GHG and N_2O abatement.

(5) Where properly measured destruction or removal efficiencies or class averages of destruction or removal efficiencies are used, the following must also be reported:

(i) A description of the class, including the abatement system manufacturer and model number and the fluorinated GHG(s) and N_2O in the effluent stream.

(ii) The total number of systems in that class for the reporting year.

(iii) The total number of systems for which destruction or removal efficiency was properly measured in that class for the reporting year.

(iv) A description of the calculation used to determine the class average, including all inputs to the calculation.

(v) A description of the method used for randomly selecting class members for testing.

(r) For heat transfer fluid emissions, inputs to the heat transfer fluid mass balance equation, Equation I–16 of this subpart, for each fluorinated GHG used.

(s) Where missing data procedures were used to estimate inputs into the heat transfer fluid mass balance equation under § 98.95(b), the number of times missing data procedures were followed in the reporting year, the method used to estimate the missing data, and the estimates of those data.

(t) A brief description of each "best available monitoring method" used according to § 98.94(a), the parameter measured or estimated using the method, and the time period during which the "best available monitoring method" was used.

§ 98.97 Records that must be retained.

In addition to the information required by § 98.3(g), you must retain the following records:

(a) All data used and copies of calculations made as part of estimating gas consumption and emissions, including all spreadsheets.

(b) Documentation for the values used for fluorinated GHG and N_2O utilization and by-product formation rates. If you use facility-specific and recipe-specific utilization and by-product formation rates, the following records must also be retained, as applicable:

(1) Complete documentation and final report for measurements for recipe-specific utilization and by-product formation rates demonstrating that the values were measured using International SEMATECH #06124825A–ENG (incorporated by reference, see § 98.7) or, if the measurements were made prior to January 1, 2007, International SEMATECH #01104197A–XFR (incorporated by reference, see § 98.7).

(2) Documentation that recipe-specific utilization and by-product formation rates developed for your facility are measured for recipes that are similar to those used at your facility, as defined in § 98.98. The documentation must include, at a minimum, recorded to the appropriate number of significant figures, reactor pressure, flow rates, chemical composition, applied RF power, direct current (DC) bias, temperature, flow stabilization time, and duration.

(3) Documentation that your facility's N_2O measurements are representative of the N_2O emitting processes at your facility.

(4) The date and results of the initial and any subsequent tests to determine utilization and by-product formation rates.

(c) Documentation for the facility-specific engineering model used to apportion fluorinated GHG and N_2O consumption. This documentation must be part of your site GHG Monitoring Plan as required under § 98.3(g)(5). At a minimum, you must retain the following:

(1) A clear, detailed description of the facility-specific model, including how it was developed; the quantifiable metric used in the model; all sources of information, equations, and formulas, each with clear definitions of terms and variables; and a clear record of any changes made to the model while it was used to apportion fluorinated GHG and N_2O consumption across individual recipes (including those in a set of similar recipes), process sub-types, and/or process types.

(2) Sample calculations used for developing a recipe-specific, process sub-type-specific, or process type-specific gas apportioning factors (f_{ij}) for the two fluorinated GHGs used at your

facility in the largest quantities, on a mass basis, during the reporting year.

(d) For each abatement system through which fluorinated GHGs or N_2O flow at your facility, for which you are reporting controlled emissions, the following:

(1) Documentation to certify the abatement system is installed, maintained, and operated in accordance with manufacturers' specifications.

(2) Abatement system calibration and maintenance records.

(3) Where the default destruction or removal efficiency value is used, documentation from the abatement system supplier describing the equipment's designed purpose and emission control capabilities for fluorinated GHG and N_2O.

(4) Where properly measured DRE is used to report emissions, dated certification by the technician who made the measurement that the destruction or removal efficiency is calculated in accordance with methods in EPA 430–R–10–003 (incorporated by reference, see § 98.7), complete documentation of the results of any initial and subsequent tests, and the final report as specified in EPA 430–R–10–003 (incorporated by reference, see § 98.7).

(e) Purchase records for gas purchased.

(f) Invoices for gas purchases and sales.

(g) Documents and records used to monitor and calculate abatement system uptime.

(h) GHG Monitoring Plans, as described in § 98.3(g)(5), must be completed by April 1, 2011. You must update your GHG Monitoring Plan to comply with § 98.94(c) consistent with the requirements in § 98.3(g)(5)(iii).

§ 98.98 Definitions.

Except as provided in this section, all of the terms used in this subpart have the same meaning given in the Clean Air Act and subpart A of this part. If a conflict exists between a definition provided in this subpart and a definition provided in subpart A, the definition in this subpart takes precedence for the reporting requirements in this subpart.

Abatement system means a device or equipment that destroys or removes fluorinated GHGs and N_2O in waste streams from one or more electronics manufacturing production processes.

Actual gas consumption means the quantity of gas used during wafer/substrate processing over some period based on a measured change in gas container weight or gas container pressure or on a measured volume of gas.

By-product formation means the creation of fluorinated GHGs during electronics manufacturing production processes or the creation of fluorinated GHGs by an abatement system. By-product formation is the ratio of the mass of the by-product formed to the mass flow of the input gas, where, for multi-fluorinated-GHG recipes, the denominator corresponds to the fluorinated GHG with the largest mass flow.

Chamber cleaning is a process type that consists of the process sub-types defined in paragraphs (1) through (3) of this definition.

(1) In situ plasma process sub-type consists of the cleaning of thin-film production chambers, after processing substrates, with a fluorinated GHG cleaning reagent that is dissociated into its cleaning constituents by a plasma generated inside the chamber where the film is produced.

(2) Remote plasma process sub-type consists of the cleaning of thin-film production chambers, after processing substrates, with a fluorinated GHG cleaning reagent dissociated by a remotely located plasma source.

(3) In situ thermal process sub-type consists of the cleaning of thin-film production chambers, after processing substrates, with a fluorinated GHG cleaning reagent that is thermally dissociated into its cleaning constituents inside the chamber where thin films are produced.

Class means a category of abatement systems grouped by manufacturer model number(s) and by the gas that the system abates, including N_2O and carbon tetrafluoride (CF_4) direct emissions and by-product formation, and all other fluorinated GHG direct emissions and by-product formation. Classes may also include any other abatement systems for which the reporting facility wishes to report controlled emissions provided that class is identified.

Controlled emissions means the quantity of emissions that are released to the atmosphere after application of an emission control device (*e.g.,* abatement system).

Destruction or removal efficiency (DRE) means the efficiency of an abatement system to destroy or remove fluorinated GHGs, N_2O, or both. The destruction or removal efficiency is equal to one minus the ratio of the mass of all relevant GHGs exiting the abatement system to the mass of GHG entering the abatement system. When GHGs are formed in an abatement system, destruction or removal efficiency is expressed as one minus the ratio of amounts of exiting GHGs to the amounts entering the system in units of CO_2-equivalents (CO_2e).

Gas utilization means the fraction of input N_2O or fluorinated GHG converted to other substances during the etching, deposition, and/or wafer and chamber cleaning processes. Gas utilization is expressed as a rate or factor for specific electronics manufacturing recipes, process sub-types, or process types.

Heat transfer fluids are fluorinated GHGs used for temperature control, device testing, and soldering in certain types of electronic manufacturing production processes. Heat transfer fluids used in the electronics sector include perfluoropolyethers, perfluoroalkanes, perfluoroethers, tertiary perfluoroamines, and perfluorocyclic ethers. Electronics manufacturers may also use these same fluorinated chemicals to clean substrate surfaces and other parts.

Heel means the amount of gas that remains in a gas container after it is discharged or off-loaded; heel may vary by container type.

Individual recipe means a specific combination of gases, under specific conditions of reactor temperature, pressure, flow, radio frequency (RF) power and duration, used repeatedly to fabricate a specific feature on a specific film or substrate.

Maximum designed substrate starts means the maximum quantity of substrates, expressed as surface area, that could be started each month during a reporting year if the facility were fully equipped as defined in the facility design specifications and if the equipment were fully utilized. It denotes 100 percent of annual manufacturing capacity of a facility.

Modeled gas consumed means the quantity of gas used during wafer/substrate processing over some period based on a verified facility-specific engineering model used to apportion gas consumption.

Nameplate capacity means the full and proper charge of chemical specified by the equipment manufacturer to achieve the equipment's specified performance. The nameplate capacity is typically indicated on the equipment's nameplate; it is not necessarily the actual charge, which may be influenced by leakage and other emissions.

Operational mode means the time in which an abatement system is being operated within the range of parameters as specified in the operations manual provided by the system manufacturer.

Plasma etching is a process type that consists of any production process using fluorinated GHG reagents to selectively

remove materials from a substrate during electronics manufacturing. The materials removed may include SiO_2, SiO_x-based or fully organic-based thin-film material, SiN, SiON, Si_3N_4, SiC, SiCO, SiCN, etc. (represented by the general chemical formula, $Si_wO_xN_yX_z$ where w, x, y and z are zero or integers and X may be some other element such as carbon), substrate, or metal films (such as aluminum or tungsten).

Process sub-type is a set of similar manufacturing steps, more closely related within a broad process type. For example, the chamber cleaning process type includes in-situ plasma chamber cleaning, remote plasma chamber cleaning, and in-situ thermal chamber cleaning sub-types.

Process types are broad groups of manufacturing steps used at a facility associated with substrate (*e.g.,* wafer) processing during device manufacture for which fluorinated GHG emissions and fluorinated GHG usages are calculated and reported. The process types are Plasma etching, Chamber cleaning, and Wafer cleaning.

Properly measured destruction or removal efficiency means destruction or removal efficiencies measured in accordance with EPA 430–R–10–003 (incorporated by reference, see § 98.7).

The Random Sampling Abatement System Testing Program (RSASTP) means the required frequency for measuring the destruction or removal efficiencies of abatement systems in order to apply properly measured destruction or removal efficiencies to report controlled emissions.

Redundant abatement systems means a system that is specifically designed, installed and operated for the purpose of destroying fluorinated GHGs and N_2O gases. A redundant abatement system is used as a backup to the main fluorinated GHGs and N_2O abatement system during those times when the main system is not functioning or operating in accordance with design and operating specifications.

Repeatable means that the variables used in the formulas for the facility's engineering model for gas apportioning factors are based on observable and measurable quantities that govern gas consumption rather than engineering judgment about those quantities or gas consumption.

Similar, with respect to recipes, means those recipes that are composed of the same set of chemicals and have the same flow stabilization times and where the documented differences, considered separately, in reactor pressure, individual gas flow rates, and applied radio frequency (RF) power are less than or equal to plus or minus 10 percent. For purposes of comparing and documenting recipes that are similar, facilities may use either the best known method provided by an equipment manufacturer or the process of record, for which emission factors for either have been measured.

Trigger point for change out means the residual weight or pressure of a gas container type that a facility uses to change out that gas container.

Uptime means the ratio of the total time during which the abatement system is in an operational mode with fluorinated GHGs or N_2O flowing through production process tool(s) connected to that abatement system, to the total time during which fluorinated GHGs or N_2O are flowing through production process tool(s) connected to that abatement system.

Wafer cleaning is a process type that consists of any production process using fluorinated GHG reagents to clean wafers at any step during production.

Wafer passes is a count of the number of times a wafer substrate is processed in a specific process recipe, sub-type, or type. The total number of wafer passes over a reporting year is the number of wafer passes per tool multiplied by the number of operational process tools in use during the reporting year.

Wafer starts means the number of fresh wafers that are introduced into the fabrication sequence each month. It includes test wafers, which means wafers that are exposed to all of the conditions of process characterization, including but not limited to actual etch conditions or actual film deposition conditions.

TABLE I–1 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS FOR THRESHOLD APPLICABILITY DETERMINATION

Product type	Emission factors EF_i					
	CF_4	C_2F_6	CHF_3	C_3F_8	NF_3	SF_6
Semiconductors (kg/m²)	0.90	1.00	0.04	0.05	0.04	0.20
LCD (g/m²)	0.50	NA	NA	NA	0.90	4.00
MEMS (kg/m²)	NA	NA	NA	NA	NA	1.02

Notes: NA denotes not applicable based on currently available information.

TABLE I–2 TO SUBPART I OF PART 98—EXAMPLES OF FLUORINATED GHGS USED BY THE ELECTRONICS INDUSTRY

Product type	Fluorinated GHGs used during manufacture
Electronics	CF_4, C_2F_6, C_3F_8, c-C_4F_8, c-C_4F_8O, C_4F_6, C_5F_8, CHF_3, CH_2F_2, NF_3, SF_6, and HTFs (CF_3-(O–CF(CF_3)-CF_2)$_n$-(O–CF_2)$_m$-O–CF_3, C_nF_{2n+2}, C_nF_{2n+1}(O)C_mF_{2m+1}, $C_nF_{2n}O$, $(C_nF_{2n+1})_{3N}$).

TABLE I–3 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS ($1–U_{ij}$) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR SEMICONDUCTOR MANUFACTURING FOR 150MM AND 200 MM WAFER SIZES

Process type/Sub-type	Process gas i										
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3	SF_6	C_4F_6	C_5F_8	C_4F_8O
Plasma Etching											
$1–U_i$	0.69	0.56	0.38	0.093	NA	0.25	0.038	0.20	0.14	NA	NA
BCF_4	NA	0.23	0.026	0.021	NA	0.19	0.0040	NA	0.13	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	0.084	NA	NA	0.12	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE I–3 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS ($1–U_{ij}$) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR SEMICONDUCTOR MANUFACTURING FOR 150MM AND 200 MM WAFER SIZES—Continued

Process type/Sub-type	Process gas i										
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3	SF_6	C_4F_6	C_5F_8	C_4F_8O
Chamber Cleaning											
In situ plasma cleaning:											
$1–U_i$	0.92	0.55	NA	NA	0.40	0.10	0.18	NA	NA	NA	0.14
BCF_4	NA	0.19	NA	NA	0.20	0.11	0.011	NA	NA	NA	0.13
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.030
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remote plasma cleaning:											
$1–U_i$	NA	NA	NA	NA	NA	NA	0.018	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.0047	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
In situ thermal cleaning:											
$1–U_i$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wafer Cleaning											
$1–U_i$	0.77	NA	NA	0.24	NA	NA	0.23	0.20	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes: NA denotes not applicable based on currently available information.

TABLE I–4 TO SUBPART I OF PART 98–DEFAULT EMISSION FACTORS ($1–U_{ij}$) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR SEMICONDUCTOR MANUFACTURING FOR 300 MM WAFER SIZE

Process type/sub-type	Process gas i										
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3	SF_6	C_4F_6	C_5F_8	C_4F_8O
Plasma Etching											
$1–U_i$	0.80	0.80	0.48	0.14	NA	0.29	0.32	0.37	0.09	NA	NA
BCF_4	NA	NA	0.0018	0.0011	NA	0.079	NA	NA	0.27	NA	NA
BC_2F_6	NA	NA	0.0011	NA	NA	0.12	NA	NA	0.29	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chamber Cleaning											
In situ plasma cleaning:											
$1–U_i$	NA	NA	NA	NA	NA	NA	0.23	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.0046	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remote Plasma Cleaning:											
$1–U_i$	NA	NA	NA	NA	0.063	NA	0.018	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.040	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
In Situ Thermal Cleaning:											
$1–U_i$	NA	NA	NA	NA	NA	NA	0.28	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.010	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wafer Cleaning											
$1–U_i$	0.77	NA	NA	0.24	NA	NA	0.23	0.20	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes: NA denotes not applicable based on currently available information.

TABLE I–5 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS ($1–U_{ij}$) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR MEMS MANUFACTURING

Process type factors	Process gas i											
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3 Remote	NF_3	SF_6	C_4F_{6a}	C_5F_{8a}	$C_4F_8O_a$
Etch $1–U_i$	0.7	[1] 0.4	[1] 0.4	[1] 0.06	NA	[1] 0.2	NA	0.2	0.2	0.1	0.2	NA
Etch BCF_4	NA	[1] 0.4	[1] 0.07	[1] 0.08	NA	0.2	NA	NA	NA	[1] 0.3	0.2	NA
Etch BC_2F_6	NA	NA	NA	NA	NA	0.2	NA	NA	NA	[1] 0.2	0.2	NA
CVD $1–U_i$	0.9	0.6	NA	NA	0.4	0.1	0.02	0.2	NA	NA	0.1	0.1
CVD BCF_4	NA	0.1	NA	NA	0.1	0.1	[2] 0.02	[2] 0.1	NA	NA	0.1	0.1
CVD BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4

Notes: NA denotes not applicable based on currently available information.
[1] Estimate includes multi-gas etch processes.
[2] Estimate reflects presence of low-k, carbide and multi-gas etch processes that may contain a C-containing fluorinated GHG additive.

TABLE I–6 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS ($1–U_{ij}$) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR LCD MANUFACTURING

Process type factors	Process Gas i								
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3 Remote	NF_3	SF_6
Etch $1–U_i$	0.6	NA	0.2	NA	NA	0.1	NA	NA	0.3
Etch BCF_4	NA	NA	0.07	NA	NA	0.009	NA	NA	NA
Etch $BCHF_3$	NA	NA	NA	NA	NA	0.02	NA	NA	NA
Etch BC_2F_6	NA	NA	0.05	NA	NA	NA	NA	NA	NA
CVD $1–U_i$	NA	NA	NA	NA	NA	NA	0.03	0.3	0.9

Notes: NA denotes not applicable based on currently available information.

TABLE I–7 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS ($1–U_{ij}$) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR PV MANUFACTURING

Process type factors	Process Gas i								
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3 Remote	NF_3	SF_6
Etch $1–U_i$	0.7	0.4	0.4	NA	NA	0.2	NA	NA	0.4
Etch BCF_4	NA	0.2	NA	NA	NA	0.1	NA	NA	NA
Etch BC_2F_6	NA	NA	NA	NA	NA	0.1	NA	NA	NA
CVD $1–U_i$	NA	0.6	NA	NA	0.1	0.1	NA	0.3	0.4
CVD BCF_4	NA	0.2	NA	NA	0.2	0.1	NA	NA	NA

Notes: NA denotes not applicable based on currently available information.

TABLE I–8 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS ($1–U_{N2O\ j}$) FOR N_2O UTILIZATION ($U_{N2O\ j}$)

Process type factors	N_2O
CVD $1–U_i$	0.8
Other Manufacturing Process $1–U_i$	1.0

■ 9. Add subpart L to read as follows:

Subpart L—Fluorinated Gas Production

Sec.

98.120 Definition of the source category.
98.121 Reporting threshold.
98.122 GHGs to report.
98.123 Calculating GHG emissions.
98.124 Monitoring and QA/QC requirements.
98.125 Procedures for estimating missing data.
98.126 Data reporting requirements.
98.127 Records that must be retained.
98.128 Definitions.

Subpart L—Fluorinated Gas Production

§ 98.120 Definition of the source category.

(a) The fluorinated gas production source category consists of processes that produce a fluorinated gas from any raw material or feedstock chemical, except for processes that generate HFC–23 during the production of HCFC–22.

(b) To produce a fluorinated gas means to manufacture a fluorinated gas from any raw material or feedstock chemical. Producing a fluorinated gas includes producing a fluorinated GHG as defined at § 98.410(b). Producing a fluorinated gas also includes the manufacture of a chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) from any raw material or feedstock chemical, including manufacture of a CFC or HCFC as an isolated intermediate for use in a process that will result in the transformation of the CFC or HCFC either at or outside of the production facility. Producing a fluorinated gas does not include the reuse or recycling of a fluorinated gas, the creation of HFC–23 during the production of HCFC–22, the creation of intermediates that are created and transformed in a single process with no storage of the intermediates, or the creation of fluorinated GHGs that are released or destroyed at the production facility

before the production measurement in § 98.414(a).

§ 98.121 Reporting threshold.

You must report GHG emissions under this subpart if your facility contains a fluorinated gas production process that generates or emits fluorinated GHG and the facility meets the requirements of either § 98.2(a)(1) or (a)(2). To calculate GHG emissions for comparison to the 25,000 metric ton CO_2e per year emission threshold in § 98.2(a)(2), calculate process emissions from fluorinated gas production using uncontrolled GHG emissions.

§ 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 frequency 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 variability 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 function of process variability and frequency of measurement.

(iii) Equation L–1 of this section provides the general formula for calculating 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):

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

Where:

e_{SA} = Absolute error of the sum, 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.

(iv) Equation L–2 of this section provides the general formula for calculating the relative errors of sums and differences:

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

Where:

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

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

a+b+c = Sum of the variables measured.

(v) Equation L–3 of this section provides the general formula for calculating 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 variables measured, a, b, c, etc. (e.g., P = a*b*c):

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

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.

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

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.

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

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 concentration 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-containing compound that is not a fluorinated GHG and that is 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 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 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).

(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 fluorine-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 (metric 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 concentrations in the process unless you possess emission characterization measurements showing otherwise. These emission characterization measurements must meet the requirements in paragraph (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-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 byproducts) 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.

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

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 estimate 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 (m^3/min).

SV = Standard molar volume of gas (0.0240 m^3/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.

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

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).

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

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.

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

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 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 product/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-boiling-point and one high-boiling-point stream, sample and analyze both of these streams. Alternatively, you may sample and analyze streams where fluorinated GHG by-products occur at less than their maximum concentrations, but you must ensure that the sensitivity of the analysis is sufficient to compensate for the expected difference in concentration. For example, if you sample and analyze streams where fluorinated GHG by-products are expected to occur at one half their maximum concentrations elsewhere in the process, you must ensure that the sensitivity of the analysis is sufficient to detect fluorinated GHG by-products that occur at concentrations of 0.05 percent or higher. You do not have to sample and analyze every stream or process vent, i.e., you do not have to sample and analyze a stream or process vent that contains only fluorinated GHGs that are contained in other streams or process vents that are being sampled and analyzed. Sampling and analysis must be conducted according to the procedures in paragraph (e) of this section.

(2) *Previous measurements.* If you have conducted testing of streams (including process streams or destroyed streams) or process vents less than 10 years before December 31, 2010, and the testing meets the requirements in paragraph (a)(1) of this section, you may use the previous testing to satisfy this requirement.

(b) *Mass balance monitoring.* If you determine fluorinated GHG emissions from any process using the mass balance method under § 98.123(b), you must estimate the total mass of each fluorinated GHG emitted from that process at least monthly. Only streams that contain greater than trace concentrations of fluorine-containing reactants, products, or by-products must be monitored under this paragraph. If you use an element other than fluorine in the mass-balance equation pursuant to § 98.123(b)(3), substitute that element for fluorine in the monitoring requirements of this paragraph.

(1) *Mass measurements.* Measure the following masses on a monthly or more frequent basis using flowmeters, weigh scales, or a combination of volumetric and density measurements with accuracies and precisions that allow the facility to meet the error criteria in § 98.123(b)(1):

(i) Total mass of each fluorine-containing product produced. Account for any used fluorine-containing product added into the production process upstream of the output measurement as directed at § 98.413(b) and § 98.414(b). For each product, the mass produced used for the mass-balance calculation must be the same as

the mass produced that is reported under subpart OO of this part, where applicable.

(ii) Total mass of each fluorine-containing reactant fed into the process.

(iii) The mass removed from the process in each stream fed into the destruction device.

(iv) The mass removed from the process in each recaptured stream.

(2) *Concentration measurements for use with § 98.123(b)(4).* If you use § 98.123(b)(4) to estimate the mass of fluorine in destroyed or recaptured streams, measure the following concentrations at least once each calendar month during which the process is operating, on a schedule to ensure that the measurements are representative of the full range of process conditions (e.g., catalyst age). Measure more frequently if this is necessary to meet the error criteria in § 98.123(b)(1). Use equipment and methods (e.g., gas chromatography) that comply with paragraph (e) of this section and that have an accuracy and precision that allow the facility to meet the error criteria in § 98.123(b)(1). Only fluorine-containing reactants, products, and by-products that occur in a stream in greater than trace concentrations must be monitored under this paragraph.

(i) The concentration (mass fraction) of the fluorine-containing product in each stream that is fed into the destruction device.

(ii) The concentration (mass fraction) of each fluorine-containing by-product in each stream that is fed into the destruction device.

(iii) The concentration (mass fraction) of each fluorine-containing reactant in each stream that is fed into the destruction device.

(iv) The concentration (mass fraction) of each fluorine-containing by-product in each stream that is recaptured (c_{Bkl}).

(3) *Concentration measurements for use with § 98.123(b)(15).* If you use § 98.123(b)(15) to estimate the mass of fluorine in destroyed or recaptured streams, measure the concentrations listed in paragraphs (3)(i) and (ii) of this section at least once each calendar month during which the process is operating, on a schedule to ensure that the measurements are representative of the full range of process conditions (e.g., catalyst age). Measure more frequently if this is necessary to meet the error criteria in § 98.123(b)(1). Use equipment and methods (e.g., gas chromatography) that comply with paragraph (e) of this section and that have an accuracy and precision that allow the facility to meet the error criteria in § 98.123(b)(1). Only fluorine-containing reactants, products, and by-products that occur in a stream in greater than trace concentrations must be monitored under this paragraph.

(i) The concentration (mass fraction) of total fluorine in each stream that is fed into the destruction device.

(ii) The concentration (mass fraction) of total fluorine in each stream that is recaptured.

(4) *Emissions characterization: process vents emitting 25,000 metric tons CO_2e or more.* To characterize emissions from any process vent emitting 25,000 metric tons CO_2e or more, comply with paragraphs (b)(4)(i) through (b)(4)(v) of this section, as appropriate. Only fluorine-containing reactants, products, and by-products that occur in a stream in greater than trace concentrations must be monitored under this paragraph.

(i) *Uncontrolled emissions.* If emissions from the process vent are not routed through a destruction device, sample and analyze emissions at the process vent or stack or sample and analyze emitted streams before the process vent. If the process has more than one operating scenario, you must either perform the emission characterization for each operating scenario or perform the emission characterization for the operating scenario that is expected to have the largest emissions and adjust the emission characterization for other scenarios using engineering calculations and assessments as specified in § 98.123(c)(4). To perform the characterization, take three samples under conditions that are representative for the operating scenario. Measure the concentration of each fluorine-containing compound in each sample. Use equipment and methods that comply with paragraph (e) of this section. Calculate the average concentration of each fluorine-containing compound across all three samples.

(ii) *Controlled emissions using § 98.123(b)(15).* If you use § 98.123(b)(15) to estimate the total mass of fluorine in destroyed or recaptured streams, and if the emissions from the process vent are routed through a destruction device, characterize emissions as specified in paragraph (b)(4)(i) of this section before the destruction device. Apply the destruction efficiency demonstrated for each fluorinated GHG in the destroyed stream to that fluorinated GHG. Exclude from the characterization fluorine-containing compounds that are not fluorinated GHGs.

(iii) *Controlled emissions using § 98.123(b)(4).* If you use § 98.123(b)(4) to estimate the mass of fluorine in destroyed or recaptured streams, and if the emissions from the process vent are routed through a destruction device, characterize the process vent's emissions monthly (or more frequently) using the monthly (or more frequent) measurements under paragraphs (b)(1)(iii) and (b)(2)(i) through (b)(2)(iii) of this section. Apply the destruction efficiency demonstrated for each fluorinated GHG in the destroyed stream to that fluorinated GHG. Exclude from the characterization fluorine-containing compounds that are not fluorinated GHGs.

(iv) *Emissions characterization frequency.* You must repeat emission characterizations performed under paragraph (b)(4)(i) and (b)(4)(ii) of this section under paragraph (b)(4)(iv)(A) or (b)(4)(iv)(B) of this section, whichever occurs first:

(A) *10-year revision.* Repeat the emission characterization every 10 years. In the calculations under § 98.123, apply the revised emission characterization to the process activity that occurs after the revision.

(B) *Operating scenario change that affects the emission characterization.* For planned operating scenario changes, you must estimate and compare the emission calculation factors for the changed operating scenario and for the original operating scenario whose process vent specific emission factor was measured. Use the engineering calculations and assessments specified in § 98.123(c)(4). If the share of total fluorine-containing compound emissions represented by any fluorinated GHG changes under the changed operating scenario by 15 percent or more of the total, relative to the previous operating scenario (this includes the cumulative change in the emission calculation factor since the last emissions test), you must repeat the emission characterization. Perform the emission characterization before February 28 of the year that immediately follows the change. In the calculations under § 98.123, apply the revised emission characterization to the process activity that occurs after the operating scenario change.

(v) *Subsequent measurements.* If a process vent with fluorinated GHG emissions less than 25,000 metric tons CO_2e, per § 98.123(c)(2), is later found to have fluorinated GHG emissions of 25,000 metric tons CO_2e or greater, you must perform an emission characterization under this paragraph during the following year.

(5) *Emissions characterization: process vents emitting less than 25,000 metric tons CO_2e.* To characterize

emissions from any process vent emitting less than 25,000 metric tons CO_2e, comply with paragraphs (b)(5)(i) through (b)(5)(iii) of this section, as appropriate. Only fluorine-containing reactants, products, and by-products that occur in a stream in greater than trace concentrations must be monitored under this paragraph.

(i) *Uncontrolled emissions.* If emissions from the process vent are not routed through a destruction device, emission measurements must consist of sampling and analysis of emissions at the process vent or stack, sampling and analysis of emitted streams before the process vent, previous test results, provided the tests are representative of current operating conditions of the process, or bench-scale or pilot-scale test data representative of the process operating conditions.

(ii) *Controlled emissions using § 98.123(b)(15).* If you use § 98.123(b)(15) to estimate the total mass of fluorine in destroyed or recaptured streams, and if the emissions from the process vent are routed through a destruction device, characterize emissions as specified in paragraph (b)(5)(i) of this section before the destruction device. Apply the destruction efficiency demonstrated for each fluorinated GHG in the destroyed stream to that fluorinated GHG. Exclude from the characterization fluorine-containing compounds that are not fluorinated GHGs.

(iii) *Controlled emissions using § 98.123(b)(4).* If you use § 98.123(b)(4) to estimate the mass of fluorine in destroyed or recaptured streams, and if the emissions from the process vent are routed through a destruction device, characterize the process vent's emissions monthly (or more frequently) using the monthly (or more frequent) measurements under paragraphs (b)(1)(iii) and (b)(2)(i) through (b)(2)(iii) of this section. Apply the destruction efficiency demonstrated for each fluorinated GHG in the destroyed stream to that fluorinated GHG. Exclude from the characterization fluorine-containing compounds that are not fluorinated GHGs.

(6) *Emissions characterization: emissions not accounted for by process vent estimates.* Calculate the weighted average emission characterization across the process vents before any destruction devices. Apply the weighted average emission characterization for all the process vents to any fluorine emissions that are not accounted for by process vent estimates.

(7) *Impurities in reactants.* If any fluorine-containing impurity is fed into a process along with a reactant (or other input) in greater than trace concentrations, this impurity shall be monitored under this section and included in the calculations under § 98.123 in the same manner as reactants fed into the process, fed into the destruction device, recaptured, or emitted, except the concentration of the impurity in the mass fed into the process shall be measured, and the mass of the impurity fed into the process shall be calculated as the product of the concentration of the impurity and the mass fed into the process. The mass of the reactant fed into the process may be reduced to account for the mass of the impurity.

(8) *Alternative to error calculation.* As an alternative to calculating the relative and absolute errors associated with the estimate of emissions under § 98.123(b), you may comply with the precision, accuracy, measurement and calculation frequency, and fluorinated GHG throughput requirements of paragraph (b)(8)(i) through (b)(8)(iv) of this section.

(i) *Mass measurements.* Measure the masses specified in paragraph (b)(1) of this section using flowmeters, weigh scales, or a combination of volumetric and density measurements with accuracies and precisions of ±0.2 percent of full scale or better.

(ii) *Concentration measurements.* Measure the concentrations specified in paragraph (b)(2) or paragraph (b)(3) of this section, as applicable, using analytical methods with accuracies and precisions of ±10 percent or better.

(iii) *Measurement and calculation frequency.* Perform the mass measurements specified in paragraph (b)(1) of this section and the concentration measurements specified in paragraph (b)(2) or paragraph (b)(3) of this section, as applicable, at least weekly, and calculate emissions at least weekly.

(iv) *Fluorinated-GHG throughput limit.* You may use the alternative to the error calculation specified in paragraph (b)(8) of this section only if the total annual CO_2-equivalent fluorinated GHG throughput of the process is 500,000 $mtCO_2e$ or less. The total throughput is the sum of the masses of the fluorinated GHG reactants, products, and by-products fed into and generated by the process. To convert these masses 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.

(c) *Emission factor testing.* If you determine fluorinated GHG emissions using the site-specific process-vent-specific emission factor, you must meet the requirements in paragraphs (c)(1) through (c)(8) of this section.

(1) *Process vent testing.* Conduct an emissions test that is based on representative performance of the process or operating scenario(s) of the process, as applicable. Include in the emission test any fluorinated greenhouse gas that occurs in more than trace concentrations in the vent stream or, where a destruction device is used, in the inlet to the destruction device. You may include startup and shutdown events if the testing is sufficiently long or comprehensive to ensure that such events are not overrepresented in the emission factor. Malfunction events must not be included in the testing. If you conduct your emission testing after a destruction device, and if the outlet concentration of a fluorinated GHG that is fed into the device is below the detection limit of the method, you may use a concentration of one-half the detection limit to estimate the emission factor.

(2) *Number of runs.* For continuous processes, sample the process vent for a minimum of 3 runs of 1 hour each. If the RSD of the emission factor calculated based on the first 3 runs is greater than or equal to 0.15 for the emission factor, continue to sample the process vent for an additional 3 runs of 1 hour each. If more than one fluorinated GHG is measured, the RSD must be expressed in terms of total CO_2 equivalents. 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 in the RSD calculation.

(3) *Process activity measurements.* Determine the mass rate of process feed, process production, or other process activity as applicable during the test using flow meters, weigh scales, or other measurement devices or instruments with an accuracy and precision of ±1 percent of full scale or better. These devices may be the same plant instruments or procedures that are used for accounting purposes (such as weigh hoppers, belt weigh feeders, combination of volume measurements and bulk density, etc.) if these devices or procedures meet the requirement. For monitoring ongoing process activity, use flow meters, weigh scales, or other measurement devices or instruments with an accuracy and precision of ±1 percent of full scale or better.

(4) *Sample each process.* If process vents from separate processes are manifolded together to a common vent or to a common destruction device, you must follow paragraph (c)(4)(i), (c)(4)(ii), or (c)(4)(iii) of this section.

(i) You may sample emissions from each process in the ducts before the emissions are combined.

(ii) You may sample in the common duct or at the outlet of the destruction device when only one process is operating.

(iii) You may sample the combined emissions and use engineering calculations and assessments as specified in § 98.123(c)(4) to allocate the emissions to each manifolded process vent, provided the sum of the calculated fluorinated GHG emissions across the individual process vents is within 20 percent of the total fluorinated GHG emissions measured during the manifolded testing.

(5) *Emission test results.* The results of an emission test must include the analysis of samples, number of test runs, the results of the RSD analysis, the analytical method used, determination of emissions, the process activity, and raw data and must identify the process, the operating scenario, the process vents tested, and the fluorinated GHGs that were included in the test (i.e., the fluorinated GHGs that occur in more than trace concentrations in the vent stream or, where a destruction device is used, in the inlet to the destruction device, and any other fluorinated GHGs included in the test). The emissions test report must contain all information and data used to derive the process-vent-specific emission factor, as well as key process conditions during the test. Key process conditions include those that are normally monitored for process control purposes and may include but are not limited to yields, pressures, temperatures, etc. (e.g., of reactor vessels, distillation columns).

(7) *Emissions testing frequency.* You must conduct emissions testing to develop the process-vent-specific emission factor under paragraph (c)(7)(i) or (c)(7)(ii) of this section, whichever occurs first:

(i) *10-year revision.* Conduct an emissions test every 10 years. In the calculations under § 98.123, apply the revised process-vent-specific emission factor to the process activity that occurs after the revision.

(ii) *Operating scenario change that affects the emission factor.* For planned operating scenario changes, you must estimate and compare the emission calculation factors for the changed operating scenario and for the original operating scenario whose process vent specific emission factor was measured. Use the calculation methods in § 98.123(c)(4). If the emission calculation factor for the changed operating scenario is 15 percent or more different from the emission calculation factor for the previous operating scenario (this includes the cumulative change in the emission calculation factor since the last emissions test), you must conduct an emissions test to update the process-vent-specific emission factor, unless the difference between the operating scenarios is solely due to the application of a destruction device to emissions under the changed operating scenario. Conduct the test before February 28 of the year that immediately follows the change. In the calculations under § 98.123, apply the revised process-vent-specific emission factor to the process activity that occurs after the operating scenario change.

(8) *Subsequent measurements.* If a continuous process vent with fluorinated GHG emissions less than 10,000 metric tons CO_2e, per § 98.123(c)(2), is later found to have fluorinated GHG emissions of 10,000 metric tons CO_2e or greater, you must conduct the emissions testing for the process vent during the following year and develop the process-vent-specific emission factor from the emissions testing.

(9) *Previous measurements.* If you have conducted an emissions test less than 10 years before December 31, 2010, and the emissions testing meets the requirements in paragraphs (c)(1) through (c)(8) of this section, you may use the previous emissions testing to develop process-vent-specific emission factors. For purposes of paragraph (c)(7)(i) of this section, the date of the previous emissions test rather than December 31, 2010 shall constitute the beginning of the 10-year re-measurement cycle.

(d) *Emission calculation factor monitoring.* If you determine fluorinated GHG emissions using the site-specific process-vent-specific emission calculation factor, you must meet the requirements in paragraphs (d)(1) through (d)(4) of this section.

(1) *Operating scenario.* Perform the emissions calculation for the process vent based on representative performance of the operating scenario of the process. If more than one operating scenario applies to the process that contains the subject process vent, you must conduct a separate emissions calculation for operation under each operating scenario. For each continuous process vent that contains more than trace concentrations of any fluorinated GHG and for each batch process vent that contains more than trace concentrations of any fluorinated GHG, develop the process-vent-specific emission calculation factor for each operating scenario. For continuous process vents, determine the emissions based on the process activity for the representative performance of the operating scenario. For batch process vents, determine emissions based on the process activity for each typical batch operating scenario.

(2) *Process activity measurements.* Use flow meters, weigh scales, or other measurement devices or instruments with an accuracy and precision of ±1 percent of full scale or better for monitoring ongoing process activity.

(3) *Emission calculation results.* The emission calculation must be documented by identifying the process, the operating scenario, and the process vents. The documentation must contain the information and data used to calculate the process-vent-specific emission calculation factor.

(4) *Operating scenario change that affects the emission calculation factor.* For planned operating scenario changes that are expected to change the process-vent-specific emission calculation factor, you must conduct an emissions calculation to update the process-vent-specific emission calculation factor. In the calculations under § 98.123, apply the revised emission calculation factor to the process activity that occurs after the operating scenario change.

(5) *Previous calculations.* If you have performed an emissions calculation for the process vent and operating scenario less than 10 years before December 31, 2010, and the emissions calculation meets the requirements in paragraphs (d)(1) through (d)(4) of this section and in § 98.123(c)(4)(i) and (c)(4)(ii), you may use the previous calculation to develop the site-specific process-vent-specific emission calculation factor.

(e) *Emission and stream testing, including analytical methods.* Select and document testing and analytical methods as follows:

(1) *Sampling and mass measurement for emission testing.* For emission testing in process vents or at the stack, use methods for sampling, measuring volumetric flow rates, non-fluorinated-GHG gas analysis, and measuring stack gas moisture that have been validated using a scientifically sound validation protocol.

(i) Sample and velocity traverses. Acceptable methods include but are not limited to EPA Method 1 or 1A in Appendix A–1 of 40 CFR part 60.

(ii) Velocity and volumetric flow rates. Acceptable methods include but are not limited to EPA Method 2, 2A, 2B, 2C, 2D, 2F, or 2G in Appendix A–1 of 40 CFR part 60. Alternatives that may be used for determining flow rates include OTM–24 (incorporated by reference, see § 98.7) and ALT–012 (incorporated by reference, see § 98.7).

(iii) Non-fluorinated-GHG gas analysis. Acceptable methods include

but are not limited to EPA Method 3, 3A, or 3B in Appendix A–1 of 40 CFR part 60.

(iv) Stack gas moisture. Acceptable methods include but are not limited to EPA Method 4 in Appendix A–1 of 40 CFR part 60.

(2) *Analytical methods.* Use a quality-assured analytical measurement technology capable of detecting the analyte of interest at the concentration of interest and use a sampling and analytical procedure validated with the analyte of interest at the concentration of interest. Where calibration standards for the analyte are not available, a chemically similar surrogate may be used. Acceptable analytical measurement technologies include but are not limited to gas chromatography (GC) with an appropriate detector, infrared (IR), fourier transform infrared (FTIR), and nuclear magnetic resonance (NMR). Acceptable methods for determining fluorinated GHGs include EPA Method 18 in appendix A–1 of 40 CFR part 60, EPA Method 320 in appendix A of 40 CFR part 63, EPA 430–R–10–003 (incorporated by reference, see § 98.7), ASTM D6348–03 (incorporated by reference, see § 98.7), or other analytical methods validated using EPA Method 301 at 40 CFR part 63, appendix A or some other scientifically sound validation protocol. Acceptable methods for determining total fluorine concentrations for fluorine-containing compounds in streams under paragraph (b)(3) of this section include ASTM D7359–08 (incorporated by reference, see § 98.7), or other analytical methods validated using EPA Method 301 at 40 CFR part 63, appendix A or some other scientifically sound validation protocol. The validation protocol may include analytical technology manufacturer specifications or recommendations.

(3) *Documentation in GHG Monitoring Plan.* Describe the sampling, measurement, and analytical method(s) used under paragraphs (e)(1) and (e)(2) of this section in the GHG Monitoring Plan as required under § 98.3(g)(5). Identify the methods used to obtain the samples and measurements listed under paragraphs (e)(1)(i) through (e)(1)(iv) of this section. At a minimum, include in the description of the analytical method a description of the analytical measurement equipment and procedures, quantitative estimates of the method's accuracy and precision for the analytes of interest at the concentrations of interest, as well as a description of how these accuracies and precisions were estimated, including the validation protocol used.

(f) *Emission monitoring for pieces of equipment.* If you conduct a site-specific leak detection method or monitoring approach for pieces of equipment, follow paragraph (f)(1) or (f)(2) of this section and follow paragraph (f)(3) of this section.

(1) *Site-specific leak monitoring approach.* You may develop a site-specific leak monitoring approach. You must validate the leak monitoring method and describe the method and the validation in the GHG Monitoring Plan. To validate the site-specific method, you may, for example, release a known rate of the fluorinated GHGs or surrogates of interest, or you may compare the results of the site-specific method to those of a method that has been validated for the fluorinated GHGs or surrogates of interest. In the description of the leak detection method and its validation, include a detailed description of the method, including the procedures and equipment used and any sampling strategies. Also include the rationale behind the method, including why the method is expected to result in an unbiased estimate of emissions from equipment leaks. If the method is based on methods that are used to detect or quantify leaks or other emissions in other regulations, standards, or guidelines, identify and describe the regulations, standards, or guidelines and why their methods are applicable to emissions of fluorinated GHGs or surrogates from leaks. Account for possible sources of error in the method, e.g., instrument detection limits, measurement biases, and sampling biases. Describe validation efforts, including but not limited to any comparisons against standard leaks or concentrations, any comparisons against other methods, and their results. If you use the Screening Ranges Approach, the EPA Correlation Approach, or the Unit-Specific Correlation Approach with a monitoring instrument that does not meet all of the specifications in EPA Method 21 at 40 CFR part 60, appendix A–7, then explain how and why the monitoring instrument, as used at your facility, would nevertheless be expected to accurately detect and quantify emissions of fluorinated GHGs or surrogates from process equipment, and describe how you verified its accuracy. For all methods, provide a quantitative estimate of the accuracy and precision of the method.

(2) *EPA Method 21 monitoring.* If you determine that EPA Method 21 at 40 CFR part 60, appendix A–7 is appropriate for monitoring a fluorinated GHG, conduct the screening value concentration measurements using EPA Method 21 at 40 CFR part 60, appendix A–7 to determine the screening range data or the actual screening value data for the Screening Ranges Approach, EPA Correlation Approach, or the Unit-Specific Correlation Approach. For the one-time testing to develop the Unit-Specific Correlation equations in EPA–453/R–95–017 (incorporated by reference, see § 98.7), conduct the screening value concentration measurements using EPA Method 21 at 40 CFR part 60, appendix A–7 and the bagging procedures to measure mass emissions. Concentration measurements of bagged samples must be conducted using gas chromatography following EPA Method 18 analytical procedures or other method according to § 98.124(e). Use methane or other appropriate compound as the calibration gas.

(3) *Frequency of measurement and sampling.* If you estimate emissions based on monitoring of equipment, conduct monitoring at least annually. Sample at least one-third of equipment annually (except for equipment that is unsafe-to-monitor, difficult-to-monitor, insulated, or 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 an upstream rupture disk, sampling connection systems with closed-loop or closed purge systems, and pieces of equipment whose leaks are routed through a closed vent system to a destruction device), changing the sample each year such that at the end of three years, all equipment in the process has been monitored. If you estimate emissions based on a sample of the equipment in the process, ensure that the sample is representative of the equipment in the process. If you have multiple processes that have similar types of equipment in similar service, and that produce or transform similar fluorinated GHGs (in terms of chemical composition, molecular weight, and vapor pressure) at similar pressures and concentrations, then you may annually sample all of the equipment in one third of these processes rather than one third of the equipment in each process.

(g) *Destruction device performance testing.* If you vent or otherwise feed fluorinated GHGs into a destruction device and apply the destruction efficiency of the device to one or more fluorinated GHGs in § 98.123, you must conduct emissions testing to determine the destruction efficiency for each fluorinated GHG to which you apply the destruction efficiency. You must either determine the destruction efficiency for the most-difficult-to-destroy fluorinated GHG fed into the device (or a surrogate

that is still more difficult to destroy) and apply that destruction efficiency to all the fluorinated GHGs fed into the device or alternatively determine different destruction efficiencies for different groups of fluorinated GHGs using the most-difficult-to-destroy fluorinated GHG of each group (or a surrogate that is still more difficult to destroy).

(1) *Destruction efficiency testing.* You must sample the inlet and outlet of the destruction device for a minimum of three runs of 1 hour each to determine the destruction efficiency. You must conduct the emissions testing using the methods in paragraph (e) of this section. To determine the destruction efficiency, emission testing must be conducted when operating at high loads reasonably expected to occur (i.e., representative of high total fluorinated GHG load that will be sent to the device) and when destroying the most-difficult-to-destroy fluorinated GHG (or a surrogate that is still more difficult to destroy) that is fed into the device from the processes subject to this subpart or that belongs to the group of fluorinated GHGs for which you wish to establish a DE. If the outlet concentration of a fluorinated GHG that is fed into the device is below the detection limit of the method, you may use a concentration of one-half the detection limit to estimate the destruction efficiency.

(i) If perfluoromethane (CF_4) is vented to the destruction device in any stream in more than trace concentrations, you must test and determine the destruction efficiency achieved specifically for CF_4 to take credit for the CF_4 emissions reduction.

(ii) If sulfur hexafluoride (SF_6) is vented to the destruction device in any stream in more than trace concentrations, you must test and determine the destruction efficiency achieved specifically for SF_6, or alternatively for CF_4 as a surrogate, to take credit for the SF_6 emissions reduction.

(iii) If saturated perfluorocarbons other than CF_4 are vented to the destruction device in any stream in more than trace concentrations, you must test and determine the destruction efficiency achieved for the lowest molecular weight saturated perfluorocarbon vented to the destruction device, or alternatively for a lower molecular weight saturated PFC or SF_6 as a surrogate, to take credit for the PFC emission reduction.

(iv) For all other fluorinated GHGs that are vented to the destruction device in any stream in more than trace concentrations, you must test and determine the destruction efficiency achieved for the most-difficult-to-destroy fluorinated GHG or surrogate vented to the destruction device. Examples of acceptable surrogates include the Class 1 compounds (ranked 1 through 34) in Appendix D, Table D–1 of "Guidance on Setting Permit Conditions and Reporting Trial Burn Results; Volume II of the Hazardous Waste Incineration Guidance Series," January 1989, EPA Publication EPA 625/6–89/019. You can obtain a copy of this publication by contacting the Environmental Protection Agency, 1200 Pennsylvania Avenue, NW., Washington, DC 20460, (202) 272–0167, *http://www.epa.gov.*

(2) *Destruction efficiency testing frequency.* You must conduct emissions testing to determine the destruction efficiency as provided in paragraphs (g)(2)(i) or (ii) of this section, whichever occurs first:

(i) Conduct an emissions test every 10 years. In the calculations under § 98.123, apply the updated destruction efficiency to the destruction that occurs after the test.

(ii) *Destruction device changes that affect the destruction efficiency.* If you make a change to the destruction device that would be expected to affect the destruction efficiency, you must conduct an emissions test to update the destruction efficiency. Conduct the test before the February 28 of the year that immediately follows the change. In the calculations under § 98.123, apply the updated destruction efficiency to the destruction that occurs after the change to the device.

(3) *Previous testing* .If you have conducted an emissions test within the 10 years prior to December 31, 2010, and the emissions testing meets the requirements in paragraph (g)(1) of this section, you may use the destruction efficiency determined during this previous emissions testing. For purposes of paragraph (g)(2)(i) of this section, the date of the previous emissions test rather than December 31, 2010 shall constitute the beginning of the 10-year re-measurement cycle.

(4) *Hazardous Waste Combustor testing.* If a destruction device used to destroy fluorinated GHG is subject to subpart EEE of part 63 of this chapter or any portion of parts 260–270 of this chapter, you may apply the destruction efficiency specifically determined for CF_4, SF_6, PFCs other than CF_4, and all other fluorinated GHGs under that test if the testing meets the criteria in paragraph (g)(1)(i) through (g)(1)(iv) of this section. If the testing of the destruction efficiency under subpart EEE of part 63 of this chapter was conducted more than 10 years ago, you may use the most recent destruction efficiency test provided that the design, operation, or maintenance of the destruction device has not changed since the last destruction efficiency test in a manner that could affect the ability to achieve the destruction efficiency, and the hazardous waste is fed into the normal flame zone.

(h) *Mass of previously produced fluorinated GHGs fed into destruction device.* You must measure the mass of each fluorinated GHG that is fed into the destruction device in more than trace concentrations and that was previously produced as defined at § 98.410(b). Such fluorinated GHGs include but are not limited to quantities that are shipped to the facility by another facility for destruction and quantities that are returned to the facility for reclamation but are found to be irretrievably contaminated and are therefore destroyed. You must use flowmeters, weigh scales, or a combination of volumetric and density measurements with an accuracy and precision of ±1 percent of full scale or better. If the measured mass includes more than trace concentrations of materials other than the fluorinated GHG being destroyed, you must measure the concentration of the fluorinated GHG being destroyed. You must multiply this concentration (mass fraction) by the mass measurement to obtain the mass of the fluorinated GHG fed into the destruction device.

(i) *Emissions due to malfunctions of destruction device.* In their estimates of the mass of fluorinated GHG destroyed, fluorinated gas production facilities that destroy fluorinated GHGs must account for any temporary reductions in the destruction efficiency that result from any malfunctions of the destruction device, including periods of operation outside of the operating conditions defined in operating permit requirements and/or destruction device manufacturer specifications.

(j) *Emissions due to process startup, shutdown, or malfunctions.* Fluorinated GHG production facilities must account for fluorinated GHG emissions that occur as a result of startups, shutdowns, and malfunctions, either recording fluorinated GHG emissions during these events, or documenting that these events do not result in significant fluorinated GHG emissions. Facilities may use the calculation methods in § 98.123(c)(1) to estimate emissions during startups, shutdowns, and malfunctions.

(k) *Monitoring for venting residual fluorinated GHG in containers.* Measure the residual fluorinated GHG in containers received by the facility either using scales or using pressure and

temperature measurements. You may use pressure and temperature measurements only in cases where no liquid fluorinated GHG is present in the container. Scales must have an accuracy and precision of ±1 percent or better of the filled weight (gas plus tare) of the containers of fluorinated GHGs that are typically weighed on the scale. For example, for scales that are generally used to weigh cylinders that contain 115 pounds of gas when full and that have a tare weight of 115 pounds, this equates to ±1 percent of 230 pounds, or ±2.3 pounds. Pressure gauges and thermometers used to measure quantities that are monitored under this paragraph must have an accuracy and precision of ±1 percent of full scale or better.

(l) Initial scoping speciations, emissions testing, emission factor development, emission calculation factor development, emission characterization development, and destruction efficiency determinations must be completed by February 29, 2012 for processes and operating scenarios that operate between December 31, 2010 and December 31, 2011. For other processes and operating scenarios, initial scoping speciations, emissions testing, emission factor development, emission calculation factor development, emission characterization development, and destruction efficiency determinations must be complete by February 28 of the year following the year in which the process or operating scenario commences or recommences.

(m) Calibrate all flow meters, weigh scales, and combinations of volumetric and density measures using monitoring instruments traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST) or other recognized national measurement institute. Recalibrate all flow meters, weigh scales, and combinations of volumetric and density measures at the minimum frequency specified by the manufacturer. Use any of the following applicable flow meter test methods or the calibration procedures specified by the flow meter, weigh-scale, or other volumetric or density measure manufacturer.

(1) ASME MFC–3M–2004 Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi (incorporated by reference, see § 98.7).

(2) ASME MFC–4M–1986 (Reaffirmed 1997) Measurement of Gas Flow by Turbine Meters (incorporated by reference, see § 98.7).

(3) ASME–MFC–5M–1985, (Reaffirmed 1994) Measurement of Liquid Flow in Closed Conduits Using Transit-Time Ultrasonic Flowmeters (incorporated by reference, see § 98.7).

(4) ASME MFC–6M–1998 Measurement of Fluid Flow in Pipes Using Vortex Flowmeters (incorporated by reference, see § 98.7).

(5) ASME MFC–7M–1987 (Reaffirmed 1992) Measurement of Gas Flow by Means of Critical Flow Venturi Nozzles (incorporated by reference, see § 98.7).

(6) ASME MFC–9M–1988 (Reaffirmed 2001) Measurement of Liquid Flow in Closed Conduits by Weighing Method (incorporated by reference, see § 98.7).

(7) ASME MFC–11M–2006 Measurement of Fluid Flow by Means of Coriolis Mass Flowmeters (incorporated by reference, see § 98.7).

(8) ASME MFC–14M–2003 Measurement of Fluid Flow Using Small Bore Precision Orifice Meters (incorporated by reference, see § 98.7).

(n) All analytical equipment used to determine the concentration of fluorinated GHGs, including but not limited to gas chromatographs and associated detectors, infrared (IR), fourier transform infrared (FTIR), and nuclear magnetic resonance (NMR) devices, must be calibrated at a frequency needed to support the type of analysis specified in the GHG Monitoring Plan as required under § 98.124(e)(3) and 93.3(g)(5). Quality assurance samples at the concentrations of concern must be used for the calibration. Such quality assurance samples must consist of or be prepared from certified standards of the analytes of concern where available; if not available, calibration must be performed by a method specified in the GHG Monitoring Plan.

(o) Special provisions for estimating 2011 and subsequent year emissions.

(1) *Best available monitoring methods.* To estimate emissions that occur from January 1, 2011 through June 30, 2011, owners or operators may use best available monitoring methods for any parameter that cannot reasonably be measured according to the monitoring and QA/QC requirements of this subpart. The owner or operator must use the calculation methodologies and equations in § 98.123, but may use the best available monitoring method for any parameter for which it is not reasonably feasible to acquire, install, or operate a required piece of monitoring equipment, to procure measurement services from necessary providers, or to gain physical access to make required measurements in a facility by January 1, 2011. Starting no later than July 1, 2011, the owner or operator must discontinue using best available methods and begin following all applicable monitoring and QA/QC requirements of this part, except as provided in paragraphs (o)(2) through (o)(4) of this section. Best available monitoring methods means any of the following methods specified in this paragraph:

(i) Monitoring methods currently used by the facility that do not meet the specifications of this subpart.

(ii) Supplier data.

(iii) Engineering calculations or assessments.

(iv) Other company records.

(2) *Requests for extension of the use of best available monitoring methods to estimate 2011 emissions: parameters other than scoping speciations, emission factors, and emission characterizations.* The owner or operator may submit a request to the Administrator to use one or more best available monitoring methods for parameters other than scoping speciations, emission factors, or emission characterizations to estimate emissions that occur between July 1, 2011 and December 31, 2011.

(i) *Timing of request.* The extension request must be submitted to EPA no later than February 28, 2011.

(ii) *Content of request.* Requests must contain the following information:

(A) A list of specific items of monitoring equipment and measurement services for which the request is being made and the locations (e.g., processes and vents) where each piece of monitoring equipment will be installed and where each measurement service will be provided.

(B) Identification of the specific rule requirements for which the monitoring equipment or measurement service is needed.

(C) A description of the reasons why the needed equipment could not be obtained, installed, or operated or why the needed measurement service could not be provided before July 1, 2011. The owner or operator must consider all of the data collection and emission calculation options outlined in the rule for a specific emissions source before claiming that a specific safety, technical, logistical, or legal barrier exists.

(D) If the reason for the extension is that the equipment cannot be purchased, delivered, or installed before July 1, 2011, include supporting documentation such as the date the monitoring equipment was ordered, investigation of alternative suppliers, the dates by which alternative vendors promised delivery or installation, backorder notices or unexpected delays, descriptions of actions taken to expedite delivery or installation, and the current expected date of delivery or installation.

(E) If the reason for the extension is that service providers were unable to provide necessary measurement

services, include supporting documentation demonstrating that these services could not be acquired before July 1, 2011. This documentation must include written correspondence to and from at least two service providers stating that they will not be able to provide the necessary services before July 1, 2011.

(F) If the reason for the extension is that the process is operating continuously without process shutdown, include supporting documentation showing that it is not practicable to isolate the process equipment or unit and install the measurement device without a full shutdown or a hot tap, and that there is no opportunity before July 1, 2011 to install the device. Include the date of the three most recent shutdowns for each relevant process equipment or unit, the frequency of shutdowns for each relevant process equipment or unit, and the date of the next planned process equipment or unit shutdown.

(G) If the reason for the extension is that access to process streams, emissions streams, or destroyed streams, as applicable, could not be gained before July 1, 2011 for reasons other than the continuous operation of the process without shutdown, include illustrative documentation such as photographs and engineering diagrams demonstrating that access could not be gained.

(H) A description of the best available monitoring methods that will be used and how their results will be applied (i.e., which calculation method will be used) to develop the emission estimate. Where the proposed best available monitoring method is the use of current monitoring data in the mass-balance approach, include the estimated relative and absolute errors of the mass-balance approach using the current monitoring data.

(I) A description of the specific actions the owner or operator will take to comply with monitoring requirements by January 1, 2012.

(3) *Requests for extension of the use of best available monitoring methods to estimate 2011 emissions: scoping speciations, emission factors, and emission characterizations.* The owner or operator may submit a request to the Administrator to use one or more best available monitoring methods for scoping speciations, emission factors, and emission characterizations to estimate emissions that occur between July 1, 2011 and December 31, 2011.

(i) *Timing of request.* The extension request must be submitted to EPA no later than June 30, 2011.

(ii) *Content of request.* Requests must contain the information outlined in paragraph (o)(2)(ii) of this section, substituting March 1, 2012 for July 1, 2011 and substituting March 1, 2013 for January 1, 2012.

(iii) *Reporting of 2011 emissions using scoping speciations, emission factors, and emission characterizations developed after February 29, 2012.* Facilities that are approved to use best available monitoring methods in 2011 for scoping speciations, emission factors, or emission characterizations for certain processes must submit, by March 31, 2013, revised 2011 emission estimates that reflect the scoping speciations, emission factors, and emission characterizations that are measured for those processes after February 29, 2012. If the operating scenario for 2011 is different from all of the operating scenarios for which emission factors are developed after February 29, 2012, use Equation L–23 at § 98.123(c)(3)(viii) to adjust the emission factor(s) or emission characterizations measured for the post-February 29, 2012 operating scenario(s) to account for the differences.

(4) *Requests for extension of the use of best available monitoring methods to estimate emissions that occur after 2011.* EPA does not anticipate approving the use of best available monitoring methods to estimate emissions that occur beyond December 31, 2011; however, EPA reserves the right to review requests for unique and extreme circumstances which include safety, technical infeasibility, or inconsistency with other local, State or Federal regulations.

(i) *Timing of request.* The extension request must be submitted to EPA no later than June 30, 2011.

(ii) *Content of request.* Requests must contain the following information:

(A) The information outlined in paragraph (o)(2)(ii) of this section. For scoping speciations, emission factors, and emission characterizations, substitute March 1, 2013 for July 1, 2011 and substitute March 1, 2014 for January 1, 2012. For other parameters, substitute January 1, 2012 for July 1, 2011 and substitute January 1, 2013 for January 1, 2012.

(B) A detailed outline of the unique circumstances necessitating an extension, including specific data collection issues that do not meet safety regulations, technical infeasibility or specific laws or regulations that conflict with data collection. The owner or operator must consider all the data collection and emission calculation options outlined in the rule for a specific emissions source before claiming that a specific safety, technical or legal barrier exists.

(C) A detailed explanation and supporting documentation of how and when the owner or operator will receive the required data and/or services to comply with the reporting requirements of this subpart in the future.

(E) The Administrator reserves the right to require that the owner or operator provide additional documentation.

(iii) *Reporting of 2011 and subsequent year emissions using scoping speciations, emission factors, and emission characterizations developed after approval to use best available monitoring methods expires.* Facilities that are approved to use best available monitoring methods in 2011 and subsequent years for scoping speciations, emission factors, or emission characterizations for certain processes must submit, by March 31 of the year that begins one year after their approval to use best available monitoring method(s) expires, revised emission estimates for 2011 and subsequent years that reflect the scoping speciations, emission factors, and emission characterizations that are measured for those processes in 2013 or subsequent years. If the operating scenario for 2011 or subsequent years is different from all of the operating scenarios for which emission factors or emission characterizations are developed in 2013 or subsequent years, use Equation L–23 of § 98.123(c)(3)(viii) to adjust the emission factor(s) or emission characterization(s) measured for the new operating scenario(s) to account for the differences.

(5) *Approval criteria.* To obtain approval, the owner or operator must demonstrate to the Administrator's satisfaction that it is not reasonably feasible to acquire, install, or operate the required piece of monitoring equipment, to procure measurement services from necessary providers, or to gain physical access to make required measurements in a facility according to the requirements of this subpart by the dates specified in paragraphs (o)(2), (3), and (4) of this section for any of the reasons described in paragraph (o)(2)(ii) of this section, or, for requests under paragraph (o)(4) of this section, any of the reasons described in paragraph (o)(4)(ii)(B) of this section.

§ 98.125 Procedures for estimating missing data.

(a) A complete record of all measured parameters used in the GHG emissions calculations in § 98.123 is required. Therefore, whenever a quality-assured value of a required parameter is

unavailable, a substitute data value for the missing parameter must be used in the calculations as specified in the paragraphs (b) and (c) of this section. You must document and keep records of the procedures used for all such estimates.

(b) For each missing value of the fluorinated GHG concentration or fluorine-containing compound concentration, the substitute data value must be the arithmetic average of the quality-assured values of that parameter immediately preceding and immediately following the missing data incident.

(c) For each missing value of the mass produced, fed into the production process, fed into the transformation process, or fed into destruction devices, the substitute value of that parameter must be a secondary mass measurement where such a measurement is available. For example, if the mass produced is usually measured with a flowmeter at the inlet to the day tank and that flowmeter fails to meet an accuracy or precision test, malfunctions, or is rendered inoperable, then the mass produced may be estimated by calculating the change in volume in the day tank and multiplying it by the density of the product. Where a secondary mass measurement is not available, the substitute value of the parameter must be an estimate based on a related parameter. For example, if a flowmeter measuring the mass fed into a destruction device is rendered inoperable, then the mass fed into the destruction device may be estimated using the production rate and the previously observed relationship between the production rate and the mass flow rate into the destruction device.

§ 98.126 Data reporting requirements.

(a) *All facilities.* In addition to the information required by § 98.3(c), you must report the information in paragraphs (a)(2) through (a)(6) of this section.

(1) *Frequency of reporting under paragraph (a) of this section.* The information in paragraphs (a)(2), (5), and (6) of this section must be reported annually. The information in paragraphs (a)(3) and (4) of this section must be reported once by March 31, 2012 for each process and operating scenarios that operates between December 31, 2010 and December 31, 2011. For other processes and operating scenarios, the information in paragraphs (a)(3) and (4) of this section must be reported once by March 31 of the year following the year in which the process or operating scenario commences or recommences.

(2) You must report the total mass in metric tons of each fluorinated GHG emitted from:

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

(ii) 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.

(iii) 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.

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

(3) The chemical identities of the contents of the stream(s) (including process, emissions, and destroyed streams) analyzed under the initial scoping speciation of fluorinated GHG at § 98.124(a), by process.

(4) The location and function of the stream(s) (including process streams, emissions streams, and destroyed streams) that were analyzed under the initial scoping speciation of fluorinated GHG at § 98.124(a), by process.

(5) The method used to determine the mass emissions of each fluorinated GHG, i.e., mass balance, process-vent-specific emission factor, or process-vent-specific emission calculation factor, for each process and process vent at the facility. For processes for which the process-vent-specific emission factor or process-vent-specific emission calculation factor are used, report the method used to estimate emissions from equipment leaks.

(6) The chemical formula and total mass produced of the fluorinated gas product in metric tons, by chemical and process.

(b) *Reporting for mass balance approach.* For processes whose emissions are determined using the mass-balance approach under § 98.123(b), you must report the information listed in paragraphs (b)(1) through (b)(13) of this section for each process on an annual basis. Identify and separately report fluorinated GHG emissions from transformation processes where the fluorinated GHG reactants are produced at another facility. If you use an element other than fluorine in the mass-balance equation pursuant to § 98.123(b)(3), substitute that element for fluorine in the reporting requirements of this paragraph.

(1) If you calculate the relative and absolute errors under 98.123(b)(1), the absolute and relative errors calculated under paragraph § 98.123(b)(1), as well as the data (including quantities and their accuracies and precisions) used in these calculations.

(2) The balanced chemical equation that describes the reaction used to manufacture the fluorinated GHG product and each fluorinated GHG transformation product.

(3) The mass and chemical formula of each fluorinated GHG reactant emitted from the process in metric tons.

(4) The mass and chemical formula of the fluorinated GHG product emitted from the process in metric tons.

(5) The mass and chemical formula of each fluorinated GHG by-product emitted from the process in metric tons.

(6) The mass and chemical formula of each fluorine-containing reactant that is fed into the process (metric tons).

(7) The mass and chemical formula of each fluorine-containing product produced by the process (metric tons).

(8) If you use § 98.123(b)(4) to estimate the total mass of fluorine in destroyed or recaptured streams, report the following.

(i) The mass and chemical formula of each fluorine-containing product that is removed from the process and fed into the destruction device (metric tons).

(ii) The mass and chemical formula of each fluorine-containing by-product that is removed from the process and fed into the destruction device (metric tons).

(iii) The mass and chemical formula of each fluorine-containing reactant that is removed from the process and fed into the destruction device (metric tons).

(iv) The mass and chemical formula of each fluorine-containing by-product that is removed from the process and recaptured (metric tons).

(v) The demonstrated destruction efficiency of the destruction device for each fluorinated GHG fed into the device from the process in greater than trace concentrations (fraction).

(9) If you use § 98.123(b)(15) to estimate the total mass of fluorine in destroyed or recaptured streams, report the following.

(i) The mass of fluorine in each stream that is fed into the destruction device (metric tons).

(ii) The mass of fluorine that is recaptured (metric tons).

(iii) The weighted average destruction efficiency of the destruction device calculated for each stream under § 98.123(b)(16).

(10) The fraction of the mass emitted that consists of each fluorine-containing reactant.

(11) The fraction of the mass emitted that consists of the fluorine-containing product.

(12) The fraction of the mass emitted that consists of each fluorine-containing by-product.

(13) The method used to estimate the total mass of fluorine in destroyed or recaptured streams (specify § 98.123(b)(4) or (15)).

(c) *Reporting for emission factor and emission calculation factor approach.* For processes whose emissions are determined using the emission factor approach under § 98.123(c)(3) or the emission calculation factor under § 98.123(c)(4), you must report the following for each process. Fluorinated GHG emissions from transformation processes where the fluorinated GHG reactants are produced at another facility must be identified and reported separately from other fluorinated GHG emissions.

(1) The identity and quantity of the process activity used to estimate emissions (e.g., tons of product produced or tons of reactant consumed).

(2) The site-specific, process-vent-specific emission factor(s) or emission calculation factor for each process vent.

(3) The mass of each fluorinated GHG emitted from each process vent (metric tons).

(4) The mass of each fluorinated GHG emitted from equipment leaks (metric tons).

(d) *Reporting for missing data.* Where missing data have been estimated pursuant to § 98.125, you must report the reason the data were missing, the length of time the data were missing, the method used to estimate the missing data, and the estimates of those data.

(e) *Reporting of destruction device excess emissions data.* Each fluorinated gas production facility that destroys fluorinated GHGs must report the excess emissions that result from malfunctions of the destruction device, and these excess emissions would be reflected in the fluorinated GHG estimates in § 98.123(b) and (c). Such excess emissions would occur if the destruction efficiency was reduced due to the malfunction.

(f) *Reporting of destruction device testing.* By March 31, 2012 or by March 31 of the year immediately following the year in which it begins fluorinated GHG destruction, each fluorinated gas production facility that destroys fluorinated GHGs must submit a report containing the information in paragraphs (f)(1) through (f)(4) of this section. This report is one-time unless you make a change to the destruction device that would be expected to affect its destruction efficiencies.

(1) Destruction efficiency (DE) of each destruction device for each fluorinated GHG whose destruction the facility reflects in § 98.123, in accordance with § 98.124(g)(1)(i) through (iv).

(2) Chemical identity of the fluorinated GHG(s) used in the performance test conducted to determine destruction efficiency, including surrogates, and information on why the surrogate is sufficient to demonstrate the destruction efficiency for each fluorinated GHG, consistent with requirements in § 98.124(g)(1), vented to the destruction device.

(3) Date of the most recent destruction device test.

(4) Name of all applicable Federal or State regulations that may apply to the destruction process.

(5) If you make a change to the destruction device that would be expected to affect its destruction efficiencies, submit a revised report that reflects the changes, including the revised destruction efficiencies measured for the device under § 98.124(g)(2)(ii), by March 31 of the year that immediately follows the change.

(g) *Reporting for destruction of previously produced fluorinated GHGs.* Each fluorinated gas production facility that destroys fluorinated GHGs must report, separately from the fluorinated GHG emissions reported under paragraphs (b) or (c) of this section, the following for each previously produced fluorinated GHG destroyed:

(1) The mass of the fluorinated GHG fed into the destruction device.

(2) The mass of the fluorinated GHG emitted from the destruction device.

(h) *Reporting of emissions from venting of residual fluorinated GHGs from containers.* Each fluorinated gas production facility that vents residual fluorinated GHGs from containers must report the following for each fluorinated GHG vented:

(1) The mass of the residual fluorinated GHG vented from each container size and type annually (tons).

(2) If applicable, the heel factor calculated for each container size and type.

(i) *Reporting of fluorinated GHG products of incomplete combustion (PICs) of fluorinated gases.* Each fluorinated gas production facility that destroys fluorinated gases must submit a one-time report by June 30, 2011, that describes any measurements, research, or analysis that it has performed or obtained that relate to the formation of products of incomplete combustion that are fluorinated GHGs during the destruction of fluorinated gases. The report must include the methods and results of any measurement or modeling studies, including the products of incomplete combustion for which the exhaust stream was analyzed, as well as copies of relevant scientific papers, if available, or citations of the papers, if they are not. No new testing is required to fulfill this requirement.

§ 98.127 Records that must be retained.

In addition to the records required by § 98.3(g), you must retain the dated records specified in paragraphs (a) through (j) of this section, as applicable.

(a) *Process information records.*

(1) Identify all products and processes subject to this subpart. Include the unit identification as appropriate.

(2) Monthly and annual records, as applicable, of all analyses and calculations conducted as required under § 98.123, including the data monitored under § 98.124, and all information reported as required and § 98.126.

(b) *Scoping speciation.* Retain records documenting the information reported under § 98.126(a)(3) and (4).

(c) *Mass-balance method.* Retain the following records for each process for which the mass-balance method was used to estimate emissions. If you use an element other than fluorine in the mass-balance equation pursuant to § 98.123(b)(3), substitute that element for fluorine in the recordkeeping requirements of this paragraph.

(1) The data and calculations used to estimate the absolute and relative errors associated with use of the mass-balance approach.

(2) The data and calculations used to estimate the mass of fluorine emitted from the process.

(3) The data and calculations used to determine the fractions of the mass emitted consisting of each reactant (FER_d), product (FEP), and by-product (FEB_k), including the preliminary calculations in § 98.123(b)(8)(i).

(d) *Emission factor and emission calculation factor method.* Retain the following records for each process for which the emission factor or emission calculation factor method was used to estimate emissions.

(1) Identify all continuous process vents with emissions of fluorinated GHGs that are less than 10,000 metric tons CO_2e per year and all continuous process vents with emissions of 10,000 metric tons CO_2e per year or more. Include the data and calculation used to develop the preliminary estimate of emissions for each process vent.

(2) Identify all batch process vents.

(3) For each vent, identify the method used to develop the factor (i.e., emission factor by emissions test or emission calculation factor).

(4) The emissions test data and reports (see § 98.124(c)(5)) and the calculations used to determine the process-vent-specific emission factor, including the actual process-vent-specific emission factor, the average hourly emission rate of each fluorinated GHG from the process vent during the test and the process feed rate, process production rate, or other process activity rate during the test.

(5) The process-vent-specific emission calculation factor and the calculations used to determine the process-vent-specific emission calculation factor.

(6) The annual process production quantity or other process activity information in the appropriate units, along with the dates and time period during which the process was operating and dates and time periods the process vents are vented to the destruction device. As an alternative to date and time periods when process vents are vented to the destruction device, a facility may track dates and time periods that process vents by-pass the destruction device.

(7) Calculations used to determine annual emissions of each fluorinated GHG for each process and the total fluorinated GHG emissions for all processes, i.e., total for facility.

(e) *Destruction efficiency testing.* A fluorinated GHG production facility that destroys fluorinated GHGs and reflects this destruction in § 98.123 must retain the emissions performance testing reports (including revised reports) for each destruction device. The emissions performance testing report must contain all information and data used to derive the destruction efficiency for each fluorinated GHG whose destruction the facility reflects in § 98.123, as well as the key process and device conditions during the test. This information includes the following:

(1) Destruction efficiency (DE) determined for each fluorinated GHG whose destruction the facility reflects in § 98.123, in accordance with § 98.124(g)(1)(i) through (iv).

(2) Chemical identity of the fluorinated GHG(s) used in the performance test conducted to determine destruction efficiency, including surrogates, and information on why the surrogate is sufficient to demonstrate destruction efficiency for each fluorinated GHG, consistent with requirements in § 98.124(g)(1)(i) through (iv), vented to the destruction device.

(3) Mass flow rate of the stream containing the fluorinated GHG(s) or surrogate into the device during the test.

(4) Concentration (mass fraction) of each fluorinated GHG or surrogate in the stream flowing into the device during the test.

(5) Concentration (mass fraction) of each fluorinated GHG or surrogate at the outlet of the destruction device during the test.

(6) Mass flow rate at the outlet of the destruction device during the test.

(7) Test methods and analytical methods used to determine the mass flow rates and fluorinated GHG (or surrogate) concentrations of the streams flowing into and out of the destruction device during the test.

(8) Destruction device conditions that are normally monitored for device control, such as temperature, total mass flow rates into the device, and CO or O_2 levels.

(9) Name of all applicable Federal or State regulations that may apply to the destruction process.

(f) *Equipment leak records.* If you are subject to § 98.123(d) of this subpart, you must maintain 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; each piece of equipment excluded from monitoring requirement; the time period each piece of equipment was in service, and the emission calculations for each fluorinated GHG for all processes. Depending on which equipment leak monitoring approach you follow, you must maintain 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; and associated screening data and leak rate data (i.e., bagging) used to develop a unit-specific correlation. If you developed and follow a site-specific leak detection approach, provide the records for monitoring events and the emissions estimation calculations, as appropriate, consistent with the approach for equipment leak emission estimation in your GHG Monitoring Plan.

(g) *Container heel records.* If you vent residual fluorinated GHGs from containers, maintain the following records of the measurements and calculations used to estimate emissions of residual fluorinated GHGs from containers.

(i) If you measure the contents of each container, maintain records of these measurements and the calculations used to estimate emissions of each fluorinated GHG from each container size and type.

(ii) If you develop and apply container heel factors to estimate emissions, maintain records of the measurements and calculations used to develop the heel factor for each fluorinated GHG and each container size and type and of the number of containers of each fluorinated GHG and of each container size and type returned to your facility.

(h) *Missing data records.* Where missing data have been estimated pursuant to § 98.125, you must record the reason the data were missing, the length of time the data were missing, the method used to estimate the missing data, and the estimates of those data.

(i) *All facilities.* Dated records documenting the initial and periodic calibration of all analytical equipment used to determine the concentration of fluorinated GHGs, including but not limited to gas chromatographs, gas chromatography-mass spectrometry (GC/MS), gas chromatograph-electron capture detector (GC/ECD), fourier transform infrared (FTIR), and nuclear magnetic resonance (NMR) devices, and all mass measurement equipment such as weigh scales, flowmeters, and volumetric and density measures used to measure the quantities reported under this subpart, including the industry standards or manufacturer directions used for calibration pursuant to § 98.124(e), (f), (g), (m), and (n).

(j) GHG Monitoring Plans, as described in § 98.3(g)(5), must be completed by April 1, 2011.

§ 98.128 Definitions.

Except as provided in this section, all of the terms used in this subpart have the same meaning given in the Clean Air Act and subpart A of this part. If a conflict exists between a definition provided in this subpart and a definition provided in subpart A, the definition in this subpart shall take precedence for the reporting requirements in this subpart.

Batch process or *batch operation* means a noncontinuous operation involving intermittent or discontinuous feed into equipment, and, in general, involves the emptying of the equipment after the batch operation ceases and prior to beginning a new operation. Addition of raw material and withdrawal of product do not occur simultaneously in a batch operation.

Batch emission episode means a discrete venting episode associated with a vessel in a process; a vessel may have more than one batch emission episode. For example, a displacement of vapor resulting from the charging of a vessel with a feed material will result in a discrete emission episode that will last through the duration of the charge and will have an average flow rate equal to

the rate of the charge. If the vessel is then heated, there will also be another discrete emission episode resulting from the expulsion of expanded vapor. Other emission episodes also may occur from the same vessel and other vessels in the process, depending on process operations.

By-product means a chemical that is produced coincidentally during the production of another chemical.

Completely destroyed means destroyed with a destruction efficiency of 99.99 percent or greater.

Completely recaptured means 99.99 percent or greater of each fluorinated GHG is removed from a stream.

Continuous process or operation means a process where the inputs and outputs flow continuously throughout the duration of the process. Continuous processes are typically steady state.

Destruction device means any device used to destroy fluorinated GHG.

Destruction process means a process used to destroy fluorinated GHG in a destruction device such as a thermal incinerator or catalytic oxidizer.

Difficult-to-monitor means the equipment piece may not be monitored without elevating the monitoring personnel more than 2 meters (7 feet) above a support surface or it is not accessible in a safe manner when it is in fluorinated GHG service.

Dual mechanical seal pump and *dual mechanical seal agitator* means a pump or agitator equipped with a dual mechanical seal system that includes a barrier fluid system where the barrier fluid is not in light liquid service; each barrier fluid system is equipped with a sensor that will detect failure of the seal system, the barrier fluid system, or both; and meets the following requirements:

(1) Each dual mechanical seal system is operated with the barrier fluid at a pressure that is at all times (except periods of startup, shutdown, or malfunction) greater than the pump or agitator stuffing box pressure; or

(2) Equipped with a barrier fluid degassing reservoir that is routed to a process or fuel gas system or connected by a closed-vent system to a control device; or

(3) Equipped with a closed-loop system that purges the barrier fluid into a process stream.

Equipment (for the purposes of § 98.123(d) and § 98.124(f) only) means each pump, compressor, agitator, pressure relief device, sampling connection system, open-ended valve or line, valve, connector, and instrumentation system in fluorinated GHG service for a process subject to this subpart; and any destruction devices or closed-vent systems to which processes subject to this subpart are vented.

Fluorinated gas means any fluorinated GHG, CFC, or HCFC.

In fluorinated GHG service means that a piece of equipment either contains or contacts a feedstock, by-product, or product that is a liquid or gas and contains at least 5 percent by weight fluorinated GHG.

In gas and vapor service means that a piece of equipment in regulated material service contains a gas or vapor at operating conditions.

In heavy liquid service means that a piece of equipment in regulated material service is not in gas and vapor service or in light liquid service.

In light liquid service means that a piece of equipment in regulated material service contains a liquid that meets the following conditions:

(1) The vapor pressure of one or more of the compounds is greater than 0.3 kilopascals at 20 °C.

(2) The total concentration of the pure compounds constituents having a vapor pressure greater than 0.3 kilopascals at 20 °C is equal to or greater than 20 percent by weight of the total process stream.

(3) The fluid is a liquid at operating conditions.

Note to definition of "in light liquid service": Vapor pressures may be determined by standard reference texts or ASTM D–2879, (incorporated by reference, see § 98.7).

In vacuum service means that equipment is operating at an internal pressure which is at least 5 kilopascals below ambient pressure.

Isolated intermediate means a product of a process that is stored before subsequent processing. An isolated intermediate is usually a product of chemical synthesis. Storage of an isolated intermediate marks the end of a process. Storage occurs at any time the intermediate is placed in equipment used solely for storage.

No external shaft pump and *No external shaft agitator* means any pump or agitator that is designed with no externally actuated shaft penetrating the pump or agitator housing.

Operating scenario means any specific operation of a process and includes the information specified in paragraphs (1) through (5) of this definition for each process. A change or series of changes to any of these elements, except for paragraph (4) of this definition, constitutes a different operating scenario.

(1) A description of the process, the specific process equipment used, and the range of operating conditions for the process.

(2) An identification of related process vents, their associated emissions episodes and durations, and calculations and engineering analyses to show the annual uncontrolled fluorinated GHG emissions from the process vent.

(3) The control or destruction devices used, as applicable, including a description of operating and/or testing conditions for any associated destruction device.

(4) The process vents (including those from other processes) that are simultaneously routed to the control or destruction device(s).

(5) The applicable monitoring requirements and any parametric level that assures destruction or removal for all emissions routed to the control or destruction device.

Process means all equipment that collectively functions to produce a fluorinated gas product, including an isolated intermediate (which is also a fluorinated gas product), or to transform a fluorinated gas product. A process may consist of one or more unit operations. For the purposes of this subpart, process includes any, all, or a combination of reaction, recovery, separation, purification, or other activity, operation, manufacture, or treatment which are used to produce a fluorinated gas product. For a continuous process, cleaning operations conducted may be considered part of the process, at the discretion of the facility. For a batch process, cleaning operations are part of the process. Ancillary activities are not considered a process or part of any process under this subpart. Ancillary activities include boilers and incinerators, chillers and refrigeration systems, and other equipment and activities that are not directly involved (i.e., they operate within a closed system and materials are not combined with process fluids) in the processing of raw materials or the manufacturing of a fluorinated gas product.

Process condenser means a condenser whose primary purpose is to recover material as an integral part of a process. All condensers recovering condensate from a process vent at or above the boiling point or all condensers in line prior to a vacuum source are considered process condensers. Typically, a primary condenser or condensers in series are considered to be integral to the process if they are capable of and normally used for the purpose of recovering chemicals for fuel value (i.e., net positive heating value), use, reuse or for sale for fuel value, use, or reuse.

Process vent (for the purposes of this subpart only) means a vent from a

process vessel or vents from multiple process vessels within a process that are manifolded together into a common header, through which a fluorinated GHG-containing gas stream is, or has the potential to be, released to the atmosphere (or the point of entry into a control device, if any). Examples of process vents include, but are not limited to, vents on condensers used for product recovery, bottoms receivers, surge control vessels, reactors, filters, centrifuges, and process tanks. Process vents do not include vents on storage tanks, wastewater emission sources, or pieces of equipment.

Typical batch means a batch process operated within a range of operating conditions that are documented in an operating scenario. Emissions from a typical batch are based on the operating conditions that result in representative emissions. The typical batch defines the uncontrolled emissions for each emission episode defined under the operating scenario.

Uncontrolled fluorinated GHG emissions means a gas stream containing fluorinated GHG which has exited the process (or process condenser or control condenser, where applicable), but which has not yet been introduced into a destruction device to reduce the mass of fluorinated GHG in the stream. If the emissions from the process are not routed to a destruction device, uncontrolled emissions are those fluorinated GHG emissions released to the atmosphere.

Unsafe-to-monitor means that monitoring personnel would be exposed to an immediate danger as a consequence of monitoring the piece of equipment. Examples of unsafe-to-monitor equipment include, but are not limited to, equipment under extreme pressure or heat.

■ 10. Add subpart DD to read as follows:

Subpart DD—Electrical Transmission and Distribution Equipment Use

Sec.
98.300 Definition of the source category.
98.301 Reporting threshold.
98.302 GHGs to report.
98.303 Calculating GHG emissions.
98.304 Monitoring and QA/QC requirements.
98.305 Procedures for estimating missing data.
98.306 Data reporting requirements.
98.307 Records that must be retained.
98.308 Definitions.

Subpart DD—Electrical Transmission and Distribution Equipment Use

§ 98.300 Definition of the source category.

(a) The electrical transmission and distribution equipment use source category consists of all electric transmission and distribution equipment and servicing inventory insulated with or containing sulfur hexafluoride (SF_6) or perfluorocarbons (PFCs) used within an electric power system. Electric transmission and distribution equipment and servicing inventory includes, but is not limited to:

(1) Gas-insulated substations.

(2) Circuit breakers.

(3) Switchgear, including closed-pressure and hermetically sealed-pressure switchgear and gas-insulated lines containing SF_6 or PFCs.

(4) Gas containers such as pressurized cylinders.

(5) Gas carts.

(6) Electric power transformers.

(7) Other containers of SF_6 or PFC.

§ 98.301 Reporting threshold.

(a) You must report GHG emissions from an electric power system if the total nameplate capacity of SF_6 and PFC containing equipment (excluding hermetically sealed-pressure equipment) located within the facility, when added to the total nameplate capacity of SF_6 and PFC containing equipment (excluding hermetically sealed-pressure equipment) that is not located within the facility but is under common ownership or control, exceeds 17,820 pounds and the facility meets the requirements of § 98.2(a)(1).

(b) A facility other than an electric power system that is subject to this part because of emissions from any other source category listed in Table A–3 or A–4 in subpart A of this part is not required to report emissions under subpart DD of this part unless the total nameplate capacity of SF_6 and PFC containing equipment located within that facility exceeds 17,820 pounds.

§ 98.302 GHGs to report.

You must report total SF_6 and PFC emissions from your facility (including emissions from fugitive equipment leaks, installation, servicing, equipment decommissioning and disposal, and from storage cylinders) resulting from the transmission and distribution servicing inventory and equipment listed in § 98.300(a). For acquisitions of equipment containing or insulated with SF_6 or PFCs, you must report emissions from the equipment after the title to the equipment is transferred to the electric power transmission or distribution entity.

§ 98.303 Calculating GHG emissions.

(a) Calculate the annual SF_6 and PFC emissions using the mass-balance approach in Equation DD–1 of this section:

$$\text{User Emissions} = (\text{Decrease in } SF_6 \text{ Inventory}) + (\text{Acquisitions of } SF_6) - (\text{Disbursements of } SF_6) - (\text{Net Increase in Total Nameplate Capacity of Equipment Operated}) \quad \text{(Eq. DD-1)}$$

Where:

Decrease in SF_6 Inventory = (pounds of SF_6 stored in containers, but not in energized equipment, at the beginning of the year)—(pounds of SF_6 stored in containers, but not in energized equipment, at the end of the year).

Acquisitions of SF_6 = (pounds of SF_6 purchased from chemical producers or distributors in bulk) + (pounds of SF_6 purchased from equipment manufacturers or distributors with or inside equipment, including hermetically sealed-pressure switchgear) + (pounds of SF_6 returned to facility after off-site recycling).

Disbursements of SF_6 = (pounds of SF_6 in bulk and contained in equipment that is sold to other entities) + (pounds of SF_6 returned to suppliers) + (pounds of SF_6 sent off site for recycling) + (pounds of SF_6 sent off-site for destruction).

Net Increase in Total Nameplate Capacity of Equipment Operated = (The Nameplate Capacity of new equipment in pounds, including hermetically sealed-pressure switchgear)—(Nameplate Capacity of retiring equipment in pounds, including hermetically sealed-pressure switchgear). (Note that Nameplate Capacity refers to the full and proper charge of equipment rather than to the actual charge, which may reflect leakage).

(b) Use Equation DD–1 of this section to estimate emissions of PFCs from power transformers, substituting the relevant PFC(s) for SF_6 in the equation.

§ 98.304 Monitoring and QA/QC requirements.

(a) For calendar year 2011 monitoring, you may follow the provisions of § 98.3(d)(1) through (d)(2) for best

available monitoring methods rather than follow the monitoring requirements of this section. For purposes of this subpart, any reference in § 98.3(d)(1) through (d)(2) to 2010 means 2011, to March 31 means June 30, and to April 1 means July 1. Any reference to the effective date in § 98.3(d)(1) through (d)(2) means February 28, 2011.

(b) You must adhere to the following QA/QC methods for reviewing the completeness and accuracy of reporting:

(1) Review inputs to Equation DD–1 of this section to ensure inputs and outputs to the company's system are included.

(2) Do not enter negative inputs and confirm that negative emissions are not calculated. However, the Decrease in SF_6 Inventory and the Net Increase in Total Nameplate Capacity may be calculated as negative numbers.

(3) Ensure that beginning-of-year inventory matches end-of-year inventory from the previous year.

(4) Ensure that in addition to SF_6 purchased from bulk gas distributors, SF_6 purchased from Original Equipment Manufacturers (OEM) and SF_6 returned to the facility from off-site recycling are also accounted for among the total additions.

(c) Ensure the following QA/QC methods are employed throughout the year:

(1) Ensure that cylinders returned to the gas supplier are consistently weighed on a scale that is certified to be accurate and precise to within 2 pounds of the scale's capacity and is periodically recalibrated per the manufacturer's specifications. Either measure residual gas (the amount of gas remaining in returned cylinders) or have the gas supplier measure it. If the gas supplier weighs the residual gas, obtain from the gas supplier a detailed monthly accounting, within +/− 2 pounds, of residual gas amounts in the cylinders returned to the gas supplier.

(2) Ensure that cylinders weighed for the beginning and end of year inventory measurements are weighed on a scale that is certified to be accurate to within 2 pounds of the scale's capacity and is periodically recalibrated per the manufacturer's specifications. All scales used to measure quantities that are to be reported under § 98.306 must be calibrated using calibration procedures specified by the scale manufacturer. Calibration must be performed prior to the first reporting year. After the initial calibration, recalibration must be performed at the minimum frequency specified by the manufacturer.

(3) Ensure all substations have provided information to the manager compiling the emissions report (if it is not already handled through an electronic inventory system).

(d) GHG Monitoring Plans, as described in § 98.3(g)(5), must be completed by April 1, 2011.

§ 98.305 Procedures for estimating missing data.

A complete record of all measured parameters used in the GHG emissions calculations is required. Replace missing data, if needed, based on data from equipment with a similar nameplate capacity for SF_6 and PFC, and from similar equipment repair, replacement, and maintenance operations.

§ 98.306 Data reporting requirements.

In addition to the information required by § 98.3(c), each annual report must contain the following information for each electric power system, by chemical:

(a) Nameplate capacity of equipment (pounds) containing SF_6 and nameplate capacity of equipment (pounds) containing each PFC:

(1) Existing at the beginning of the year (excluding hermetically sealed-pressure switchgear).

(2) New during the year (all SF_6-insulated equipment, including hermetically sealed-pressure switchgear).

(3) Retired during the year (all SF_6-insulated equipment, including hermetically sealed-pressure switchgear).

(b) Transmission miles (length of lines carrying voltages above 35 kilovolt).

(c) Distribution miles (length of lines carrying voltages at or below 35 kilovolt).

(d) Pounds of SF_6 and PFC stored in containers, but not in energized equipment, at the beginning of the year.

(e) Pounds of SF6 and PFC stored in containers, but not in energized equipment, at the end of the year.

(f) Pounds of SF_6 and PFC purchased in bulk from chemical producers or distributors.

(g) Pounds of SF_6 and PFC purchased from equipment manufacturers or distributors with or inside equipment, including hermetically sealed-pressure switchgear.

(h) Pounds of SF_6 and PFC returned to facility after off-site recycling.

(i) Pounds of SF_6 and PFC in bulk and contained in equipment sold to other entities.

(j) Pounds of SF_6 and PFC returned to suppliers.

(k) Pounds of SF_6 and PFC sent off-site for recycling.

(l) Pounds of SF_6 and PFC sent off-site for destruction.

§ 98.307 Records that must be retained.

In addition to the information required by § 98.3(g), you must retain records of the information reported and listed in § 98.306.

§ 98.308 Definitions.

Except as specified in this section, all terms used in this subpart have the same meaning given in the Clean Air Act and subpart A of this part.

Facility, with respect to an electric power system, means the electric power system as defined in this paragraph. An electric power system is comprised of all electric transmission and distribution equipment insulated with or containing SF_6 or PFCs that is linked through electric power transmission or distribution lines and functions as an integrated unit, that is owned, serviced, or maintained by a single electric power transmission or distribution entity (or multiple entities with a common owner), and that is located between: (1) The point(s) at which electric energy is obtained from an electricity generating unit or a different electric power transmission or distribution entity that does not have a common owner, and (2) the point(s) at which any customer or another electric power transmission or distribution entity that does not have a common owner receives the electric energy. The facility also includes servicing inventory for such equipment that contains SF_6 or PFCs.

Electric power transmission or distribution entity means any entity that transmits, distributes, or supplies electricity to a consumer or other user, including any company, electric cooperative, public electric supply corporation, a similar Federal department (including the Bureau of Reclamation or the Corps of Engineers), a municipally owned electric department offering service to the public, an electric public utility district, or a jointly owned electric supply project.

Operator, for the purposes of this subpart, means any person who operates or supervises a facility, excluding a person whose sole responsibility is to ensure reliability, balance load or otherwise address electricity flow.

■ 11. Add Subpart QQ to read as follows:

Subpart QQ—Importers and Exporters of Fluorinated Greenhouse Gases Contained in Pre-Charged Equipment or Closed-Cell Foams

Sec.

98.430 Definition of the source category.
98.431 Reporting threshold.
98.432 GHGs to report.
98.433 Calculating GHG emissions.

98.434 Monitoring and QA/QC requirements.
98.435 Procedures for estimating missing data.
98.436 Data reporting requirements.
98.437 Records that must be retained.
98.438 Definitions.

Subpart QQ—Importers and Exporters of Fluorinated Greenhouse Gases Contained in Pre-Charged Equipment or Closed-Cell Foams

§ 98.430 Definition of the source category.

(a) The source category, importers and exporters of fluorinated GHGs contained in pre-charged equipment or closed-cell foams, consists of any entity that imports or exports pre-charged equipment that contains a fluorinated GHG, and any entity that imports or exports closed-cell foams that contain a fluorinated GHG.

§ 98.431 Reporting threshold.

Any importer or exporter of fluorinated GHGs contained in pre-charged equipment or closed-cell foams who meets the requirements of § 98.2(a)(4) must report each fluorinated GHG contained in the imported or exported pre-charged equipment or closed-cell foams.

§ 98.432 GHGs to report.

You must report the mass of each fluorinated GHG contained in pre-charged equipment or closed-cell foams that you import or export during the calendar year. For imports and exports of closed-cell foams where you do not know the identity and mass of the fluorinated GHG, you must report the mass of fluorinated GHG in CO_2e.

§ 98.433 Calculating GHG contained in pre-charged equipment or closed-cell foams.

(a) The total mass of each fluorinated GHG imported and exported inside equipment or foams must be estimated using Equation QQ–1 of this section:

$$I = \sum_t S_t * N_t * 0.001 \quad \text{(Eq. QQ-1)}$$

Where:

I = Total mass of the fluorinated GHG imported or exported annually (metric tons).
t = Equipment/foam type containing the fluorinated GHG.
S_t = Mass of fluorinated GHG per unit of equipment type t or foam type t (charge per piece of equipment or cubic foot of foam, kg).
N_t = Number of units of equipment type t or foam type t imported or exported annually (pieces of equipment or cubic feet of foam).
0.001 = Factor converting kg to metric tons.

(b) When the identity and mass of fluorinated GHGs in a closed-cell foam is unknown to the importer or exporter, the total mass in CO_2e for the fluorinated GHGs imported and exported inside closed-cell foams must be estimated using Equation QQ–2 of this section:

$$I = \sum_t S_t * N_t * 0.001 \quad \text{(Eq. QQ-2)}$$

Where:

I = Total mass in CO_2e of the fluorinated GHGs imported or exported in close-cell foams annually (metric tons).
t = Equipment/foam type containing the fluorinated GHG.
S_t = Mass in CO_2e of the fluorinated GHGs per unit of equipment type t or foam type t (charge per piece of equipment or cubic foot of foam, kg).
N_t = Number of units of equipment type t or foam type t imported or exported annually (pieces of equipment or cubic feet of foam).
0.001 = Factor converting kg to metric tons.

§ 98.434 Monitoring and QA/QC requirements.

(a) For calendar year 2011 monitoring, you may follow the provisions of § 98.3(d)(1) through (d)(2) for best available monitoring methods rather than follow the monitoring requirements of this section. For purposes of this subpart, any reference in § 98.3(d)(1) through (d)(2) to the year 2010 means 2011, to March 31 means June 30, and to April 1 means July 1. Any reference to the effective date or date of promulgation in § 98.3(d)(1) through (d)(2) means February 28, 2011.

(b) The inputs to the annual submission must be reviewed against the import or export transaction records to ensure that the information submitted to EPA is being accurately transcribed as the correct chemical or blend in the correct pre-charged equipment or closed-cell foam in the correct quantities (metric tons) and units (kg per piece of equipment or cubic foot of foam).

§ 98.435 Procedures for estimating missing data.

Procedures for estimating missing data are not provided for importers and exporters of fluorinated GHGs contained in pre-charged equipment or closed-cell foams. A complete record of all measured parameters used in tracking fluorinated GHGs contained in pre-charged equipment or closed-cell foams is required.

§ 98.436 Data reporting requirements.

(a) Each importer of fluorinated GHGs contained in pre-charged equipment or closed-cell foams must submit an annual report that summarizes its imports at the corporate level, except for transshipments, as specified:

(1) Total mass in metric tons of each fluorinated GHG imported in pre-charged equipment or closed-cell foams.

(2) For each type of pre-charged equipment with a unique combination of charge size and charge type, the identity of the fluorinated GHG used as a refrigerant or electrical insulator, charge size (holding charge, if applicable), and number imported.

(3) For closed-cell foams that are imported inside of appliances, the identity of the fluorinated GHG contained in the foam in each appliance, the mass of the fluorinated GHG contained in the foam in each appliance, and the number of appliances imported with each unique combination of mass and identity of fluorinated GHG within the closed-cell foams.

(4) For closed cell-foams that are not imported inside of appliances, the identity of the fluorinated GHG in the foam, the density of the fluorinated GHG in the foam (kg fluorinated GHG/cubic foot), and the volume of foam imported (cubic feet) for each type of closed-cell foam with a unique combination of fluorinated GHG density and identity.

(5) Dates on which the pre-charged equipment or closed-cell foams were imported.

(6) If the importer does not know the identity and mass of the fluorinated GHGs within the closed-cell foam, the importer must report the following:

(i) Total mass in metric tons of CO_2e of the fluorinated GHGs imported in closed-cell foams.

(ii) For closed-cell foams that are imported inside of appliances, the mass of the fluorinated GHGs in CO_2e contained in the foam in each appliance and the number of appliances imported for each type of appliance.

(iii) For closed-cell foams that are not imported inside of appliances, the mass in CO_2e of the fluorinated GHGs in the foam (kg CO_2e/cubic foot) and the volume of foam imported (cubic feet) for each type of closed-cell foam.

(iv) Dates on which the closed-cell foams were imported.

(v) Name of the foam manufacturer for each type of closed-cell foam where the identity and mass of the fluorinated GHGs is unknown.

(vi) Certification that the importer was unable to obtain information on the identity and mass of the fluorinated GHGs within the closed-cell foam from the closed-cell foam manufacturer or manufacturers.

(b) Each exporter of fluorinated GHGs contained in pre-charged equipment or closed-cell foams must submit an annual report that summarizes its exports at the corporate level, except for transshipments, as specified:

(1) Total mass in metric tons of each fluorinated GHG exported in pre-charged equipment or closed-cell foams.

(2) For each type of pre-charged equipment with a unique combination of charge size and charge type, the identity of the fluorinated GHG used as a refrigerant or electrical insulator, charge size (including holding charge, if applicable), and number exported.

(3) For closed-cell foams that are exported inside of appliances, the identity of the fluorinated GHG contained in the foam in each appliance, the mass of the fluorinated GHG contained in the foam in each appliance, and the number of appliances exported with each unique combination of mass and identity of fluorinated GHG within the closed-cell foams.

(4) For closed-cell foams that are not exported inside of appliances, the identity of the fluorinated GHG in the foam, the density of the fluorinated GHG in the foam (kg fluorinated GHG/cubic foot), and the volume of foam exported (cubic feet) for each type of closed-cell foam with a unique combination of fluorinated GHG density and identity.

(5) Dates on which the pre-charged equipment or closed-cell foams were exported.

(6) If the exporter does not know the identity and mass of the fluorinated GHG within the closed-cell foam, the exporter must report the following:

(i) Total mass in metric tons of CO_2e of the fluorinated GHGs exported in closed-cell foams.

(ii) For closed-cell foams that are exported inside of appliances, the mass of the fluorinated GHGs in CO_2e contained in the foam in each appliance and the number of appliances imported for each type of appliance.

(iii) For closed-cell foams that are not exported inside of appliances, the mass in CO_2e of the fluorinated GHGs in the foam (kg CO_2e/cubic foot) and the volume of foam imported (cubic feet) for each type of closed-cell foam.

(iv) Dates on which the closed-cell foams were exported.

(v) Name of the foam manufacturer for each type of closed-cell foam where the identity and mass of the fluorinated GHGg is unknown.

(vi) Certification that the exporter was unable to obtain information on the identity and mass of the fluorinated GHGs within the closed-cell foam from the closed-cell foam manufacturer or manufacturers.

§ 98.437 Records that must be retained.

(a) In addition to the data required by § 98.3(g), importers of fluorinated GHGs in pre-charged equipment and closed-cell foams must retain the following records substantiating each of the imports that they report:

(1) A copy of the bill of lading for the import.

(2) The invoice for the import.

(3) The U.S. Customs entry form.

(4) Ports of entry through which the pre-charged equipment or closed-cell foams passed.

(5) Countries from which the pre-charged equipment or closed-cell foams were imported.

(6) For importers that report the mass of fluorinated GHGs within closed-cell foams on a CO_2e basis, correspondence or other documents that show the importer was unable to obtain information on the identity and mass of fluorinated GHG within closed-cell foams from the foam manufacturer.

(b) In addition to the data required by § 98.3(g), exporters of fluorinated GHGs in pre-charged equipment and closed-cell foams must retain the following records substantiating each of the exports that they report:

(1) A copy of the bill of lading for the export and

(2) The invoice for the export.

(3) Ports of exit through which the pre-charged equipment or closed-cell foams passed.

(4) Countries to which the pre-charged equipment or closed-cell foams were exported.

(5) For exporters that report the mass of fluorinated GHGs within closed-cell foams on a CO_2e basis, correspondence or other documents that show the exporter was unable to obtain information on the identity and mass of fluorinated GHG within closed-cell foams from the foam manufacturer.

(c) For importers and exports of fluorinated GHGs inside pre-charged equipment and closed-cell foams, the GHG Monitoring Plans, as described in § 98.3(g)(5), must be completed by April 1, 2011.

(d) Persons who transship pre-charged equipment and closed-cell foams containing fluorinated GHGs must maintain records that indicated that the pre-charged equipment or foam originated in a foreign country and was destined for another foreign country and did not enter into commerce in the United States.

§ 98.438 Definitions.

Except as provided in this section, all of the terms used in this subpart have the same meaning given in the Clean Air Act and subpart A of this part. If a conflict exists between a definition provided in this subpart and a definition provided in subpart A, the definition in this subpart must take precedence for the reporting requirements in this subpart.

Appliance means any device which contains and uses a fluorinated greenhouse gas refrigerant and which is used for household or commercial purposes, including any air conditioner, refrigerator, chiller, or freezer.

Closed-cell foam means any foam product, excluding packaging foam, that is constructed with a closed-cell structure and a blowing agent containing a fluorinated GHG. Closed-cell foams include but are not limited to polyurethane (PU) appliance foam, PU continuous and discontinuous panel foam, PU one component foam, PU spray foam, extruded polystyrene (XPS) boardstock foam, and XPS sheet foam. Packaging foam means foam used exclusively during shipment or storage to temporarily enclose items.

Electrical equipment means gas-insulated substations, circuit breakers, other switchgear, gas-insulated lines, or power transformers.

Fluorinated GHG refrigerant means, for purposes of this subpart, any substance consisting in part or whole of a fluorinated greenhouse gas and that is used for heat transfer purposes and provides a cooling effect.

Pre-charged appliance means any appliance charged with fluorinated greenhouse gas refrigerant prior to sale or distribution or offer for sale or distribution in interstate commerce. This includes both appliances that contain the full charge necessary for operation and appliances that contain a partial "holding" charge of the fluorinated greenhouse gas refrigerant (e.g., for shipment purposes).

Pre-charged appliance component means any portion of an appliance, including but not limited to condensers, compressors, line sets, and coils, that is charged with fluorinated greenhouse gas refrigerant prior to sale or distribution or offer for sale or distribution in interstate commerce.

Pre-charged equipment means any pre-charged appliance, pre-charged appliance component, pre-charged electrical equipment, or pre-charged electrical equipment component.

Pre-charged electrical equipment means any electrical equipment, including but not limited to gas-insulated substations, circuit breakers, other switchgear, gas-insulated lines, or power transformers containing a fluorinated GHG prior to sale or

distribution, or offer for sale or distribution in interstate commerce. This includes both equipment that contain the full charge necessary for operation and equipment that contain a partial "holding" charge of the fluorinated GHG (e.g., for shipment purposes).

Pre-charged electrical equipment component means any portion of electrical equipment that is charged with SF_6 or PFCs prior to sale or distribution or offer for sale or distribution in interstate commerce.

■ 12. Add subpart SS to read as follows:

Subpart SS—Electrical Equipment Manufacture or Refurbishment

Sec.
98.450 Definition of the source category.
98.451 Reporting threshold.
98.452 GHGs to report.
98.453 Calculating GHG emissions.
98.454 Monitoring and QA/QC requirements.
98.455 Procedures for estimating missing data.
98.456 Data reporting requirements.
98.457 Records that must be retained.
98.458 Definitions.

§ 98.450 Definition of the source category.

The electrical equipment manufacturing or refurbishment category consists of processes that manufacture or refurbish gas-insulated substations, circuit breakers, other switchgear, gas-insulated lines, or power transformers (including gas-containing components of such equipment) containing sulfur-hexafluoride (SF_6) or perfluorocarbons (PFCs). The processes include equipment testing, installation, manufacturing, decommissioning and disposal, refurbishing, and storage in gas cylinders and other containers.

§ 98.451 Reporting threshold.

You must report GHG emissions under this subpart if your facility contains an electrical equipment manufacturing or refurbishing process and the facility meets the requirements of § 98.2(a)(1). Electrical equipment manufacturing and refurbishing facilities covered by this rule are those that have total annual purchases of SF_6 and PFCs that exceed 23,000 pounds.

§ 98.452 GHGs to report.

(a) You must report SF_6 and PFC emissions at the facility level. Annual emissions from the facility must include SF_6 and PFC emissions from equipment that is installed at an off-site electric power transmission or distribution location whenever emissions from installation activities (e.g., filling) occur before the title to the equipment is transferred to the electric power transmission or distribution entity.

(b) You must report CO_2, N_2O and CH_4 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 of this part.

§ 98.453 Calculating GHG emissions.

(a) For each electrical equipment manufacturer or refurbisher, estimate the annual SF_6 and PFC emissions using the mass-balance approach in Equation SS–1 of this section:

$$\text{User Emissions} = (\text{Decrease in } SF_6 \text{ Inventory}) + (\text{Acquisitions of } SF_6) - (\text{Disbursements of } SF_6) \quad \text{(Eq. SS-1)}$$

Where:

Decrease in SF_6 Inventory = (Pounds of SF_6 stored in containers at the beginning of the year)—(Pounds of SF_6 stored in containers at the end of the year).

Acquisitions of SF_6 = (Pounds of SF_6 purchased from chemical producers or suppliers in bulk) + (Pounds of SF_6 returned by equipment users) + (Pounds of SF_6 returned to site after off-site recycling).

Disbursements of SF_6 = (Pounds of SF_6 contained in new equipment delivered to customers) + (Pounds of SF_6 delivered to equipment users in containers) + (Pounds of SF_6 returned to suppliers) + (Pounds of SF_6 sent off site for recycling) + (Pounds of SF_6 sent off-site for destruction).

(b) Use the mass-balance method in paragraph (a) of this section to estimate emissions of PFCs associated with the manufacture or refurbishment of power transformers, substituting the relevant PFC(s) for SF_6 in Equation SS–1 of this section.

(c) Estimate the disbursements of SF_6 or PFCs sent to customers in new equipment or cylinders or sent off-site for other purposes including for recycling, for destruction or to be returned to suppliers using Equation SS–2 of this section:

$$D_{GHG} = \sum_{p=1}^{n} Q_p \quad \text{(Eq. SS-2)}$$

Where:

D_{GHG} = The annual disbursement of SF_6 or PFCs sent to customers in new equipment or cylinders or sent off-site for other purposes including for recycling, for destruction or to be returned to suppliers.

Q_p = The mass of the SF_6 or PFCs charged into equipment or containers over the period p sent to customers or sent off-site for other purposes including for recycling, for destruction or to be returned to suppliers.

n = The number of periods in the year.

(d) Estimate the mass of SF_6 or PFCs disbursed to customers in new equipment or cylinders over the period p by monitoring the mass flow of the SF_6 or PFCs into the new equipment or cylinders using a flowmeter or by weighing containers before and after gas from containers is used to fill equipment or cylinders.

(e) If the mass of SF_6 or the PFC disbursed to customers in new equipment or cylinders over the period p is estimated by weighing containers before and after gas from containers is used to fill equipment or cylinders, estimate this quantity using Equation SS–3 of this section:

$$Q_p = M_B - M_E - E_L \quad \text{(Eq. SS-3)}$$

Where:

Q_p = The mass of SF_6 or the PFC charged into equipment or containers over the period p sent to customers or sent off-site for other purposes including for recycling, for destruction or to be returned to suppliers.

M_B = The mass of the contents of the containers used to fill equipment or cylinders at the beginning of period p.

M_E = The mass of the contents of the containers used to fill equipment or cylinders at the end of period p.

E_L = The mass of SF_6 or the PFC emitted during the period p downstream of the containers used to fill equipment or

cylinders and in cases where a flowmeter is used, downstream of the flowmeter during the period p (e.g., emissions from hoses or other flow lines that connect the container to the equipment or cylinder that is being filled).

(f) If the mass of SF_6 or the PFC disbursed to customers in new equipment or cylinders over the period p is determined using a flowmeter, estimate this quantity using Equation SS–4 of this section:

$$Q_p = M_{mr} - E_L \quad \text{(Eq. SS-4)}$$

Where:

Q_p = The mass of SF_6 or the PFC charged into equipment or containers over the period p sent to customers or sent off-site for other purposes including for recycling, for destruction or to be returned to suppliers.

M_{mr} = The mass of the SF_6 or the PFC that has flowed through the flowmeter during the period p.

E_L = The mass of SF_6 or the PFC emitted during the period p downstream of the containers used to fill equipment or cylinders and in cases where a flowmeter is used, downstream of the flowmeter during the period p (e.g., emissions from hoses or other flow lines that connect the container to the equipment that is being filled).

(g) Estimate the mass of SF_6 or the PFC emitted during the period p downstream of the containers used to fill equipment or cylinders (e.g., emissions from hoses or other flow lines that connect the container to the equipment or cylinder that is being filled) using Equation SS–5 of this section:

$$E_L = \sum_{i=1}^{n} F_{Ci} \times EF_{Ci} \quad \text{(Eq. SS-5)}$$

Where:

E_L = The mass of SF_6 or the PFC emitted during the period p downstream of the containers used to fill equipment or cylinders and in cases where a flowmeter is used, downstream of the flowmeter during the period p (e.g., emissions from hoses or other flow lines that connect the container to the equipment or cylinder that is being filled)

F_{Ci} = The total number of fill operations over the period p for the valve-hose combination Ci.

EF_{Ci} = The emission factor for the valve-hose combination Ci.

n = The number of different valve-hose combinations C used during the period p.

(h) The mass of SF_6 or the PFC disbursed to customers in new equipment over the period p must be determined either by using the nameplate capacity of the equipment or, in cases where equipment is shipped with a partial charge, by calculating the partial shipping charge. Calculate the partial shipping charge by multiplying the nameplate capacity of the equipment by the ratio of the densities of the partial charge to the full charge. To determine the equipment's actual nameplate capacity, you must measure the nameplate capacities of a representative sample of each make and model and take the average for each make and model as specified at § 98.454(f).

(i) Estimate the annual SF_6 and PFC emissions from the equipment that is installed at an off-site electric power transmission or distribution location before the title to the equipment is transferred by using Equation SS–6 of this section:

$$EI = M_F + M_c - N_I \quad \text{(Eq. SS-6)}$$

Where:

EI = Total annual SF_6 or PFC emissions from equipment installation at electric transmission or distribution facilities.

MF = The total annual mass of the SF_6 or PFCs, in pounds, used to fill equipment.

MC = The total annual mass of the SF_6 or PFCs, in pounds, used to charge the equipment prior to leaving the electrical equipment manufacturer facility.

NI = The total annual nameplate capacity of the equipment, in pounds, installed at electric transmission or distribution facilities.

§ 98.454 Monitoring and QA/QC requirements.

(a) For calendar year 2011 monitoring, you may follow the provisions of § 98.3(d)(1) through (d)(2) for best available monitoring methods rather than follow the monitoring requirements of this section. For purposes of this subpart, any reference in § 98.3(d)(1) through (d)(2) to 2010 means 2011, March 31 means June 30, and April 1 means July 1. Any reference to the effective date in § 98.3(d)(1) through (d)(2) means February 28, 2011.

(b) Ensure that all the quantities required by the equations of this subpart have been measured using either flowmeters with an accuracy and precision of ±1 percent of full scale or better or scales with an accuracy and precision of ±1 percent of the filled weight (gas plus tare) of the containers of SF_6 or PFCs that are typically weighed on the scale. For scales that are generally used to weigh cylinders containing 115 pounds of gas when full, this equates to ±1 percent of the sum of 115 pounds and approximately 120 pounds tare, or slightly more than ±2 pounds. Account for the tare weights of the containers. You may accept gas masses or weights provided by the gas supplier e.g., for the contents of cylinders containing new gas or for the heels remaining in cylinders returned to the gas supplier) if the supplier provides documentation verifying that accuracy standards are met; however, you remain responsible for the accuracy of these masses and weights under this subpart.

(c) All flow meters, weigh scales, and combinations of volumetric and density measures that are used to measure or calculate quantities under this subpart must be calibrated using calibration procedures specified by the flowmeter, scale, volumetric or density measure equipment manufacturer. Calibration must be performed prior to the first reporting year. After the initial calibration, recalibration must be performed at the minimum frequency specified by the manufacturer.

(d) For purposes of Equations SS–5 of this subpart, the emission factor for the valve-hose combination (EF_C) must be estimated using measurements and/or engineering assessments or calculations based on chemical engineering principles or physical or chemical laws or properties. Such assessments or calculations may be based on, as applicable, the internal volume of hose or line that is open to the atmosphere during coupling and decoupling activities, the internal pressure of the hose or line, the time the hose or line is open to the atmosphere during coupling and decoupling activities, the frequency with which the hose or line is purged and the flow rate during purges. You must develop a value for EF_c (or use an industry-developed value) for each combination of hose and valve fitting, to use in Equation SS–5 of this subpart. The value for EF_C must be determined for each combination of hose and valve fitting of a given diameter or size. The calculation must be recalculated annually to account for changes to the specifications of the valves or hoses that may occur throughout the year.

(e) Electrical equipment manufacturers and refurbishers must account for SF_6 or PFC emissions that occur as a result of unexpected events or accidental losses, such as a malfunctioning hose or leak in the flow line, during the filling of equipment or containers for disbursement by including these losses in the estimated mass of SF_6 or the PFC emitted downstream of the container or flowmeter during the period p.

(f) If the mass of SF_6 or the PFC disbursed to customers in new equipment over the period p is determined by assuming that it is equal to the equipment's nameplate capacity or, in cases where equipment is shipped with a partial charge, equal to its partial shipping charge, equipment samples for

conducting the nameplate capacity tests must be selected using the following stratified sampling strategy in this paragraph. For each make and model, group the measurement conditions to reflect predictable variability in the facility's filling practices and conditions (e.g., temperatures at which equipment is filled). Then, independently select equipment samples at random from each make and model under each group of conditions. To account for variability, a certain number of these measurements must be performed to develop a robust and representative average nameplate capacity (or shipping charge) for each make, model, and group of conditions. A Student T distribution calculation should be conducted to determine how many samples are needed for each make, model, and group of conditions as a function of the relative standard deviation of the sample measurements. To determine a sufficiently precise estimate of the nameplate capacity, the number of measurements required must be calculated to achieve a precision of one percent of the true mean, using a 95 percent confidence interval. To estimate the nameplate capacity for a given make and model, you must use the lowest mean value among the different groups of conditions, or provide justification for the use of a different mean value for the group of conditions that represents the typical practices and conditions for that make and model. Measurements can be conducted using SF_6, another gas, or a liquid. Re-measurement of nameplate capacities should be conducted every five years to reflect cumulative changes in manufacturing methods and conditions over time.

(g) Ensure the following QA/QC methods are employed throughout the year:

(1) Procedures are in place and followed to track and weigh all cylinders or other containers at the beginning and end of the year.

(h) You must adhere to the following QA/QC methods for reviewing the completeness and accuracy of reporting:

(1) Review inputs to Equation SS–1 of this subpart to ensure inputs and outputs to the company's system are included.

(2) Do not enter negative inputs and confirm that negative emissions are not calculated. However, the decrease in SF_6 inventory may be calculated as negative.

(3) Ensure that beginning-of-year inventory matches end-of-year inventory from the previous year.

(4) Ensure that in addition to SF_6 purchased from bulk gas distributors, SF_6 returned from equipment users with or inside equipment and SF_6 returned from off-site recycling are also accounted for among the total additions.

§ 98.455 Procedures for estimating missing data.

A complete record of all measured parameters used in the GHG emissions calculations is required. Replace missing data, if needed, based on data from similar manufacturing operations, and from similar equipment testing and decommissioning activities for which data are available.

§ 98.456 Data reporting requirements.

In addition to the information required by § 98.3(c), each annual report must contain the following information for each chemical at the facility level:

(a) Pounds of SF_6 and PFCs stored in containers at the beginning of the year.

(b) Pounds of SF_6 and PFCs stored in containers at the end of the year.

(c) Pounds of SF_6 and PFCs purchased in bulk.

(d) Pounds of SF_6 and PFCs returned by equipment users with or inside equipment.

(e) Pounds of SF_6 and PFCs returned to site from off site after recycling.

(f) Pounds of SF_6 and PFCs inside new equipment delivered to customers.

(g) Pounds of SF_6 and PFCs delivered to equipment users in containers.

(h) Pounds of SF_6 and PFCs returned to suppliers.

(i) Pounds of SF_6 and PFCs sent off site for destruction.

(j) Pounds of SF_6 and PFCs sent off site to be recycled.

(k) The nameplate capacity of the equipment, in pounds, delivered to customers with SF_6 or PFCs inside, if different from the quantity in paragraph (f) of this section.

(l) A description of the engineering methods and calculations used to determine emissions from hoses or other flow lines that connect the container to the equipment that is being filled.

(m) The values for EF_C for each hose and valve combination and the associated valve fitting sizes and hose diameters.

(n) The total number of fill operations for each hose and valve combination, or, F_{Ci} of Equation SS–5 of this subpart.

(o) The mean value for each make, model, and group of conditions if the mass of SF_6 or the PFC disbursed to customers in new equipment over the period p is determined by assuming that it is equal to the equipment's nameplate capacity or, in cases where equipment is shipped with a partial charge, equal to its partial shipping charge.

(p) The number of samples and the upper and lower bounds on the 95 percent confidence interval for each make, model, and group of conditions if the mass of SF_6 or the PFC disbursed to customers in new equipment over the period p is determined by assuming that it is equal to the equipment's nameplate capacity or, in cases where equipment is shipped with a partial charge, equal to its partial shipping charge.

(q) Pounds of SF_6 and PFCs used to fill equipment at off-site electric power transmission or distribution locations, or M_F, of Equation SS–6 of this subpart.

(r) Pounds of SF_6 and PFCs used to charge the equipment prior to leaving the electrical equipment manufacturer or refurbishment facility, or M_C, of Equation SS–6 of this subpart.

(s) The nameplate capacity of the equipment, in pounds, installed at off-site electric power transmission or distribution locations used to determine emissions from installation, or N_I, of Equation SS–6 of this subpart.

(t) For any missing data, you must report the reason the data were missing, the parameters for which the data were missing, the substitute parameters used to estimate emissions in their absence, and the quantity of emissions thereby estimated.

§ 98.457 Records that must be retained.

In addition to the information required by § 98.3(g), you must retain the following records:

(a) All information reported and listed in § 98.456.

(b) Accuracy certifications and calibration records for all scales and monitoring equipment, including the method or manufacturer's specification used for calibration.

(c) Certifications of the quantity of gas, in pounds, charged into equipment at the electrical equipment manufacturer or refurbishment facility as well as the actual quantity of gas, in pounds, charged into equipment at installation.

(d) Check-out and weigh-in sheets and procedures for cylinders.

(e) Residual gas amounts, in pounds, in cylinders sent back to suppliers.

(f) Invoices for gas purchases and sales.

(g) GHG Monitoring Plans, as described in § 98.3(g)(5), must be completed by April 1, 2011.

§ 98.458 Definitions.

All terms used in this subpart have the same meaning given in the CAA and subpart A of this part.

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