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

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 98

[EPA–HQ–OAR–2009–0927; FRL–9130–7]

RIN 2060–AQ00

Mandatory Reporting of Greenhouse Gases: Additional Sources of Fluorinated GHGs

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: EPA is revising and supplementing its initial proposed actions to require reporting of fluorinated greenhouse gas (fluorinated GHG) emissions from certain source categories. Specifically, EPA is revising and supplementing its initial proposal to require reporting of fluorinated GHG emissions from electronics manufacturing, production of fluorinated gases, and use of electrical transmission and distribution equipment. EPA is also proposing to require such reporting from manufacture or refurbishment of electrical equipment and import and export of pre-charged equipment and closed cell foams. This proposed rule would not require control of greenhouse gases; rather it would require only that sources above certain threshold levels monitor and report emissions.

DATES: Comments must be received on or before June 11, 2010. There will be a public hearing from 9 a.m. to 12 noon on April 20, 2010 at 1310 L St., NW., Room 152, Washington, DC 20005.

ADDRESSES: Submit your comments, identified by docket ID EPA–HQ–OAR–2009–0927 by one of the following methods:

- *Federal eRulemaking Portal: http://www.regulations.gov.* Follow the online instructions for submitting comments.
- *E-mail: GHGReportingFGHG@epa.gov.*
- *Fax:* (202) 566–1741.
- *Mail:* EPA Docket Center, Attention Docket OAR–2009–0927, Mail code 2822T, 1200 Pennsylvania Avenue, NW., Washington, DC 20460.
- *Hand/Courier Delivery:* EPA Docket Center, Public Reading Room, Room 3334, EPA West Building, Attention Docket OAR–2009–0927, 1301 Constitution Avenue, NW., Washington, DC 20004. Such deliveries are only accepted during the Docket's normal hours of operation, and special arrangements should be made for deliveries of boxed information.

Instructions: Direct your comments to Docket ID No. EPA–HQ–OAR–2009–0927. EPA's policy is that all comments received will be included in the public docket without change and may be made available online at *http://www.regulations.gov,* including any personal information provided, unless the comment includes information claimed to be CBI or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through *http://www.regulations.gov* or e-mail. The *http://www.regulations.gov* Web site is an "anonymous access" system, which means EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an e-mail comment directly to EPA without going through *http://www.regulations.gov* your e-mail address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD–ROM you submit. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses.

Docket: All documents in the docket are listed in the *http://www.regulations.gov* index. Although listed in the index, some information is not publicly available, *e.g.,* CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available either electronically in *http://www.regulations.gov* or in hard copy at EPA's Docket Center, Public Reading Room, EPA West Building, Room 3334, 1301 Constitution Ave., 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 contact the Greenhouse Gas Reporting Rule e-mail: *ghgmrr@epa.gov.* To obtain information about the public hearings or to register to speak at the hearings, please go to *http://www.epa.gov/climatechange/emissions/ghgrulemaking.html.*

SUPPLEMENTARY INFORMATION:

Additional Information on Submitting Comments: To expedite review of your comments by Agency staff, you are encouraged to send a separate copy of your comments, in addition to the copy you submit to the official docket, to Carole Cook, U.S. EPA, Office of Atmospheric Programs, Climate Change Division, Mail Code 6207–J, Washington, DC 20460, telephone (202) 343–9263, e-mail *GHGReportingRule@epa.gov.*

As indicated above, although EPA previously proposed a version of some parts of this rule, that proposal has not become final. This proposal partly supplements and partly replaces that initial proposal. Comments on the initial proposal will be considered only to the extent they remain relevant. To ensure that their comments on newly proposed or re-proposed provisions are considered, parties should submit or re-submit them at this time.

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 section 307(d) apply to "such other actions as the Administrator may determine."). This is a proposed regulation. If finalized, these regulations would affect owners or 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 would 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	LCD unit screens manufacturing facilities.
	334419	MEMS manufacturing facilities.
Fluorinated GHG 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.
	423620	Air-conditioners, room, merchant wholesalers.
	443111	Household Appliance Stores.
	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 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 proposed subparts related to electronics manufacturing facilities, fluorinated gas production facilities, electrical equipment use, 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 INFORMATION CONTACT** section.

Many facilities that would be affected by the proposed rule have GHG emissions from multiple source categories listed in 40 CFR part 98 or in this proposed rule. Table 2 of this preamble has been developed as a guide to help potential reporters in the source categories subject to the proposed 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 GHG 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.
	Sulfur Hexafluoride and PFCs from Electrical Equipment Manufacture and Refurbishment.
Electrical Equipment Manufacture or Refurbishment	General Stationary Fuel Combustion
	Imports and Exports of Fluorinated GHGs Inside Pre-charged Equipment and Closed-Cell Foams.

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
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
EIA	Economic Impact Analysis
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
HCFC	hydrochlorofluorocarbon
HFC	hydrofluorocarbon
HFE	hydrofluoroether
HTF	heat transfer fluid
ICR	information collection request
IPCC	Intergovernmental Panel on Climate Change
kg	kilograms
LCD	liquid crystal displays
MEMS	microelectromechanical devices
$MMTCO_2e$	million metric tons carbon dioxide equivalent
MRR	mandatory greenhouse gas reporting rule
MS	mass spectrometry
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
NSPS	New Source Performance Standards
OMB	Office of Management and Budget
PFC	perfluorocarbon
PSD	Prevention of Significant Deterioration
PV	photovoltaic cells
QA	quality assurance
QA/QC	quality assurance/quality control
R&D	research and development
RFA	Regulatory Flexibility Act
RGGI	Regional Greenhouse Gas Initiative
RIA	Regulatory Impact Analysis
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 above 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 proposed rule, including a brief discussion of the initial proposed requirements for electronics, fluorinated gas production, and use of electrical transmission and distribution equipment. This section also discusses EPA's use of our legal authority under the CAA to collect the proposed data, and the benefits of collecting the data.

The second section of this preamble provides a brief summary of, and rationale for, the key design elements on which EPA is seeking comment today for each subpart. Depending on the subpart, this section may include EPA's rationale for (i) the definition of the source category, (ii) selection of reporting threshold, (iii) selection of proposed reporting and monitoring methods, (iv) selection of procedures for estimating missing data, (v) selection of data reporting requirements, and (vi) selection of records that must be retained. EPA describes the proposed options for each design element, as well as the other options considered. Throughout this discussion, EPA highlights specific issues on which we solicit comment. 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 proposed rule from the Economic Analysis. Finally, the last section discusses the various statutory and executive order requirements applicable to this proposed rulemaking.

B. Background on the Proposed Rule

The Final Mandatory GHG Reporting Rule (Final MRR), (40 CFR part 98) was signed by EPA Administrator Lisa Jackson on September 22, 2009 and published in the **Federal Register** on October 30, 2009 (74 FR 56260). The Final MRR, which became effective on December 29, 2009, included reporting of GHGs from the facilities and suppliers that EPA determined should be included to appropriately respond to the direction in the 2008 Consolidated Appropriations Act.[1] These source categories capture approximately 85 percent of U.S. GHG emissions through reporting by direct emitters as well as suppliers of fossil fuels and industrial gases.

In the April 2009 proposed mandatory GHG reporting rule, the electronics, fluorinated GHG production, and electrical equipment use source categories were included as subparts I, L, and DD. In addition, EPA requested comment on requiring reporting under subpart OO of the quantities of fluorinated GHGs imported and exported inside pre-charged equipment and foams. EPA received a number of lengthy, detailed comments regarding proposed subparts I and L, several comments regarding the definition of "facility" under subpart DD, and several comments regarding a reporting requirement for imports and exports of fluorinated GHGs contained inside pre-charged equipment and foams. These comments, which are described in more detail in the discussions of the individual source categories below, 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 imports of fluorinated GHGs contained in imported and exported pre-charged equipment and closed-cell foams.

EPA recognized the concerns raised by stakeholders, and decided not to finalize subparts I, L, and DD with the Final MRR, but instead to re-propose significant pieces of these subparts. For subparts I and L this proposal incorporates a number of 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 proposal. Where aspects of the initial proposals for subparts I and L are retained in this proposal, 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, today's proposal adds more flexibility in how and how frequently the underlying data are gathered. In addition, EPA is proposing requirements 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 believe the monitoring approaches proposed in this action, which combine direct measurement and facility-specific calculations, effectively balance

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[1] Consolidated Appropriations Act, 2008, Public Law 110–161, 121 Stat. 1844, 2128.

accuracy and costs, and that they are warranted even though the rule does not contain any emissions reduction requirements. As we stated in the Final MRR, the data collected by the rule are expected to be used in analyzing and developing a range of potential CAA GHG policies and programs. A consistent and accurate data set is crucial to serve this intended purpose.

Under this proposed rule, facilities not already reporting but required to report under this rule would begin data collection in 2011 following the methods outlined in the proposed rule and would submit data to EPA by March 31, 2012. As is the case under the Final MRR, facilities would have the option to use Best Available Monitoring Methods (BAMM) for the first quarter of the first reporting year for the source categories included in this proposed rule. Thus, for these source categories, facilities could use BAMM through March 31, 2011.

C. Legal Authority

EPA is proposing this rule under its existing CAA authority, specifically authorities provided in CAA section 114. As discussed further below and in “Mandatory Greenhouse Gas Reporting Rule: EPA’s Response to Public Comments, Legal Issues” (available in EPA–HQ–OAR–2008–0508), EPA is not citing the FY 2008 Consolidated Appropriations Act as the statutory basis for this action. While that law required that EPA spend no less than $3.5 million on a rule requiring the mandatory reporting of GHG emissions, it is the CAA, not the Appropriations Act, that EPA is citing as the authority to gather the information proposed by this rule.

As stated in the Final MRR, CAA section 114 provides EPA broad authority to require the information proposed by this rule because such data would inform and are relevant to EPA’s carrying out a wide variety of CAA provisions. As discussed in the initial proposed rule (74 FR 16448, April 10, 2009), CAA section 114(a)(1) authorizes the Administrator to require emissions sources, persons subject to the CAA, 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. EPA notes that while climate change legislation approved by the U.S. House of Representatives, and pending in the U.S. Senate, would provide EPA additional authority for a GHG registry similar to this proposed rule, and would do so for purposes of that pending legislation, this proposed rule is authorized by, and the information being gathered by this proposed rule is relevant to implementing, the existing CAA. EPA expects, however, that the information collected by this proposed rule would also prove useful to legislative efforts to address GHG emissions.

For further information about EPA’s legal authority, *see* the proposed and Final MRR.

D. Relationship to Other Federal, State and Regional Programs

In developing this proposed rule, EPA reviewed monitoring methods included in international guidance (*e.g.,* Intergovernmental Panel on Climate Change), as well as Federal voluntary programs (*e.g.,* EPA PFC Reduction/Climate Partnership for the Semiconductor Industry and the U.S. Department of Energy Voluntary Reporting of Greenhouse Gases Program (1605(b) of the Energy Policy Act), corporate protocols (*e.g.,* World Resources Institute and World Business Council for Sustainable Development GHG Protocol) and industry guidance (*e.g.,* 2006 ISMI Guideline for Environmental Characterization of Semiconductor Process Equipment).

EPA also reviewed State reporting programs (*e.g.,* California and New Mexico) and Regional partnerships (*e.g.,* Regional Greenhouse Gas Initiative, Western Climate Initiative, The Climate Registry). These are important programs that not only led the way in reporting of GHG emissions before the Federal government acted but also assist in quantifying the GHG reductions achieved by various policies. Many of these programs collect different or additional data as compared to this proposed rule. For example, State programs may establish lower thresholds for reporting, request information on areas not addressed in EPA’s reporting rule, or include different data elements to support other programs (*e.g.,* offsets). For further discussion on the relationship of this proposed rule to other programs, please refer to the preamble to the Final MRR.

II. Summary of and Rationale for the Reporting, Recordkeeping and Verification Requirements for Specific Source Categories

A. Electronics Manufacturing

1. Overview of Reporting Requirements

Electronics manufacturing includes, but is not limited to, the manufacture of semiconductors, liquid crystal displays (LCDs), micro-electro-mechanical systems (MEMS), and photovoltaic cells (PV). The electronics industry uses multiple long-lived fluorinated greenhouse gases (fluorinated GHGs) such as perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3), as well as nitrous oxide (N_2O). This proposed rule would apply to electronics manufacturing facilities where emissions from electronics manufacturing processes such as plasma etching, chemical vapor deposition, chamber cleaning, and heat transfer fluid use as well as stationary fuel combustion units equal or exceed 25,000 metric tons of CO_2e per year.[2] In this action, we are proposing methods to estimate emissions from cleaning and etching for semiconductor, LCD, MEMS, and PV manufacture and also methods for estimating N_2O emissions from chemical vapor deposition and other manufacturing processes such as chamber cleaning. We are also clarifying methods for estimating emissions from heat transfer fluids. And lastly, we are proposing methods for reporting controlled emissions from abatement systems.

2. Major Changes Since Initial Rule Proposed

In the initial proposal for electronics manufacturing, we included the following provisions for reporting emissions from electronics manufacture: (1) A capacity-based threshold for semiconductors, LCDs, and MEMS facilities and an emissions-based threshold for PV facilities; (2) methods for estimating fluorinated GHG emissions from etching and cleaning; (3) methods for estimating N_2O emissions during etching and cleaning; (4) methods for verifying destruction or removal efficiency (DRE) of abatement systems; and (5) methods for estimating emissions from heat transfer fluids.

As noted in the preamble to the Final MRR, we received a number of lengthy, detailed comments regarding the electronics manufacturing subpart. In total, we received comments from approximately 10 entities on the proposed rule regarding electronics manufacture. The commenters generally opposed the proposed reporting requirements for large semiconductor facilities and stated that excessive monitoring and reporting were required. For example, commenters asserted that they do not currently collect the data required to report using an IPCC Tier 3

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[2] As discussed further below, EPA is proposing that uncontrolled emissions be used for purposes of determining whether a facility’s emissions are equal to or greater than 25,000 $mtCO_2e$.

approach, and that to collect such data would entail significant burden and capital costs. In most cases, commenters provided alternative approaches to each of the reporting requirements.

We have carefully reviewed the comments, issues, and suggestions raised by stakeholders regarding electronics manufacturing. In response, we are revising our initial proposal and are proposing the following reporting provisions for electronics manufacture: (1) A single emissions-based reporting threshold for all semiconductor, LCD, MEMS, and PV facilities; (2) modified methods for estimating emissions from cleaning and etching activities for semiconductor facilities and other electronics facilities including those that manufacture LCDs, MEMS, and PVs; (3) modified methods for estimating facility N_2O emissions; (4) clarified methods for estimating emissions from heat transfer fluids; and (5) revised methods for reporting controlled emissions from abatement systems.

In the paragraphs below, we summarize the main provisions included in the initial proposal for reporting emissions from electronics manufacturing and we briefly summarize the major changes that are being proposed today. For more detailed information on the initial proposal, *see* the electronics manufacturing section of EPA's proposed MRR (74 FR 16448, April 10, 2009).

Reporting Threshold. In the initial proposal, we proposed a capacity-based threshold, requiring those facilities with emissions equal to or greater than the thresholds to report their GHG emissions. We proposed production capacity-based thresholds of 1,080 m^2, 1,020 m^2, and 236,000 m^2 of substrate for semiconductor, MEMS, and LCD manufacturing facilities, respectively. The capacity-based threshold proposed were equivalent to 25,000 $mtCO_2e$ using the IPCC 2006 Tier 1 default factors and assumed no abatement. Where IPCC 2006 Tier 1 default emission factors were unavailable (*i.e.,* MEMS), the emission factor was estimated based on relevant IPCC Tier 1 emission factors for semiconductor production. Due to a lack of information on use and emissions of fluorinated GHGs for PV manufacture, we proposed an emissions-based threshold of 25,000 $mtCO_2e$ for those facilities. We proposed to use a capacity-based threshold based on the published capacities of facilities, as opposed to an emissions-based threshold, where possible, because we believed that it simplified the applicability determination.

Several commenters stated that the proposed capacity-based threshold created ambiguity. For example, one commenter noted that it was unclear how production capacity was defined as actual manufacturing levels could fluctuate year by year. In response to these comments, we are now proposing a single emissions-based threshold equal to or greater than 25,000 metric tons of CO_2e per year for electronics manufacturing facilities. We have concluded that a single emissions-based threshold will simplify the applicability determination and that by applying the method for determining whether the threshold is met, a facility will be able to quickly determine whether they must report under this rule.

Estimating Emissions from Cleaning and Etching Processes. With respect to estimating emissions from chamber cleaning and etching, in our initial proposal, we outlined two different methods; one method for relatively large semiconductor facilities, and another method for all other semiconductor facilities and LCD, MEMS, and PV facilities required to report. We defined large semiconductor facilities as those facilities with annual capacities of greater than 10,500 m^2 silicon (equivalent to 29 out of 175 total semiconductor manufacturing facilities). For large semiconductor facilities we proposed an approach based on the IPCC Tier 3 method that required the use of company-specific data for (1) gas consumption, (2) gas utilization,[3] (3) by-product formation[4], and (4) DRE for all emissions abatement processes at the facility. As we stated in the initial proposal, we had concluded that large semiconductor facilities were already using Tier 3 methods and/or had the necessary data readily available either in-house or from suppliers to apply the highest Tier method. For smaller semiconductor facilities and LCD, MEMS, and PV facilities, we proposed an approach based on the IPCC Tier 2b method, which required using default emission factors for process utilization, by-product formation, and site-specific DRE measurements.

Comments received in response to our initial proposal stated that the 2006 IPCC Tier 3 method would be overly burdensome for semiconductor manufacturers and that process-specific emission factors do not exist for many tools and processes. The commenters noted that most semiconductor facilities do not track gas consumption by tool or process-type and that currently, only one large semiconductor company uses the Tier 3 method. Generally, commenters requested the use of the 2006 IPCC Tier 2b method.

In response to these comments, we are now proposing the use of a "Refined Method" for estimating these emissions from semiconductor facilities. Our revised methodology includes a simpler approach to estimating emissions from cleaning and etching as compared to the Tier 3 method that was initially proposed for larger semiconductor facilities. To this end, we estimate that our proposed methodology will result in a reduction in burden compared to the Tier 3 method for those facilities previously defined as large semiconductor facilities, and an improvement in accuracy of the emissions estimate as compared to the 2006 IPCC Tier 2b method. Furthermore, since we anticipate that all semiconductor facilities already have, or have ready access to, the information required by this proposed methodology, we are also proposing to require all semiconductor facilities required to report to estimate emissions using the Refined Method. We have concluded the method we are proposing is the most appropriate method taking into account both the cost to the reporter as well as accuracy of emissions achieved.

For LCD, MEMS, and PV facilities, in this action we are proposing to require an approach based on a slightly modified 2006 IPCC Tier 2b method which would include (1) gas-and facility-specific heel factors (consistent with the requirements we are proposing for semiconductor facilities), (2) gas consumption apportioned to 2006 IPCC Tier 2b process categories (*i.e.* clean and etch), (3) default factors consistent with the 2006 IPCC Tier 2b factors, and (4) methods for reporting controlled emissions from abatement systems (as proposed below). The main difference between the method proposed in this revised proposal and in the initial proposal is the addition of a gas-and facility-specific heel factor to determine overall gas consumption. We did not receive any comments on the Tier 2b method that we proposed for LCD, MEMS, and PV facilities in our initial proposal. We are proposing to add the requirement of gas-and-facility specific

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[3] For purposes of electronics manufacturing, we are using the term "gas utilization" to describe the fraction of input N_2O or fluorinated GHG converted to other substances during the etching, deposition, and/or chamber/wafer cleaning processes. Gas utilization is expressed as a rate or factor for specific manufacturing processes. "Utilization" should not be confused with "use;" "use" refers to gas consumption or the quantity of gas fed into process at an electronics manufacturing facility.

[4] For purposes of electronics manufacturing, "by-product formation" is the quantity of fluorinated GHGs created during electronics manufacturing processes. Fluorinated GHG by-products may also be formed by abatement devices.

heel factors based on comments received from semiconductor facilities in response to the initial proposal. It is our understanding that LCD, MEMS, and PV facilities have the data required to develop a gas-and-facility specific heel factors and that it can be implemented with minimal burden.

Estimating Facility N_2O Emissions. In our initial proposal, our approach required that facilities estimate annual N_2O emissions using a simple mass-balance method. This method assumed that all N_2O consumed is emitted (*i.e.,* not converted or destroyed). We also requested comment on utilization factors for N_2O as well as on data on N_2O by-product formation.

In response to our initial proposal, we received comments that clarified that N_2O is used primarily in the chemical vapor deposition process. Commenters opposed our proposed method for estimating N_2O emissions, which assumed 100 percent N_2O used is emitted, and asserted that semiconductor facilities should be permitted to use measured N_2O emission factors where these factors were measured using methods consistent with the December 2006 International SEMATECH Manufacturing Initiative's Guideline for Environmental Characterization of Semiconductor Process Equipment (2006 ISMI Guidelines). Commenters also noted that facilities that have not developed N_2O emission factors should be allowed to use a default emission factor of 60 percent, reflecting N_2O utilization of 40 percent.[5] Lastly, commenters asserted that those companies that have a measured DRE for N_2O abatement be allowed to apply these DREs in the emission estimates.

We are now proposing two methods for estimating N_2O emissions from electronics manufacturing: one for estimating N_2O emissions from chemical vapor deposition and another for estimating N_2O emissions from all other manufacturing processes such as chamber cleaning.

Reporting Controlled Emissions From Abatement Systems. The emissions estimation method originally proposed accounted for destruction by abatement systems only if facilities verified the performance of their systems using one of two methods. In particular, we proposed to require that the DRE be verified by either (1) measurement by the facility using the methods described in EPA's Protocol for Measuring Destruction or Removal Efficiency of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing (EPA's DRE Protocol), or (2) purchase by the facility of abatement systems that were tested by a third party using a standard protocol such as EPA's DRE Protocol.

We also proposed to require that facilities use the systems within the manufacturer's specified system lifetime, operate the system within the manufacturer specific limits for the gas mix and exhaust flow rate intended for the fluorinated GHG destruction, and maintain the equipment according to the manufacturer's guidelines.

In response to the initial proposal, commenters were generally opposed to EPA's initial approach for measuring DRE, noting that according to the *Results of the ISMI ESH Technology Center Greenhouse Gas Facility Survey,* less than one percent of installed abatement systems have been properly tested using the draft EPA Protocol and that generally, facilities use the IPCC default factors or manufacturer-supplied measurements. In addition, commenters were also opposed to EPA's proposed requirement that facilities rely on manufacturer-specified system lifetime as properly maintained and serviced abatement systems can last beyond the manufactures' specified lifetime. For purposes of this reporting rule, we are now proposing that facilities that wish to document and report fluorinated GHG and N_2O emissions reflecting the use of abatement systems adhere to a method that would require (1) documentation to certify that the abatement device is installed, operated, and maintained according to manufacturers' specifications, (2) accounting for the system's uptime, and (3) either certification that the abatement system is specifically designed for fluorinated GHG and N_2O abatement and the use of EPA default DRE value, or directly and properly measured DRE (*i.e.,* in accordance with EPA DRE Protocol) confirming abatement system's performance.

Estimating Emissions from Heat Transfer Fluids. To estimate the emissions from heat transfer fluids we proposed to require that electronics manufacturers use the 2006 IPCC Tier 2 approach, which is based on a mass-balance method. As we stated in the initial proposal, the 2006 IPCC Tier 2 approach uses company-specific data and accounts for differences among facilities' heat transfer fluids, leak rates, and service practices.

In comments we received on our initial proposal, it was noted that our proposed method for estimating emissions from heat transfer fluids would require companies to compile a detailed inventory of all fluorinated heat transfer equipment and its nameplate capacity. Comments stated that such a mass balance approach would be overly burdensome.

In evaluating these comments, we believe that there was some confusion regarding our intended method. As a result, we are not changing the broad outlines of our initial proposal, but we are clarifying required data elements.

3. Definition of the Source Category

The electronics industry uses multiple long-lived fluorinated GHGs such as PFCs, HFCs, SF_6, and NF_3, as well as N_2O, during manufacturing of semiconductors, LCDs, MEMS, and PV. We understand that there are other electronics manufacturers such as those facilities that manufacture light-emitting diodes (LEDs) and disk readers that use fluorinated GHGs in similar manufacturing processes as semiconductors. As a result, we are seeking information on fluorinated GHG and N_2O emissions associated with the manufacture of these products and also comment on whether to include them as part of the electronics manufacturing source category. It is our intent to include these other sources as part of the electronics manufacturing source category in the final rule where their emissions meet or exceed our proposed threshold of 25,000 $mtCO_2e$.

Fluorinated GHGs are used for plasma etching of silicon materials, cleaning deposition tool chambers, and wafer cleaning. N_2O is also used in depositing certain films and chamber cleaning. Additionally, electronics manufacturing employs fluorinated GHGs (typically liquids at ambient temperature) as heat transfer fluids. The most common fluorinated GHGs in use for these purposes are CHF_3 (HFC–23), CF_4, C_2F_6, NF_3, SF_6 and Fluorinert™ and Galden® heat transfer fluids; other compounds such as perfluoropropane (C_3F_8) and perfluorocyclobutane (c-C_4F_8) are also used in smaller quantities (EPA, 2008a). Table 3 of this preamble presents fluorinated GHGs typically used during manufacture of electronics devices.

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[5] The 40% utilization rate (60% emission factor) was identified based on a survey of industry conducted by ISMI and provided in comments in response to the initial proposal.

TABLE 3—EXAMPLES OF FLUORINATED GHGS USED BY THE ELECTRONICS INDUSTRY

Product type	Fluorinated GHGs used during manufacture
Electronics (*e.g.,* Semiconductor, MEMS, LCD, PV)	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 Heat Transfer Fluids (CF3–(O–CF(CF3)–CF2)n-(O–CF2)m-O–CF3, CnF2n+2, CnF2n+1(O)CmF2m+1, CnF2nO, (CnF2n+1)3N) [a]

[a] IPCC Guidelines do not specify the fluorinated GHGs used for MEMS production. Literature reviews revealed that among others CF_4, SF_6, and the Bosch process (consisting of alternating steps of SF_6 and c-C_4F_8) are used to manufacture MEMS. For further information, *see* the Electronics Manufacturing TSD in the docket for this rulemaking (EPA–HQ–OAR–2009–0927).

Description of Electronics Manufacturing Processes and Activities. Fluorinated GHG and N_2O emissions result from the following electronics processes and activities:

(1) Plasma etching;
(2) Chemical vapor deposition;
(3) Chamber cleaning;
(4) Wafer cleaning; and
(5) Heat transfer fluid use.

Plasma etching, essential to fabricating intricate, nanometer size features in contemporary electronic devices, is the removal of solid material from a substrate surface with gaseous reactants, in plasma, to produce gaseous products, which are then pumped away and disposed. Unless abated, unreacted fluorinated reactants or fluorinated GHG by-products from etching are emitted into the atmosphere.

Typical fluorinated GHG etching reagents, used either individually or in combination, are CF_4, CHF_3, C_2F_6 and c–C_4F_8 for silicon dioxide and nitride films; CF_4, NF_3 and SF_6 for polysilicon films; and CHF_3 for aluminum and SF_6 for tungsten films. A typical fluorinated GHG by-product from etching processes is CF_4; in some instances C_2F_6 may also be formed.

Deposition is a fundamental step in the fabrication of a variety of electronic devices. During deposition, layers of dielectric, barrier, or electrically conductive films are deposited or grown on a wafer or other substrate. Chemical vapor deposition enables the deposition of dielectric or metal films. During the chemical vapor deposition process, gases that contain atoms of the material to be deposited react on the wafer surface to form a thin film of solid material. Films deposited by chemical vapor deposition may be silicon oxide, single-layer crystal epitaxial silicon, amorphous silicon, silicon nitride, dielectric anti-reflective coatings, low k dielectric, aluminum, titanium, titanium nitride, polysilicon, tungsten, refractory metals or silicides. Nitrous oxide may be the oxidizer of choice during deposition of silicon oxide films.

Chambers used for depositing polysilicon, dielectric and metal films are cleaned periodically using fluorinated GHGs, N_2O, and other gases. During the cleaning cycle, the gas is converted to fluorine atoms in plasma, which etches away residual silicon-containing material from chamber walls, electrodes, and chamber hardware. Undissociated fluorinated gases and other fluorinated and non-fluorinated products pass from the chamber to waste streams and, unless emissions control systems are employed, into the atmosphere.

Typical fluorinated GHGs used for chamber cleaning are NF_3, C_2F_6 and C_3F_8. N_2O may also be used to reduce particle formation during chamber cleaning. As with etching films, fluorinated GHG by-products may be formed during chamber cleaning, typically CF_4.

During wafer processing, any residual photoresist material can be removed through an ashing process, which consists of placing partially processed wafers in an oxygen plasma to which CF_4 may be added. The edges of wafers (the bevel) may require additional cleaning to remove yield-reducing residual material. Bevel cleaning may also use a plasma process with fluorinated gas chemistry. In both of these wafer cleaning processes, unused fluorinated GHGs are emitted unless abated.

Fluorinated GHG liquids (at ambient temperature) such as fully fluorinated linear, branched or cyclic alkanes, ethers, tertiary amines and aminoethers, and mixtures thereof are used as heat transfer fluids at several semiconductor facilities to cool process equipment, control temperature during device testing, and solder semiconductor devices to circuit boards. The fluorinated heat transfer fluid's high vapor pressures can lead to evaporative losses during use.[6]

Our understanding is that heat transfer fluids are widely used within semiconductor manufacturing. We are seeking comment on the extent of use and annual replacement quantities of heat transfer fluids in other electronics sectors, such as their use for cooling or cleaning during LCD manufacture.

Total U.S. Emissions From Electronics Manufacturing. Emissions of fluorinated GHGs from 216 electronics facilities were estimated to be 6.1 million metric tons CO_2e in 2006. Below is a breakdown of emissions by electronics product type.

Semiconductors. Emissions of fluorinated GHGs, including heat transfer fluids, from 175 semiconductor facilities were estimated to be 5.9 million metric tons CO_2e in 2006. Of the total estimated semiconductor emissions, 5.4 million metric tons CO_2e are from etching/chamber cleaning and 0.5 million metric tons CO_2e are from heat transfer fluid usage.

MEMS. Emissions of fluorinated GHGs from 12 MEMS facilities were estimated to be 0.1 million metric tons CO_2e in 2006.

LCDs. Emissions of fluorinated GHGs from 9 LCD facilities were estimated to be 0.02 million metric tons CO_2e in 2006.

PV. Emissions of fluorinated GHGs from 20 PV facilities were estimated to be 0.07 million metric tons CO_2e in 2006. We request comment on the number and capacity of PV facilities that employ thin film technologies (*i.e.,* amorphous silicon) and other PV manufacturing facilities in the United States using fluorinated GHGs.

For additional background information on the electronics industry, refer to the Electronics Manufacturing Technical Support Document (TSD) in the docket for this rulemaking (EPA–HQ–OAR–2009–0927).

4. Threshold for Reporting

For facilities that manufacture semiconductors, LCD, MEMS, and PV, we are proposing an emissions-based threshold of 25,000 $mtCO_2e$. Consistent with other sections of the Final MRR, EPA is proposing that for the purposes of determining whether a facility emits amounts equal to or greater than 25,000 $mtCO_2e$, a facility must include emissions from all source categories for which methods are provided in the rule. For purposes of the threshold determination under subpart I, we are proposing two different methods, depending on whether the facility

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[6] Electronics Manufacturing TSD (EPA–HQ–OAR–2009–0927); 2006 IPCC Guidelines.

manufacturers semiconductors, MEMS, LCDs or PVs (*see* proposed section 98.91). It is important to note that these methods are only for determining whether a facility exceeds the threshold; the proposed methods required for monitoring and reporting emissions data are presented in section 5 below.

To determine whether a manufacturer falls above or below the proposed 25,000 $mtCO_2e$ threshold, we are proposing that semiconductor, MEMS, and LCD facilities use gas specific emission factors assuming 100 percent manufacturing capacity to calculate annual metric tons of emissions in CO_2 equivalents. Because we understand that heat transfer fluids are widely used within semiconductor manufacturing, we are proposing that semiconductor manufacturers add 10 percent of total clean and etch emissions at a facility to their estimate. For applicability purposes, we propose that manufacturing capacity means the facility's full planned design capacity.

The gas specific emission factors we are proposing to use for threshold applicability for semiconductors and LCD facilities are consistent with the 2006 IPCC Tier 1 emission factors. For MEMS, because there are no IPCC factors available, we are assuming that SF_6 accounts for 100 percent of the sector's total emissions. The emission factor we are proposing for threshold applicability is based on the assumption that the MEMS SF_6 emission factor is equivalent to the IPCC Tier 1 SF_6 emission factor for semiconductors, scaled up by a factor of 5.[7]

We are proposing that PV facilities multiply annual fluorinated GHG purchases or consumption by the gas-appropriate 100-year GWPs, as defined in Table A–1 of subpart A of part 98, to calculate annual metric tons of emissions in CO_2 equivalents. None of these calculations would account for emission abatement systems.

We are proposing to require an emissions estimating method that does not account for destruction by abatement systems because actual emissions from facilities employing abatement systems may exceed estimates when based on the manufacturers' rated DREs of the equipment and may therefore exceed the 25,000 $mtCO_2e$ threshold without the knowledge of the facility operators. When abatement equipment is used, electronics manufacturers often estimate their emissions using the manufacturer-supplied DRE for the system. However, an abatement system may fail to achieve its rated DRE either because it was not installed properly, is not being properly operated and maintained, or because the DRE value itself was incorrectly measured due to a failure to properly account for the effects of dilution. For example, reported DREs for CF_4 can be overstated by as much as a factor of 20 to 50, and the corresponding figure for C_2F_6 can be overstated by a factor of up to 10 because of failure to properly account for dilution (Burton, 2007).

In our analysis of the emissions thresholds, we considered thresholds of 1,000 $mtCO_2e$, 10,000 $mtCO_2e$, 25,000 $mtCO_2e$, and 100,000 $mtCO_2e$ per year. To estimate the number of semiconductor facilities that would have to report under each of the various thresholds, we estimated emissions for each facility in the U.S. by using IPCC Tier 1 emission factors. These emissions estimates were then evaluated to determine how many facilities would meet the various thresholds. To estimate the collective emissions from the facilities that would have to report under the various thresholds, we used information from EPA's PFC Reduction/Climate Partnership for Semiconductors and the EPA PFC Emissions Vintaging Model.

To estimate the number of LCD and PV facilities that would have to report under the various thresholds, as well as the collective emissions from these facilities, we used IPCC Tier 1 emission factors. Because IPCC emission factors for MEMS are not available, the number of facilities that would have to report and the collective emissions from these facilities were determined using an emission factor based on a relevant IPCC Tier 1 emission factor for semiconductor production.[8] All of our analyses assumed no abatement.

Table 4 of this preamble shows emissions and facilities that would be captured by the respective emissions thresholds.

TABLE 4—THRESHOLD ANALYSIS FOR ELECTRONICS INDUSTRY

Emission threshold level metric tons CO_2e/yr	Total national emissions	Total number of facilities	Emissions covered		Facilities covered	
			metric tons CO_2e/yr	Percent	Facilities	Percent
1,000	5,984,463	216	5,962,091	99.6	165	76
10,000	5,984,463	216	5,813,200	97	114	53
25,000	5,984,463	216	5,622,570	94	94	44
100,000	5,984,463	216	4,737,622	79	55	26

We selected the 25,000 $mtCO_2e$ per year threshold because it maximizes emissions reporting, while excluding small facilities that do not contribute significantly to the overall GHG emissions.

Table 5 of this preamble shows the estimated emissions and number of facilities that would report for each type of source under the proposed emissions-based thresholds.

TABLE 5—SUMMARY OF RULE APPLICABILITY UNDER THE PROPOSED THRESHOLDS

Emissions source	Threshold	Total national facilities	Total emissions of source (metric tons CO_2e)	Emissions covered		Facilities covered	
				metric tons CO_2e/yr	Percent	Facilities	Percent
Semi-conductors	25,000 Mt CO_2 Eq.	175	5,741,676	5,492,066	96	91	52

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

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

TABLE 5—SUMMARY OF RULE APPLICABILITY UNDER THE PROPOSED THRESHOLDS—Continued

Emissions source	Threshold	Total national facilities	Total emissions of source (metric tons CO_2e)	Emissions covered		Facilities covered	
				metric tons CO_2e/yr	Percent	Facilities	Percent
MEMS	25,000 Mt CO_2 Eq.	12	146,115	96,164	66	2	17
LCD	25,000 Mt CO_2 Eq.	9	23,632	0	0	0	0
PV	25,000 Mt CO_2 Eq.	20	73,039	34,340	47	1	5

The proposed emissions-based thresholds are estimated to include approximately 50 percent of semiconductor facilities and between approximately 5 percent and 17 percent of the facilities manufacturing PV and MEMS, respectively. At the same time, the thresholds are expected to cover nearly 96 percent of fluorinated GHG emissions from semiconductor facilities, 66 percent of fluorinated GHG emissions from facilities manufacturing MEMS, and 47 percent of fluorinated GHG emissions from facilities manufacturing PV. Combined, these emissions are estimated to account for close to 94 percent of fluorinated GHG emissions from the electronics industry as a whole.

Based on our current analysis, facilities manufacturing LCDs are not expected to meet the proposed threshold. In addition, only 2 MEMS facilities and 1 PV facility are expected to be covered. The data and information that we currently have on MEMS, LCD, and PV manufacturing, however, is limited and incomplete. We are including these sectors because they have similar fluorinated GHG and N_2O use and manufacturing processes as those of semiconductor manufacturing and they are high growth sectors. We estimate that emissions from MEMS, LCD, and PV may be higher than our data show currently and we expect them to increase in the future.

For additional background information on the threshold analysis, refer to the Electronics Manufacturing TSD. For specific information on costs, including unamortized first year capital expenditures, please refer to the EIA and the EIA cost appendix.

5. Selection of Proposed Monitoring Methods

We are proposing methods to monitor and estimate fluorinated GHG and N_2O emissions from semiconductor, LCD, MEMS, and PV manufacture. The proposed methods discussed below include the following: (a) Estimating emissions from cleaning and etching processes; (b) estimating facility N_2O emissions; (c) estimating emissions from heat transfer fluids; and (d) reporting controlled emissions from abatement equipment. The methods described and proposed in this section are for estimating emissions that would be required to be reported under this subpart (*see* proposed sections 98.93 and 98.94). It is important to note that these methods differ from those proposed in the section above which are for determining applicability of the subpart.

a. Methods for Estimating Emissions From Cleaning and Etching Processes

We are proposing different methods for estimating fluorinated GHG emissions from etching and cleaning based on whether the facility is a semiconductor manufacturer or an LCD, MEMS, or PV manufacturer.

Method for Semiconductor Facilities. Under this proposal, all semiconductor manufacturers that have emissions equal to or greater than 25,000 mtCO_2e would be required to estimate and report emissions from etching and cleaning using one of two approaches. First, we are proposing an approach, hereinafter referred to as the “Refined Method,” that is based on:

(1) Gas consumption as calculated using the facility’s purchase records, inventory, and gas- and facility-specific heel factors,

(2) Facility-specific methods for apportioning gas consumption by process category[9] using indicators of GHG-using activity (*e.g.,* wafer passes),

(3) Emission factors for utilization and by-product formation rates based on refined process categories (*e.g.,* categories with more specificity than the simpler cleaning and etching categories listed in the 2006 IPCC Guidelines), and

(4) Methods for reporting controlled emissions (as proposed below).

Alternatively, we are proposing to permit those facilities that have monitoring infrastructure or the necessary data to estimate emissions obtained through recipe-specific measurements to report their emissions using their data by following an approach consistent with the 2006 IPCC Tier 3 method. In addition, for those semiconductor manufacturers that fabricate electronic devices on wafers of measuring greater than 300 mm in diameter, we are proposing to require that they estimate and report their emissions using recipe-specific measurements and follow an approach consistent with the IPCC Tier 3 method. Each of these approaches is discussed below.

Refined Method.

The Refined Method would apply to all covered semiconductor facilities and would not make a distinction between relatively large and other facilities. In the paragraphs below, we discuss in detail each one of the components we are proposing to require under this approach.

Gas consumption as calculated using the facility’s purchase records, inventory, and gas- and facility-specific heel factors. Notwithstanding the definition of “heel” in subpart A of this rule,[10] we are proposing that for purposes of electronics manufacturing that a heel means, “the amount of gas that remains in a gas cylinder or container after it is discharged or off-loaded (this may vary by cylinder or container type and facility).” We are not planning to use the subpart A definition because it contains a default value of 10 percent. In this action, we are proposing to require facilities to calculate gas- and facility-specific heel factors rather than using a default value.

As part of determining each facility’s overall usage of each gas for a reporting period, we are proposing that a facility use their purchase records, inventory, and gas- and facility-specific heel factors. More specifically, for each cylinder/container type for each gas used, we are proposing that semiconductor facilities be required to base their heel factors on the residual

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[9] For purposes of electronic manufacturing, “process category” is a set of similar manufacturing steps, performed for the same purpose, associated with substrate (*e.g.,* wafer) processing during device manufacture for which fluorinated GHG and N_2O emissions and fluorinated GHG and N_2O usages are calculated and reported.

[10] Pursuant to subpart A of the Final MRR, “heel” means the amount of gas that remains in a shipping container after it is discharged or off-loaded (that is no more than ten percent of the volume of the container).

weight or pressure of the gas cylinder or container that a facility uses to change out that cylinder/container. This is common practice in the industry and is typically referred to as the "trigger point for change out." These points, one for each gas and cylinder/container type, together with the initial container mass or pressure, are used to calculate the unused gas for each container, which when expressed as a fraction of the initial amount in the container is the "heel" (or unused fraction of the container). This gas- and facility-specific heel factor would then be applied to each container for that gas to determine the net amount of that gas used at a facility. In cases where the "trigger point for change out" used at a facility differs by more than one percentage point from that used to calculate the previous gas-specific heel factor, we propose that the gas- and facility-specific heel factor must be recalculated.

Currently most semiconductor facilities rely upon the IPCC default heel factor of 10 percent and apply that value to each cylinder/container. Based on information provided in an industry study of facility-specific, gas-specific heel factors, the heel factor in a given facility for individual cylinders/containers can vary from 3 percent to 25 percent. Given this variation, we conclude that gas- and facility-specific heel factors would provide improved accuracy in emissions estimates over the use of the IPCC default heel factor.

We understand that there are exceptional circumstances when facilities do not always change cylinders/containers exactly when they reach the targeted residual weight or pressure. In those instances, which we expect are infrequent, we are proposing that the cylinder/container must be weighed or the pressure measured using a pressure gauge; as opposed to using the facility-wide gas-specific heel factor as part of determining the net amount of gas used at a facility. We are proposing to define an exceptional circumstance as one which the cylinder/container is changed at a residual mass or pressure that differs by more than 20 percent from the "trigger point for change out." We request comment on the frequency of these exceptional circumstances and also the percentage difference (*i.e.* 20 percent) for which we are proposing to require that the exceptional cylinder/container be weighed or the pressure measured.

When taking an annual inventory, we understand that multiple cylinders/containers are in service. We request comment on the significance of accounting for the quantity of fluorinated GHGs or N_2O remaining in cylinders/containers in service at the end of the reporting period. We also request comment and detailed information on other methods and technologies (*i.e.* other than purchase records) that facilities may be using for determining annual gas consumption (*e.g.,* recorded data from an automated gas inventory system).

We are proposing that all flowmeters, weigh scales, pressure gauges, and thermometers used to measure quantities that are monitored or used in calculations in this proposal have an accuracy and precision of 1 percent of full scale or better. We request comment on this requirement including alternative accuracy and precision requirements and detailed information about why particular instruments can not meet the proposed 1 percent standard.

Apportioning gas consumption to process categories. Estimating facility emissions requires apportioning annual facility-wide gas consumption across a facility's emitting process categories by way of applying facility-specific apportioning factors. A facility's uncontrolled emissions are the product of that apportioned gas consumption and the corresponding emission factor. To determine the share of each gas used by each process category, we are proposing to require that semiconductor facilities use a quantifiable indicator (or metric) of gas usage activity. More specifically, we are proposing facilities track wafer passes as an indicator of activity with which to apportion the facility's gas consumption. Wafer passes is a count of the number of times a silicon wafer is processed for a specific process category. The total number of wafer passes over a reporting year is the number of wafer passes per tool times the number of operational process tools during the reporting year.

To illustrate a case where wafer passes is used as a facility-specific engineering model, consider a facility that uses NF_3 for chamber cleaning with remote plasma systems and for etching polysilicon and oxide films. With knowledge of the NF_3-specfic heel and the number of NF_3 containers used, the facility knows the amount of NF_3 consumed. To estimate emissions, the facility must now apportion NF_3 usage between the chamber cleaning and oxide and polysilicon etching processes. To do this it might use the total number of wafer passes through each and every NF_3-cleaning system together with the time and nominal (not measured actual) gas flow rate for each and every NF_3-cleaning system and the corresponding figures for oxide and polysilicon etch processes to arrive at the proportion of NF_3 used for cleaning chambers and etching oxide and polysilicon films. Once developed, these apportioning factors would be used to estimate NF_3 gas usage for the cleaning and etching process categories proposed in our method. This example is illustrated further in Table 6 of this preamble.

TABLE 6—ILLUSTRATIVE CALCULATION FOR NF_3 EXAMPLE AT ONE FACILITY

Gas type—annual usage, kg.	Process category	Apportioning factor	Process category gas usage, kg.
NF_3—56,286 kg	RPS Chamber Cleaning	82%	46,202
	Polysilicon Etch	17%	9,561
	Oxide Etch	1%	523

Annual gas usage presented is the modeled usage not the nominal usage.

We request comment on using wafer passes as an appropriate quantifiable indicator of activity, and on our description and example of how it would be used.

We recognize that facilities may use other types of quantifiable indicators of gas-usage activity data to develop facility-specific engineering models to estimate gas consumption. We may include additional indicators as options in the final rule if they are quantifiable and if we receive adequate information regarding how they were developed and how they are used, including descriptions, examples, and any additional information that may be necessary to understand how such indicators of activity would be developed and used in a facility-specific engineering model to apportion annual facility-wide gas usage across a facility's emitting process categories. The use of engineering judgment, for example, is not based on a quantitative metric and would not be considered an acceptable quantifiable indicator of gas usage. We also request comment on the use of a representative sampling method for tracking activity indicators such as wafer passes that may be used in the engineering model.

In many cases, EPA anticipates that the development of apportioning factors will result in a facility-wide consumption estimates that are independent of the estimates calculated using purchase records, inventory, and facility-specific heel factors. In such cases, we propose that facilities report these consumption estimates.

Emission factors for refined process categories. We are proposing that semiconductor facilities estimate their emissions using a specific set of process categories. Our proposed method would simplify the reporting requirements as compared to the 2006 IPCC Tier 3 method by lowering the number of emitting process categories from up to 455 per facility down to a fixed figure of approximately nine. Our goal in establishing the process categories is to account for most of the variability in emission factors across processes while limiting the total number of process categories whose gas usage must be tracked by semiconductor facilities.

Under this approach, we are proposing to require reporting of fluorinated GHG emissions for the following nine emitting process categories: four subcategories for wafer patterning (etching), three subcategories for chamber cleaning, and two subcategories for wafer cleaning. The nine process categories we are proposing account for distinct and widely-used manufacturing activities during production of discrete, logic and memory devices. We anticipate that these nine categories effectively capture current and projected processes and the differences in emission factors across various semiconductor manufacturing technologies.

Our proposed definitions of these nine emitting categories are:

Wafer patterning subcategories:

Oxide etch means any process using fluorinated GHG reagents to selectively remove SiO_2, SiO_x-based or fully organic-based thin-film material that has been deposited on a wafer during semiconductor device manufacturing.

Nitride etch means any process using fluorinated GHG reagents to selectively remove 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 can be some other element such as carbon) that has been deposited on a wafer during semiconductor manufacturing.

Silicon etch also often called *polysilicon etch* means any process using fluorinated GHG reagents to selectively remove silicon during semiconductor manufacturing.

Metal etch means any process using fluorinated GHG reagents associated with removing metal films (such as aluminum or tungsten) that have been deposited on a wafer during semiconductor manufacturing.

Chamber cleaning subcategories:

In situ plasma means cleaning thin-film production chambers, after processing one or more wafers, with a fluorinated GHG cleaning reagent that is dissociated into its cleaning constituents by a plasma generated inside the chamber where the film was produced.

Remote plasma system means cleaning thin-film production chambers, after processing one or more wafers, with a fluorinated GHG cleaning reagent dissociated by a remotely located (*e.g.,* upstream) plasma source.

In situ thermal means cleaning thin-film production chambers, after processing one or more wafers, with a fluorinated GHG cleaning reagent that is thermally dissociated into its cleaning constituents inside the chamber where the thin-film (or thin films) was (were) produced.

Wafer cleaning subcategories:

Bevel cleaning means any process using fluorinated GHG reagents with plasma to clean the edges of wafers during semiconductor manufacture.

Ashing means any process using fluorinated GHG reagents with plasma to remove photoresist materials during wafer manufacture.

We request comment on the nine process categories we are proposing, their definitions as specified above, and whether they clearly define a specific process without ambiguity. In addition we request comment on whether the categories should be further refined to better capture the variability in emission rates among fluorinated GHG using manufacturing activities (*e.g.,* whether any additional categories should be added or whether the proposed categories should be combined, and the definition of those categories).

Under this approach of defining a specific set of process categories, we are also considering additional patterning and chamber cleaning subcategories. The alternative patterning subcategories, which may replace or complement the four thin-film based subcategories defined previously, are: contact etch, self-alignment contact etch, gate etch, deep trench etch, isolation trench etch, through silicon vias and regular vias. Each of these subcategories represents a specific feature achieved through etching (instead of subcategories based on the type of thin film etched).

Alternative chamber cleaning categories may distinguish between the types of films being removed from the chamber during cleaning. These might include distinguishing between chambers coated with tungsten and silicon-based films, or distinguishing between thin-film deposition equipment manufacturers. We request comment on these additional process categories and whether or not we should include alternative process categories in addition to the nine process categories that we are proposing. We also request comment on other methods of categorizing processes and detailed information on those categories.

We are proposing nine process categories differentiated by production technology generation (*i.e.,* wafer size). For each of the proposed nine process categories, we are proposing to establish a default emission factor within a range of values presented in Tables I–6, I–7, I–8 of subpart I. Within each process category, factors account for (1) the mass fraction of the input gas that is utilized during (*i.e.,* not emitted from) the process and (2) the mass of each fluorinated GHG by-product formed as a fraction of the mass of the dominant fluorinated GHG input gas used.[11] EPA is proposing a range of values for each default emission factor because the Agency has not yet received sufficient data to select a specific value within each range.

To develop the proposed ranges for each emission factor, EPA requested from semiconductor device manufacturers and equipment suppliers, information on utilization and by-product formation rates and details on the associated measurement approach (*e.g.,* measured in accordance with the 2006 ISMI Guidelines). EPA evaluated the data received as well as the standard deviations provided in Table 6.9 from Chapter 3 of the 2006 IPCC Guidelines. For additional information on how the ranges were developed, please refer to the Electronics Manufacturing TSD (EPA–HQ–OAR–2009–0927).

In a final rule, EPA intends to publish default emission factors for gas utilization and by-product formation rates for each process category,

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[11] In the case of mixtures of fluorinated GHGs, the "dominant" fluorinated GHG constitutes the largest mass of gas used for that process.

differentiating amongst 150 mm, 200 mm and 300 mm wafer technology to the extent feasible. To this end, EPA requests additional utilization and by-product formation rates and supporting information on how they were developed. More specifically, EPA requests emission factors and by-product formation rates and information including but not limited to the specific measurement method used (*e.g.,* measurement using the 2006 ISMI Guidelines), the date of measurement, achievement of fluorine mass balance, associated standard deviations of measured factors, the relevant emissions process types and categories (for the patterning/etching process type noting both film type and etched feature where applicable), substrate size (*i.e.,* 150 mm, 200 mm, or 300 mm), the number of wafers used in the measurement study, and the equipment manufacturer name and model number where not considered confidential.

Using additional data received, EPA intends to develop default emission factors for each process category using a method of aggregation similar to the 2006 IPCC factor development methodology.[12] Where available emission factor data are very limited or produce highly uncertain average factors, EPA may develop emissions factors that are conservative and less likely to underestimate actual emissions. If additional data are received in a timely fashion, EPA may develop draft emission factors prior to issuance of the final rule and will determine an appropriate way to promptly and clearly inform the regulated community. We welcome comments on such draft emission factors, recognizing that depending on when the emission factors are made available, such comments could be submitted after the close of the formal comment period. We will make every effort to consider such comments, including late comments, to the extent practicable in the development of the final rule.

In developing emission factors for the final rule, EPA is also considering developing weighted average emission factors, for each wafer technology, with the weights based on the market penetration rates of process recipes used in current device manufacturing practices.[13] Such weighted emission factors, if possible, may better represent actual emissions from installed manufacturing equipment and operating processes. We request comment on using a weighting scheme and detailed information on how it would be developed and implemented.

The uncertainties associated with the 2006 IPCC Tier 2b method are associated with aggregating, for each gas, all usage into just two process categories (*i.e.,* etching and chamber cleaning) and all wafer technologies (*i.e.,* 150 mm, 200 mm, and 300 mm wafer sizes) into one, and giving equal weights to all process recipes. A method based on refined processes categories keeps those processes separate, which reflects actual device manufacturing practices and as a result, produces a more representative and accurate emissions estimate.

As an alternative, we are also considering an approach where each facility would develop for themselves or acquire from process equipment manufacturers emission factors (*i.e.,* gas utilization and by-product formation rates) for the nine process categories. Under this approach, we would require the gas utilization and by-product formation rates to be developed using the 2006 ISMI Guidelines. Facilities would be required to construct and apply averages for each process category. One advantage of this approach is that these facility-specific emission factors would be expected to be more representative of the particular processes at that facility than the default emission factors. On the other hand, we estimate the burden associated with each facility developing its own emission factors would be greater compared to using the factors published by EPA. We request comment on this approach.

We recognize that given the dynamic manufacturing processes by the industry, updates to the process categories and emission factors may be necessary. We request comment on the frequency with which those should be updated.

We estimate that our Refined Method will result in a reduction in burden for the large semiconductor facilities (annual capacities greater than 10,000 m ^{2} silicon) and an increase in accuracy as compared to the IPCC Tier 2b method. We estimate the uncertainty from using a set of refined process categories to be roughly one-half the uncertainty of the Tier 2b method, assuming similar methods for apportioning gas usage for each method. For the Tier 2b method the fluorinated GHG consuming processes used during semiconductor production are collapsed into just two categories, resulting in considerable variability for each category. For the Refined Method there are nine fluorinated GHG-using categories, resulting in less variability, on average, per category. Please refer to the Electronics Manufacturing TSD for a more detailed discussion of our uncertainty analysis.

For the relatively smaller semiconductor facilities (annual production of less than 10,500 m ^{2} of silicon) we estimate an increase in burden as compared to our initial proposal where we required the use of the 2006 IPCC Tier 2b method; however, we anticipate that these facilities have the necessary data available to comply. The increase in burden for estimating emissions using the Refined Method, as opposed to the IPCC Tier 2b method, can be attributed to the increased level of effort to distinguish between nine refined process categories in comparison to two broad clean and etch categories, respectively.

Recipe-specific measurements. As an alternative to the Refined Method where EPA default factors would be used, we are also proposing to permit those facilities that have monitoring infrastructure or the necessary data to estimate emissions obtained through recipe-specific measurements to report their emissions using their data (*see* proposed sections in 98.93 98.94(d)). This approach, consistent with the 2006 IPCC Tier 3 method, is based on (1) gas consumption as calculated using the facility's purchase records, inventory, and gas-and facility-specific heel factors (as described above), (2) facility-specific methods for apportioning gas consumption by individual process using indicators of GHG-using activity, (3) recipe-specific gas utilization and by-product formation factors, and also (4) methods for reporting controlled emissions from abatement devices (as proposed below). Under this approach, gas utilization and by-product formation rates would be required to be developed using the 2006 ISMI Guidelines for all fluorinated GHG-using process types at that facility.

According to information provided by one of the commenters in response to our initial proposal, only one company currently estimates their emissions using an approach consistent with the Tier 3 method. Nevertheless, if a facility is using a method that provides more accurate data, then we believe that they should be permitted to use such method. We request comment on the number of companies that are currently

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[12] For additional information on the 2006 IPCC factor development methodology, *see Emission Factors for Semiconductor Manufacturing: Sources, Methods, and Results* (February 2006) available in the docket (EPA–HQ–OAR–2009–0927).

[13] *Note,* in the creation of the IPCC factors, sufficient information was not available to weigh each general process type (*i.e.,* etch and clean categories for the IPCC Tier 2b method).

or expecting to in the near future, report their emissions using this method.

We are also proposing to require semiconductor manufacturers that fabricate devices on wafers measuring larger than 300 mm in diameter to estimate their emissions based on an approach consistent with the IPCC Tier 3 method and gas- and facility-specific heel factors for estimating and reporting GHG emissions. Under this approach, gas utilization and by-product formation rates would be required to be developed using the 2006 ISMI Guidelines for all fluorinated GHG using process types at that facility. We understand the industry's conversion to 450 mm is expected to begin in 2011 or shortly thereafter. We are proposing this requirement because we estimate that this method that uses recipe-specific gas utilization and by-product formation factors results in the most accurate facility-specific emission estimate. By including this requirement for only the 450 mm or larger wafers in this proposal, we anticipate a reduction in burden as compared to requiring existing large semiconductor facilities to estimate their emissions using an approach consistent with the IPCC Tier 3 method for the smaller sized wafers as well (*i.e.* 300 mm and smaller). We anticipate a reduction in burden because emission factors (*i.e.* gas utilization and by-product formation rates) can be developed over a number of years as semiconductor manufacturers begin to transition to 450 mm tools and develop the estimating and reporting infrastructure. The commissioning process for new tools is an ideal opportunity for emission factor development and/or verification. We request comment on requiring semiconductor manufacturers that fabricate electronic devices on wafers of diameter 450 mm or larger to estimate their emissions based on an approach consistent with the IPCC Tier 3 method.

During the development of this proposal, the 2006 International SEMATECH Manufacturing Initiative's Guideline for Environmental Characterization of Semiconductor Process Equipment was revised and republished (December 2009). We request comment on requiring the use of the revised version of the ISMI Guidelines to measure emission factors as opposed to the 2006 version of the ISMI Guidelines, and also information on emission factors (including utilization by-product formation rates) measured using the revised ISMI Guidelines.

Method for LCD, MEMS, and PV Facilities. In this action for LCD, MEMS, and PV facilities, we are proposing an approach based on a slightly modified 2006 IPCC Tier 2b method which would include (1) gas consumption calculated using the facility's purchase records, inventory, and gas- and facility-specific heel factors (as described above for semiconductor manufacturing facilities), (2) gas consumption apportioned to 2006 IPCC Tier 2b broad process categories, clean and etch, (3) default emission factors consistent with the 2006 IPCC Tier 2b factors, and (4) methods for reporting controlled emissions from abatement equipment (as proposed below).

The method proposed to develop the gas- and facility-specific heel factors for LCD, MEMS, and PV facilities is the same as proposed for semiconductor facilities including the provisions for exceptional circumstances. Although we don't have complete information on how LCD, MEMS, and PV facilities are currently estimating their emissions from manufacture and how they are currently accounting for heels, their gas use and manufacturing processes are similar to that of semiconductor manufacturing. As a result, we have concluded these facilities have the data required to develop a gas- and facility-specific heel factors and this method can be implemented with minimal burden. Similar to the semiconductor manufacturing case, the use of a gas- and facility-specific heel factor is expected to result in improved accuracy when compared to the IPCC's 10 percent default factor. We request comment on our proposal to require LCD, MEMS, and PV facilities to use gas- and facility-specific heel factors and our understanding that these facilities have the data to develop such a factor with minimal burden.

Under this approach consistent with the 2006 IPCC Tier 2b method, we propose that LCD, MEMS, and PV manufacturing facilities use the calculated mass of gas consumed and apportion this amount to the simplified process categories (*i.e.* etch and chemical vapor deposition chamber cleaning.) The associated emission factors including utilization and by-product formation rates, would then be used to calculate uncontrolled fluorinated GHG emissions. The emission factors being proposed are consistent with the 2006 IPCC default values. For MEMS manufacturing, where an IPCC default value does not exist, we propose the use of factors consistent with the 2006 IPCC Tier 2b factors for semiconductor manufacturing. We selected these factors because we understand MEMS manufacturing is silicon wafer-based and uses processes similar to those found in semiconductor manufacturing.

Additionally, we are proposing that LCD, MEMS, and PV manufacturing facilities abide by the requirements proposed for reporting controlled emissions from abatement systems as proposed below.

We are requesting information on emissions and emission factors from LCD, MEMS, and PV manufacturing. We are requesting such information as a means to verify that the Tier 2b emission factors for each of the manufacturing types are reflective of current fluorinated GHG emitting processes. Based on new information we receive, we may consider updating the emission factors in the final rule.

We expect that LCD, MEMS, and PV manufacturers may also use engineering models and quantifiable indicators (*e.g.,* substrate-area based) of manufacturing activity for apportioning gas consumption by process category similar to the approach described for semiconductors above (*e.g.,* wafer passes). We request detailed information on those indicators, how they were developed, and how they are used in a facility-specific engineering model to apportion annual facility-wide gas usage across a facility's emitting process categories.

We request comment on permitting those LCD, MEMS, and PV manufacturing facilities that have monitoring infrastructure or the necessary data to estimate emissions obtained through recipe-specific measurements to report their emissions using their data by following an approach consistent with the 2006 IPCC Tier 3 method.

Review of Existing Reporting Programs and Methodologies and Consideration of Alternative Methods. EPA considered various methods for estimating emissions from etching and cleaning processes for electronics manufacturing facilities including the 2006 IPCC Tier 1, 2a, 2b, and Tier 3 method as well as a Tier 2b/3 hybrid which would apply Tier 3 to the most heavily used fluorinated GHGs in all facilities. For a detailed description of our evaluation of these options, please *see* the Electronics Manufacturing section of the initial Mandatory Reporting Rule (74 FR 16499).

For this proposal, to estimate emissions from all semiconductor manufacturing facilities, we are also considering the alternative of a modified Tier 2b method (our preferred option for other electronics manufacturers) which would require the use of the 2006 IPCC Tier 2b default factors and gas- and facility-specific data on heels and gas use by process category. This approach would be based on a modified version of the 2006 IPCC Tier 2b method for estimating emissions and would require semiconductor facilities to report emissions using (1) gas consumption as calculated using the facility's purchase records, inventory, and gas- and facility-specific heel factors (as described above), (2) facility-specific methods for apportioning gas usage by process category using indicators of activity (as described above, *e.g.,* wafer pass), (3) IPCC Tier 2b emission factors, and (4) methods for reporting controlled emissions using our proposed approach discussed below. We request comment on this approach.

As an alternative to the Refined Method, we are also considering requiring all semiconductor manufacturing facilities to estimate their emissions using an approach consistent with the IPCC Tier 3 method based on (1) gas consumption as calculated using the facility's purchase records, inventory, and gas- and facility-specific heel factors, (2) facility-specific methods for apportioning gas consumption by individual process using indicators of GHG-using activity, (3) recipe-specific gas utilization and by-product formation factors, and also (4) methods for reporting controlled emissions from abatement devices (as proposed below). Under this approach, facilities would be required to develop gas utilization and by-product formation rates using the 2006 ISMI Guidelines for all fluorinated GHG-using process types at that facility. We request comment on this approach.

Another option we are considering is to evaluate emissions from electronics manufacturing using continuous emission monitoring system(s) (CEMS). Under this approach, facilities would be required to install and operate CEMS to measure process emissions. A typical electronics manufacturing facility may have many individual process tools that influence emissions. Process tool exhaust is managed within the facility using stainless steel plumbing and ductwork. Due to the complexity of the manufacturing layout, CEMS would be attached either to every tool or to one or more final exhaust points (*e.g.,* scrubber stacks). One possible option is to use Fourier Transform Infrared Spectrometers (FTIRs) in scrubber stacks to measure facility emissions. FTIR spectroscopy is presently used to conduct short-term fluorinated GHG emission measurements from single tools. EPA requests comment on the use of CEMS at electronics manufacturing facilities. We also request data and other information evaluating the use of CEMS in electronics facilities to determine fluorinated GHG and N_2O emissions.

(b) Method for Estimating N_2O Emissions

We are proposing that electronics manufacturers estimate N_2O emissions from chemical vapor deposition processes and all other electronics manufacturing processes such as chamber cleaning, and that they estimate those emissions using the following proposed methods.

To estimate N_2O emissions from chemical vapor deposition we are proposing the use of a facility-specific emission factor based on facility measurements of N_2O utilization for chemical vapor deposition, using 2006 ISMI Guidelines. Under this approach, we propose to permit the facility to apply the average N_2O utilization emission factor to all N_2O using chemical vapor deposition recipes. In cases where a facility has not developed a facility-specific N_2O utilization factor for chemical vapor deposition processes, we are proposing a default value in the range of 0 to 40 percent. We are taking comment on this range due to a lack of information for N_2O utilization for chemical vapor deposition processes.

In comments received in response to our initial proposal, industry provided information to support a N_2O utilization factor of 40 percent, primarily in 300 mm chemical vapor deposition processes. Taking the industry-provided 40 percent utilization into account, we propose to select a N_2O utilization factor in the range from 0 to 40 percent. In the industry's survey, the measured utilization factors are largely from newer 300 mm manufacturing equipment. We do not expect these data fairly represent the entire population of all N_2O processes and installed equipment, many of which are older tools. In addition, the industry comments did not fully identify the specific processes from which the average N_2O utilization factor was calculated. For these reasons, and because we understand that N_2O is most commonly used for chemical vapor deposition as opposed to other processes, we are proposing to establish a default value within a range of values with 40 percent as the upper bound and 0 percent as the lower bound to be conservative, reducing potential for underestimating emissions.

To estimate N_2O emissions from all other manufacturing processes (*e.g.,* chamber cleaning), we are proposing either a facility-specific utilization factor based on measurements using 2006 ISMI Guidelines, or applying a default utilization factor of 0 percent which assumes N_2O is not converted or destroyed during the manufacturing process. We are proposing this method due to a lack of information regarding other processes for which N_2O is used and N_2O utilization data in those processes.

We request comment on values within the range that we are proposing to estimate N_2O emissions from chemical vapor deposition processes and our approach for estimating N_2O emissions from all other manufacturing processes. We also request additional information on N_2O uses and N_2O utilization in electronics manufacturing processes. More specifically, we request N_2O emission factors and detailed supporting information including but not limited to the specific measurement method used, date of measurement, standard deviation of measured factors, identification of manufacturing process or process category, substrate size, and equipment manufacturer name and model number where not considered confidential.

In addition, we request comment on using wafer passes or other appropriate quantifiable indictors of activity for apportioning N_2O consumption to chemical vapor deposition and other manufacturing processes.

We are proposing that as part of determining annual facility N_2O emissions, if a facility employs abatement systems and it wishes to report N_2O emission reductions due to these systems it must adhere to the methods for reporting controlled emissions included in this proposal.

(c) Method for Estimating Emissions of Heat Transfer Fluids

To estimate the emissions of heat transfer fluids, we propose that electronics manufacturers use the 2006 IPCC Tier 2b approach, which is a mass-balance approach. We are not changing the broad outlines of our initial proposal; however, we are clarifying required data elements.

In evaluating the comments we received, we understand that there was some confusion regarding our intended method. The proposed method required data on the total nameplate capacity[14] of equipment that "is installed during the reporting year." We intended "installed during the reporting year" to mean newly installed during the period,

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[14] Nameplate capacity means the full and proper charge of gas 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.

not in place from the beginning of that period. To eliminate confusion, we are clarifying that facilities are required to provide the total nameplate capacity (charge) of equipment that is "newly installed" during the reporting year. We anticipate that facilities will find it straightforward to track the nameplate capacities of equipment that is newly installed or retired during the reporting year.

In addition, we are also clarifying that a facility may only subtract the amount of fluorinated heat transfer fluids sent off site if the heat transfer fluids are properly recovered, stored, and sent off site for verifiable recycling or destruction during the reporting year. We are adding this clarification because we understand that facilities may be recovering, storing, and removing from their facility, fluorinated heat transfer fluids in a manner that does not effectively prevent the substance(s) from evaporating to the atmosphere. In such cases, the users of the chemicals would be required to account for these emissions using the mass-balance calculation provided.

As we stated in our initial proposal, in developing our proposal for estimating heat transfer fluid emissions, we reviewed both the IPCC Tier 1 and IPCC Tier 2 approaches. The Tier 1 approach for heat transfer fluid emissions is based on the utilization capacity of the semiconductor facility multiplied by a default emission factor. Although the Tier 1 approach has the advantages of simplicity, it is less accurate than the Tier 2 approach according to the 2006 IPCC Guidelines. The IPCC Tier 2 approach uses company-specific data and accounts for differences among facilities' heat transfer fluids (which vary in their GWPs), leak rates, and service practices. It has an uncertainty on the order of ±20 percent at the 95 percent confidence interval according to the 2006 IPCC Guidelines.

(d) Method for Reporting Controlled Emissions From Abatement Systems

For this proposed rule, we are defining DRE as the efficiency of a control system designed to destroy or remove fluorinated GHGs, N_2O, or both. The DRE is equal to one minus the ratio of the mass of all relevant GHGs exiting the emission abatement system to the mass of GHGs entering the emission abatement system. When fluorinated GHGs are formed in an abatement system, DRE is expressed as one minus the ratio of amounts of exiting GHGs to the amounts entering the system in units of CO_2-equivalents. In addition, we are clarifying facilities may account for all abatement systems (*e.g.,* multichamber POU, central devices) provided that they abide by the requirements below.

We are proposing to use the term destruction or removal efficiency (DRE) as opposed to "destruction efficiency" or "destruction," terms that are already defined in subpart A of the Final MRR. We are proposing to use DRE because it is the term generally used by the electronics manufacturing industry. Furthermore, in addition to capturing the destruction of materials in the exhaust, the term also captures materials in the exhaust that are recycled or captured for reuse.

For purposes of this reporting rule, we propose that facilities that wish to document and report fluorinated GHG and N_2O emissions reflecting the use of abatement systems adhere to a method that would require: (1) Documentation to certify that the abatement system is installed, operated, and maintained in accordance with manufacturers' specifications, (2) accounting for the system's uptime,[15] and (3) either certification that the abatement system is specifically designed for fluorinated GHG and N_2O abatement and the use of an EPA default DRE value, or direct, proper DRE measurement to confirm the performance of the abatement system. Proper DRE measurement means 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). EPA's DRE Protocol is available for review in the docket (EPA–HQ–OAR–2009–0927). Our proposed approach is depicted as a decision tree in Figure 1 of this preamble.

The proposed approach requires annual certification to ensure that abatement systems for which controlled emissions are reported are installed, operating, and maintained according to manufacturers' specifications. Our approach would also require that any DRE used in reporting emissions be based on an EPA default DRE value or on recent on-site measurements and actual uptime of the system, accounting for system redundancy. When process tools are equipped with multiple abatement systems designed for fluorinated GHGs and N_2O, the facility may account for the combined uptime for the specific calculation of controlled emissions. Each one of these components is discussed in detail in the paragraphs below. We anticipate this method for reporting controlled emissions will ensure that abatement systems have been properly installed, operated and maintained during each reporting period and that best available measured DRE values are used to estimate and report emissions.

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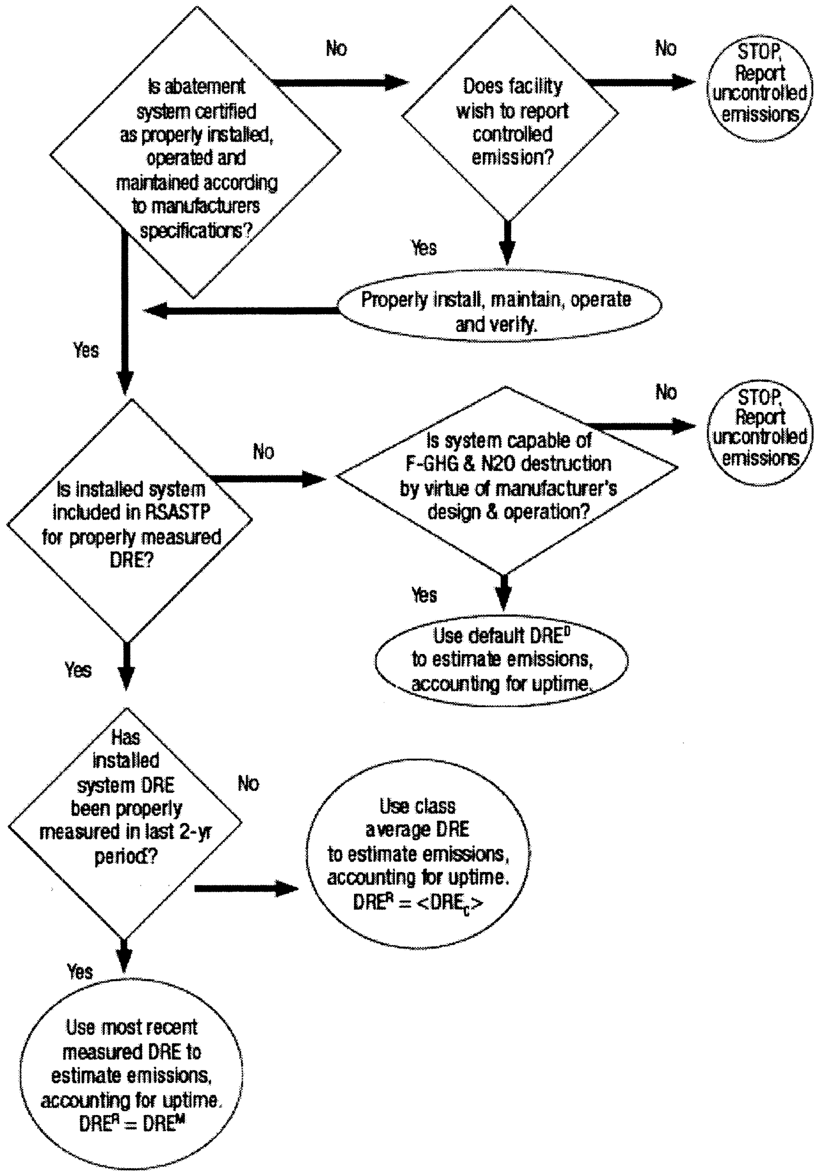
[15] Uptime means the total time during the reporting year when the abatement system for which controlled emissions will be reported was properly installed, operated, and maintained.

Figure 1. DRE Verification Decision Tree.



Notes:

DRE^D EPA default DRE
DRE^R DRE used when reporting emissions
DRE^M Properly measured DRE
$<DRE_c>$ Class average DRE
RSASTP Random sampling abatement system testing program

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Proper Installation, Operation, and Maintenance. We are proposing that all facilities that use abatement systems and would like to reflect these emissions reductions in their annual emissions estimations be required to document and certify the abatement equipment's proper installation, operation, and maintenance. There are many manufacturers, and for each manufacturer multiple models, that are marketed as fluorinated GHG-destruction capable (Beu, 2005). While some abatement systems may be capable of destroying some fluorinated GHGs, they may not be effective in abating CF_4 (Beu, 2005), which in some processes can constitute 10 percent—20 percent (by volume) of fluorinated GHG exhaust composition (EPA, 2006). It appears that this variability may be partially attributable to installation as well as operating and maintenance practices although variations in how destruction is measured may also contribute to this variability (Beu, 2005). Evidence indicates abatement devices must be properly installed to ensure achievement of the manufacturer's design goals. For this reason, we propose devices be installed in accordance with manufacturers' specifications.

In terms of operation and maintenance, we also propose to require that abatement systems be operated and maintained in accordance with the manufacturers' specifications. 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 (Beu, 2005, EPA 2006, 2007)). Our proposed requirement that abatement systems be operated and maintained in accordance with manufacturers' specifications is intended to ensure best performance.

We understand that many times a facility may have an independent quality assurance expert certify the installation, operation, and maintenance of abatement equipment. We are considering the inclusion in the final rule, a requirement for annual, on-site independent inspections of abatement system installation, operation, and maintenance, which could include a review of records and physical inspection of installed equipment. We request comment on whether to require an independent quality assurance audit/inspection for abatement system installation, operation, and maintenance.

Accounting for Abatement System Uptime. We are proposing that facilities account for abatement systems' uptime to report controlled emissions. Uptime is the total time during the reporting year when the abatement systems for which controlled emissions are being reporting was properly installed, operated, and maintained. Uptime is calculated as the sum of time during the reporting period that an abatement system is in a standby, productive, and engineering state as described in SEMI Standard E10–0304, Specification for Definition and Measurement of Equipment Reliability, Availability, and Maintainability (2004). Abatement system uptime is expressed as the sum of an abatement system's operational productive, standby, and engineering times divided by the total operations time of its associated manufacturing tool. For example, the time during which a system is in by-pass mode, undergoing maintenance, or not operating with O_2-flow (in the case of a CF_4 combustion system) is not included in uptime. An exception to this is time during which exhaust flows are passed through a redundant abatement system that is in the same abatement system class (discussed below) as the primary abatement system. Such time may be included in the uptime of the primary system.

We are proposing this requirement because we anticipate accounting for uptime (*i.e.,* tracking incidents when abatement systems may be "bypassed" or otherwise not in service) will produce a more accurate emissions estimate. We request comment on our proposal to account for and report the uptime of abatement systems. We also request detailed information on how uptime may be monitored and calculated.

EPA Default DRE Value. In addition to certifying that an abatement system is installed, operated, and maintained according to manufacturers' specifications, and accounting for the system's uptime, the first approach we are proposing includes the following two key elements: (1) Certification that the abatement system is specifically designed for fluorinated GHG and N_2O abatement, and (2) an EPA default DRE value. By applying the EPA default DRE value, the facility is not required to measure the DRE of their abatement system(s). We are proposing the use of a default DRE value of 60 percent if the facility certifies that the abatement systems for which this value is applied are specifically designed for fluorinated GHG and N_2O abatement.

To develop the default DRE of 60 percent, we reviewed the individual DREs measured under our in-fab DRE measurement program and selected those that constituted discrete values[16] for systems that had been properly installed, operated and maintained. Of the data from the DRE measurement program, those that met the stated criteria were values for CF_4. We calculated the mean and the lower one sided tolerance interval of the (CF_4) DRE data set. This yielded an understated, default DRE, reducing the likelihood that the DRE of any particular system will be either overestimated or greatly underestimated. For additional information on how the EPA default DRE was developed, please refer to the Electronics Manufacturing TSD.

While we are now proposing the use of an EPA default DRE value, consistent with our initial proposal we are not planning to permit use of the 2006 IPCC default factors or the manufacturer's DRE values. We are not permitting their use because once installed, abatement equipment may fail to achieve the default or a 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 20 to 50 and C_2F_6 can be off by a factor of up to 10 [Burton, 2007].) This understanding is supported by industry assessments as presented in Beu, 2005.

We are permitting the use of our default DRE value because we estimate that it strikes an appropriate balance between being conservative and being representative where equipment is properly operated and maintained. Our 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.

We request comment on our proposed default DRE value, and additional data and supporting documentation on DREs from studies that have been conducted on properly installed, operated, and maintained abatement systems and consistent with EPA's DRE Protocol.

Proper Measurement of the Abatement DRE. The second proposed approach for quantifying, documenting, and reporting controlled emissions from abatement systems, described below, would require proper measurement of the abatement system DRE in addition to documentation to certify that the abatement system is installed, operated, and maintained in accordance with manufacturers' specifications, and accounting for uptime.

Consistent with our initial proposal, this second proposed method permits facilities to account for destruction if the abatement system performance is measured and verified using EPA's DRE Protocol. To measure DRE, we propose requiring facilities to conduct annual sampling through a random sampling abatement system testing program (RSASTP), spanning all abatement classes using the methods outlined in EPA's DRE Protocol. "Class" refers to a category of abatement systems grouped by manufacturer model number(s) and by gas for which the system is used to abate, including N_2O and CF_4 direct and by-product formation, and all other fluorinated GHG gas direct and by-product formation.[17] "Classes" may also include any other abatement systems for which the reporting facility wishes to report controlled emissions provided that class is identified. For each class, the representative or average DRE

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[16] Using data available from the in-fab DRE measurement program, we selected discrete numbers rather than the lower bound (*e.g.,* ≥ 99%).

[17] CF_4 is a very stable chemical and especially difficult to effectively destroy. It may be used as an input gas and generated as a byproduct of other fluorinated GHG process reactions.

factors would then be applied to the yet unmeasured abatement devices of that class.

An annual representative sample as part of the RSASTP would consist of three or 20 percent of installed abatement systems, whichever is greater, for each class each year, measuring the DRE for a different three or 20 percent set of systems each year. Where 20 percent of total abatement systems do not equal a whole number, the number of systems to be tested would be rounded up to the nearest integer (*e.g.,* 16 abatement devices, 20 percent of which equals 3.2; therefore, four abatement systems would be measured each year). Using the RSASTP and our rounding convention, all systems in each class would be tested within a five-year period. EPA is seeking comment on the required frequency of abatement system performance measurement.

When reporting controlled emissions from manufacturing, we propose that the facility either use the measured DRE or, in those instances where an individual abatement system has not yet undergone proper DRE testing, a simple average of the measured DREs for systems of that class would be used. If redundant abatement systems were used during periods of maintenance or repair, then we propose that the measured or average DRE for that system's class would be used. In any of these cases, the DRE used to report emissions would be adjusted to account for the actual uptime of the system. For example, if the uptime for a device is 98 percent over the reporting period, then the measured DRE (or class average of measured DREs when a system has not yet been measured) would be multiplied by 0.98.

Under the RSASTP, all systems in each class would be tested within a five-year period, after which the process would be repeated as long as controlled emissions were reported. There are two reasons for requiring the DRE to be measured for each abatement device over a time period and by specific class. Some fluorinated GHGs, particularly CF_4, are harder to destroy than others; thus, the performance of abatement systems with one fluorinated GHG cannot necessarily be assumed to apply to other fluorinated GHGs.[18] Second, even if abatement systems rely on the same operating principle (*e.g.,* thermal oxidation) and are used on the same gases, their performance can vary depending on their operation and maintenance.[19] Moreover, 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). This argues for gradually testing all of the abatement systems within a class, and for retesting individual abatement systems over time.

We request comment on the method proposed for proper measurement of DRE at a facility and the proposed RSASTP for abatement systems by class.

6. Selection of Procedures for Estimating Missing Data

In general, it is not expected that data to estimate emissions from electronics manufacturing would be missing; gas consumption data and indicators of activity data (*e.g.,* wafer passes) is collected as business as usual. For this reason, we are not proposing procedures for estimating missing data from emissions from cleaning, etching or deposition processes. Because our proposal includes an EPA default DRE value for estimating and reporting controlled emissions, we propose that no missing data procedures would apply.

When estimating heat transfer fluid emissions during electronics manufacture, the use of the mass-balance approach requires facilities to correct records for all inputs. Should the facility be missing records for a given input, heat transfer fluid emissions may be estimated using the arithmetic average of the emission rates for the year immediately preceding the period of missing data and the months immediately following the period of missing data. Alternatively it may be possible that the heat transfer fluid supplier has information in their records for the facility.

7. Selection of Data Reporting Requirements

We are proposing that owners and operators be required to report fluorinated GHG and N_2O emissions for the facility for each electronics manufacturing process as well as all heat transfer fluid use. In addition, facilities would be required to report the following: method used to calculate emissions; factors used for gas utilization and by-product formation rates and the source for each factor for each fluorinated GHG and N_2O; production in terms of substrate surface area (*e.g.,* silicon, PV-cell, LCD); for each fluorinated GHG and N_2O, annual gas consumed during the reporting year and gas- and facility-specific heel factors used; the apportioning factors used, a description of the engineering model used for apportioning gas usage, and facility-wide consumption estimates based upon development of the apportioning factors, independent of the consumption value calculated using purchase records; fraction of each gas fed into each process type that is fed into tools with abatement systems; descriptions and information about abatement systems through which fluorinated GHGs and N_2O flow; inputs in the mass-balance equation (for heat transfer fluid emissions); and example calculations. Where process categories defined in the Refined Method and/or default gas utilization and by-product formation rates are not used, we propose that facilities provide descriptions of individual processes or processes categories used to estimate emissions consistent with the IPCC Tier 3 method.

For each abatement system for which a facility is reporting controlled emissions, we propose that facilities be required to report the following: certification that the abatement device is installed, operated, and maintained according to manufacturers' specifications; the uptime and the calculations to determine uptime for that reporting year; the DRE used (*i.e.* either the EPA default DRE value or a properly measured DRE); and documentation for the EPA default DRE value or a properly measured DRE.

These data form the basis of the calculations and are needed for us to understand the reported emissions and verify their reasonableness.

8. Selection of Records That Must Be Retained

We propose that facilities keep records of data used to estimate emissions, records supporting values used to estimate emissions, purchase records, and invoices for gas purchases and sales. For those facilities that use facility-specific, recipe-specific gas utilization and by-production formation rates, we are proposing that the following records be maintained: documentation that the rates were measured using the 2006 ISMI Guidelines, documentation that the measurements made are representative of fluorinated GHG and N_2O emitting

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[18] There are many manufacturers, and for each manufacturer many models, that are marketed as fluorinated GHGs-destruction capable (Beu, 2005). While some abatement devices may be capable of destroying some fluorinated GHGs, they may not be effective in abating CF4 (Beu, 2005), which in some processes can constitute 10%–20% (by volume) of fluorinated GHGs exhaust composition (EPA, 2006).

[19] Some variability in performance may be partially attributable to installation as well as operating and maintenance practices although variations in how destruction is measured may also contribute to this variability (Beu, 2005).

processes at the facility, and the date and results of the initial and any subsequent tests to determine process tool gas utilization and by-product formation rates.

For those facilities that are reporting controlled emissions, we propose that the following records be kept: documentation to certify that each abatement device used at the facility is installed, maintained, and operated in accordance with manufacturers' specifications; records of the uptime and the calculations to determine uptime; abatement system calibration and maintenance records; documentation for the EPA default DRE value or a properly measured DRE.

These records consist of values that are directly used to calculate the emissions that are reported and are necessary to enable verification that the GHG emissions monitoring and calculations are done correctly.

B. Fluorinated Gas Production

1. Overview of Reporting Requirements

Under this proposal, subpart L would require facilities that produce fluorinated gases to report their fluorinated GHG emissions from fluorinated gas production and transformation and from fluorinated GHG destruction. Fluorinated gases include fluorinated GHGs (HFCs, PFCs, SF_6, NF_3, HFEs, *etc.*), CFCs, and HCFCs. Certain emissions subject to other subparts or authorities are excluded from this subpart. Specifically, emissions of HFC–23 from HCFC–22 production are addressed under subpart O and are therefore excluded from this subpart. Similarly, as discussed in the Final MRR, emissions of ozone depleting substances (*e.g.,* CFCs and HCFCs) are subject to Title VI of the CAA and are therefore excluded from this subpart.

Under this proposed rule, facilities would be required to estimate their emissions from fluorinated GHG production processes using either a mass-balance approach or an approach based on measured (or in some cases, calculated) emission factors. Facilities would be required to estimate their emissions from CFC and HCFC production processes and from fluorinated gas transformation processes using an emission-factor-based approach. Consistent with the Final MRR, this proposal would establish an annual frequency for reporting and would include provisions to ensure the accuracy of emissions data through monitoring, reporting, and recordkeeping requirements. Reporting would be at the facility level.

2. Summary of Major Changes Since Initial Proposal

In the April 2009 proposed mandatory GHG reporting rule (74 FR 16448; April 10, 2009), the fluorinated GHG production source category was included as proposed subpart L. That initial proposal would have required reporting from facilities emitting more than 25,000 $mtCO_2e$ from fluorinated GHG production and other source categories (*e.g.,* stationary combustion). We proposed monitoring based on a daily mass-balance or yield approach that included measurements of the reactants and the fluorinated GHG product and byproducts. Under that approach, facilities would have had to calculate the difference between the expected production of each fluorinated GHG based on the consumption of reactants and the measured production of that fluorinated GHG, accounting for yield losses related to byproducts and wastes and accounting for streams that were recaptured and destroyed. Facilities would have been required to measure the various inputs and outputs daily using scales and flow meters with an accuracy and precision of 0.2 percent of full scale, and to measure concentrations in streams using methods with an accuracy and precision of 5 percent. (For more detailed information on the initial proposal, *see* the fluorinated gas production section of the April 10, 2009 proposed rule.)

We received numerous comments on the proposed approach. Commenters stated that there may be significant uncertainty associated with the mass-balance approach, that EPA's stated accuracy and precision requirement of 0.2 percent for flow meters and weigh equipment was costly and not technically achievable for many streams, that daily calculations were excessive and likely to introduce errors, that it was sometimes impracticable to perform a mass-balance for more than one reactant, and that the mass-balance approach was not appropriate for batch processes.

Commenters also suggested alternatives to the mass-balance approach. Several commenters focused on the use of site-specific or process-specific emission factors. These commenters noted that many facilities in this source category already measure emissions during performance testing to verify compliance with their emission limits under other EPA regulations. Commenters also noted that some fluorinated GHG producers currently estimate their emissions of fluorinated GHG using the emission factor approach and that this approach is both more cost effective and more accurate than the mass-balance approach. One commenter using the emission factor approach stated that the estimated uncertainty of its overall fluorinated GHG emissions estimate was 13 percent (expressed as one standard deviation) and that the uncertainty associated with the estimates that it would develop using the proposed mass-balance approach would be significantly higher. Commenters suggested both emissions testing and chemical engineering calculations as appropriate techniques to develop site-specific emissions factors.

Partly in response to the comments received on the April 2009 proposed MRR (74 FR 16448; April 10, 2009), today's proposed subpart L rule incorporates a number of changes compared to the original proposal, including but not limited to:

- Inclusion of additional emission estimation methodologies, including process-specific, site-specific emission factors, which allow facilities to estimate emissions using methods that may already be in place;
- Revisions to the mass-balance approach, including provisions to allow monthly rather than daily monitoring; greater flexibility in the accuracy and precision of flowmeters, weigh scales, and concentration measurements (as long as the final estimate meets an overall accuracy and precision requirement); and the use of one rather than two reactants in the mass-balance equation;
- Inclusion of fluorinated GHGs emitted as a by-product of the production of CFCs and HCFCs; and
- Inclusion of fluorinated GHGs emitted as a feedstock or by-product of transformation processes that are not intended to produce any fluorinated gases (when those transformation processes are co-located with fluorinated gas production processes).

3. Definition of Source Category

This source category covers emissions of fluorinated GHGs that occur during the production of fluorinated gases, where fluorinated gases include fluorinated GHGs (HFCs, PFCs, SF_6, NF_3, and fluorinated ethers, among others), CFCs, and HCFCs (except HCFC–22).[20] It also covers emissions of

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[20] In the April 2009 proposal, EPA requested comment on whether emissions of fluorinated GHGs from CFC and HCFC production processes should be subject to the subpart L reporting requirements. While no public comments were received on this topic, EPA has determined that HFCs and PFCs are likely to be generated during the production of several CFCs and HCFCs, and that the quantities generated may be significant. According

fluorinated GHGs from transformation and destruction processes that occur at fluorinated gas production facilities. EPA estimates that total emissions from this source category were 10.6 million metric tons of CO_2e in 2006.

Emissions from fluorinated gas production facilities can occur from vents, from leaks at flanges and connections in the production line, and from control devices (*e.g.,* thermal oxidizers). Undesired by-products may be deliberately vented, and some product (or reactant) may be vented at the same time due to imperfect separation of by-products, products, and reactants. Emissions can also occur during occasional service work on the production equipment, during blending and recycling of fluorinated GHGs, and during the evacuation and filling of tanks or other containers that are distributed by the producer (*e.g.,* on trucks and railcars).

Fluorinated GHG Emissions from Fluorinated GHG Production. Emissions that occur during fluorinated GHG production include fluorinated GHG products that are emitted before the production measurement and fluorinated GHG byproducts that are generated and emitted either without or despite recapture or destruction.[21] These emissions are not counted as "mass produced" under the final requirements for suppliers of industrial GHGs in 40 CFR part 98, subpart OO (74 FR 56260; October 30, 2009).

Fluorinated GHG emissions from U.S. facilities producing fluorinated GHGs are estimated to range from 0.8 percent to 2 percent of the amount of fluorinated GHG produced, depending on the facility. In 2006, 12 U.S. facilities produced over 350 million metric tons CO_2e of HFCs, PFCs, SF_6, and NF_3, and an additional 6 facilities produced approximately 1 million metric tons CO_2e of fluorinated anesthetics. Based on an emission rate of 1.5 percent, facilities are estimated to have emitted approximately 5.3 million metric tons CO_2e of HFCs, PFCs, SF_6, and NF_3, and approximately 15,000 metric tons CO_2e of fluorinated anesthetics.

Fluorinated GHG Emissions from CFC and HCFC Production. Our proposal to include fluorinated GHG emissions that occur during CFC and HCFC production processes is based on two important considerations. First, while the quantity of by-product emissions is uncertain, we believe that it is significant and could be similar to total estimated emissions from fluorinated GHG production. Second, many CFC and HCFC production processes are co-located with fluorinated GHG production facilities, allowing for efficiencies in the application of estimation methods and monitoring and reporting infrastructures. These issues are discussed in more detail in the Fluorinated Gas Production Technical Support Document in the docket for this rulemaking (EPA–HQ–OAR–2009–0927).

Although we do not have precise estimates of the magnitude of fluorinated GHG emissions from production of CFCs and HCFCs, we estimate that if CFC and HCFC production processes emitted fluorinated GHGs equivalent to one percent of their CFC and HCFC production (excepting HCFC–22 production), U.S. emissions from this source would be 5.3 $mtCO_2e$, the same as from fluorinated GHG production. EPA requests comment on the extent to which fluorinated GHGs are generated and emitted during CFC and HCFC production. EPA also requests comment on the extent to which fluorinated GHGs may be generated and emitted during production of other ozone-depleting substances such as methyl chloroform and carbon tetrachloride and on whether such emissions should be reported under this rule.

CFCs and HCFCs are often produced at the same facilities that produce fluorinated GHGs. In these cases, these facilities would need to quantify their fluorinated GHG emissions from a few processes in addition to those producing fluorinated GHGs. In other cases, CFCs or HCFCs are produced at facilities that do not produce fluorinated GHGs. In these cases, which EPA estimates include 2 facilities, the facilities would not have been covered by the initially proposed subpart L, but would be covered by today's proposal. This coverage is reflected in the threshold analysis discussed below.

Fluorinated GHG Emissions from Other Processes. Facilities producing fluorinated gases would also be required to report emissions of fluorinated GHG feedstocks that occur during the transformation of these feedstocks into other fluorinated substances such as fluoropolymers, as well as emissions of fluorinated GHGs that occur during destruction of fluorinated GHGs that are removed from the supply of industrial gases.

The reasons for requiring reporting of fluorinated GHG emissions from transformation processes that are co-located with fluorinated gas production processes are similar to those for requiring reporting of fluorinated GHG emissions from CFC and HCFC production. First, although EPA does not have precise estimates of the magnitude of fluorinated GHG emissions from transformation processes, discussions with fluoropolymer producers indicate that these emissions do occur. Second, facilities could apply similar methods and monitoring approaches to estimate emissions from both fluorinated gas production and fluorinated gas transformation. The rationale for requiring reporting of emissions from the destruction of fluorinated GHGs that are removed from the supply of industrial gases is discussed below under *Relationship between emissions covered under subpart L and those covered under subpart OO.*

EPA is also considering requiring reporting of fluorinated GHG emissions from two other types of processes. The first type includes processes (other than CFC and HCFC production processes) in which fluorinated GHGs are neither reactants nor products of the process but are nevertheless generated as by-products or intermediates. To the extent that such processes may generate or emit significant amounts of fluorinated GHGs, it may be appropriate to require reporting of those emissions. This would be particularly true if the processes were co-located with fluorinated GHG production processes, permitting effiencies in the application of estimation methods and reporting infrastructures. EPA requests comment on whether, how often, and where such processes occur (*i.e.,* at fluorinated gas production facilities or elsewhere). The second type of process includes fluorinated gas transformation processes that are not co-located with fluorinated gas production facilities. Again, it may be appropriate to require reporting of fluorinated GHG emissions from such processes if these emissions are significant. EPA requests comment on both of these options.

Relationship between emissions covered under subpart L and those covered under subpart OO. Subpart L would require reporting from many of

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to the 2006 IPCC Guidelines and fluorinated gas producers, production of CFCs and HCFCs can generate and emit fluorinated GHGs such as various HFCs and some PFCs. (These HFCs exclude HFC–23 generated during HCFC–22 production, which is already covered under Subpart O). These emissions are by-product emissions that occur due to the chemical similarities between HFCs, PFCs, HCFCs, and CFCs and the common use of halogen replacement chemistry to produce them. HFC–23 generated during HCFC–22 production is already covered under Subpart O.

[21] Byproducts that are emitted or destroyed at the production facility are excluded from the Subpart OO definition of "produce a fluorinated GHG." Any HFC–23 generated during the production of HCFC–22 is also excluded from this definition, even if the HFC–23 is recaptured. However, other fluorinated GHG byproducts that are recaptured for any reason are considered to be "produced."

the same facilities (fluorinated GHG producers) that are required to report under subpart OO, which contains the industrial gas supply reporting provisions of the final MRR. In general, subpart OO is intended to capture the quantities of fluorinated GHGs that are entering and leaving the U.S. supply of industrial gases,[22] while subpart L is intended to capture the quantities of fluorinated GHGs emitted at fluorinated gas production facilities.

There are several areas of possible overlap between the emissions that could be reported under this subpart and those reported under subpart OO. The areas of overlap all concern emissions that occur at the fluorinated GHG production facility after (downstream of) the fluorinated GHG production measurement. These include emissions from:

- Fluorinated GHG transformation processes (including polymerization),
- Destruction of fluorinated GHGs that are removed from the supply of industrial gases,
- Cylinder filling (if this occurs after the production measurement),
- Blending of fluorinated GHGs,
- Recycling or reclamation of fluorinated GHGs, and
- Evacuation of fluorinated GHG heels from returned cylinders.

The MRR is intended to inform a range of possible policies for reducing emissions of GHGs, including both upstream and downstream approaches. Under a policy that focused primarily on supply, the fluorinated GHGs added to and subtracted from the gas supply would be tracked, and only the on-site emissions that occurred before (upstream of) the fluorinated GHG production measurement would need to be covered for completeness. On-site emissions that occurred after the production measurement would be assumed to be captured by the production measurement. Under a policy that focused on actual emissions (*i.e.,* "downstream coverage") rather than supply, on-site emissions that occurred both before and after the production measurement would need to be tracked.

Maintaining flexibility to adopt either upstream or downstream approaches argues for some counting under L of emissions that are counted upstream (as supply) under OO.[23] (*See* the October 30, 2009 Final MRR, 74 FR 56260, for more discussion of the rationale for including both upstream and downstream emissions under the rule.) As noted above, EPA is proposing to require reporting of fluorinated GHG emissions from transformation and destruction processes that are located at fluorinated gas production facilities. However, EPA is also considering requiring reporting of fluorinated GHG emissions from the other activities that occur at fluorinated GHG production facilities downstream of the production measurement. EPA requests comment on the magnitude of these other on-site emissions and on whether or not they should be required to be reported under subpart L.

4. Selection of Reporting Threshold

Under today's proposed rule, owners and operators of fluorinated gas production facilities would be required to estimate and report GHG emissions if those emissions, including both combustion and fluorinated GHG emissions, would exceed 25,000 mtCO$_2$e in the absence of control technology (*e.g.,* thermal oxidation).[24]

In developing the threshold, we considered multiple controlled and uncontrolled emissions thresholds, including 1,000, 10,000, 25,000, and 100,000 metric tons CO$_2$e. For fluorinated GHG production processes (including fluorinated anesthetics production processes), uncontrolled (pre-control) emissions were estimated by multiplying a factor of 3 percent by the estimated production at each facility. For CFC and HCFC production processes (except for HCFC–22 production processes), uncontrolled emissions were estimated by multiplying a factor of 2 percent by the estimated production at each facility. Uncontrolled emissions are strongly influenced by by-product generation rates, which are known to vary between zero and several percent for fluorinated gas production processes; thus, these estimates are uncertain. Controlled emissions were assumed to be half of uncontrolled emissions at each facility. Because EPA has little information on combustion-related emissions at fluorinated gas production facilities, these emissions were not included in the analysis. The results of the analysis for production of HFCs, PFCs, SF$_6$, NF$_3$, CFCs, and HCFCs are shown in Tables 7 and 8 of this preamble.

TABLE 7—THRESHOLD ANALYSIS FOR FLUORINATED GHG EMISSIONS FROM PRODUCTION OF HFCS, PFCS, SF6, NF3, CFCS, AND HCFCS

[Uncontrolled Emissions]

Threshold level (metric tons CO$_2$e/r)	Total national emissions (metric tons CO$_2$e)	Number of facilities	Emissions covered		Facilities covered	
			Metric tons CO$_2$e	Percent	Number	Percent
1,000	10,600,000	14	10,600,000	100	14	100
10,000	10,600,000	14	10,600,000	100	14	100
25,000	10,600,000	14	10,600,000	100	14	100
100,000	10,600,000	14	10,600,000	100	13	93

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[22] Specifically, subpart OO tracks the quantities of fluorinated GHGs that are (1) produced, (2) transformed, (3) destroyed, (4) imported, and (5) exported.

[23] In theory, it might be possible to track emissions from transformation and destruction simply using quantities reported under OO. However, this would require that (1) fluorinated GHGs that are produced only to be transformed or destroyed be tracked separately, (2) production, transformation, and destruction be measured to very good precision and accuracy (*e.g.,* 0.2 percent), and (3) that no by-products be formed or emitted during these processes. If all of these conditions were met, emissions could be equated to the differences between production and transformation and production and destruction. In practice, however, it would be difficult to meet all of these conditions.

[24] Following the precedents set by other Clean Air Act regulations, EPA is using the term "uncontrolled" to describe such emissions. Specifically, EPA is proposing to define "uncontrolled fluorinated GHG emissions" as a gas stream containing fluorinated GHG which has exited the process (or process condenser, where applicable), but which has not yet been introduced into an air pollution control device to reduce the mass of fluorinated GHGs in the stream. The term does not imply that the emissions are never controlled, but is synonymous with "pre-control emissions."

TABLE 8—THRESHOLD ANALYSIS FOR FLUORINATED GHG EMISSIONS FROM PRODUCTION OF HFCS, PFCS, SF_6, NF_3, CFCS, AND HCFCS

[Controlled Emissions]

Threshold level (metric tons CO_2e/r)	Total national emissions (metric tons CO_2e)	Number of facilities	Emissions covered		Facilities covered	
			Metric tons CO_2e	Percent	Number	Percent
1,000	10,600,000	14	10,600,000	100	14	100
10,000	10,600,000	14	10,600,000	100	14	100
25,000	10,600,000	14	10,600,000	100	14	100
100,000	10,600,000	14	10,300,000	97	10	71

As can be seen from the tables, most HFC, PFC, SF_2e , NF_3, CFC, and HCFC production facilities would be covered by all the thresholds considered. Although we do not have facility-specific production information for producers of fluorinated anesthetics, we believe that few or none of these facilities are likely to have uncontrolled emissions above the proposed threshold.

EPA is proposing to use a threshold based on uncontrolled (pre-control) rather than controlled (post-control) emissions to ensure that facilities that generate significant quantities fluorinated GHGs fully characterize and quantify their emissions, even if they initially believe those emissions to be small. Discussions with fluorinated gas manufacturers indicate that occasionally, fluorinated GHG by-products may be generated and emitted from production processes unexpectedly. If these by-products are relatively difficult to destroy (*e.g.,* CF_4), facilities' post-control emissions may be significantly higher than expected.[25] The initial scoping test described in the next section is intended to identify the full range of fluorinated GHGs in potentially emitted streams. Applying the full methodologies on the basis of the initial scoping study will provide EPA and the facilities with critical information on the extent to which control technologies are actually reducing emissions and therefore on the actual emissions from the facility.

EPA is requesting comment on an alternative approach in which all fluorinated gas production facilities, regardless of their estimated pre-control emissions, would analyze their emissions using the initial scoping test discussed in the next section. This approach would ensure that facilities understood the identities, and therefore the GWPs, of the fluorinated GHGs potentially emitted. EPA requests comment on this option, as well as on the option of simply eliminating the threshold for fluorinated gas production facilities and making this an "all-in" category.

As is true for the source categories covered by the Final MRR, fluorinated GHG production facilities could cease reporting if their controlled (post-control) emissions were 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. This approach may be appropriate if control technologies are effective and there is no evidence of unexpected uncontrolled emissions. However, EPA requests comment on an alternative "off-ramp" for this source category. Under this alternative approach, the 25,000 and 15,000 $mtCO_2e$ triggers would be based on the level of emissions that is estimated before accounting for the use of any control technology (*e.g.,* thermal oxidation). EPA is requesting comment on this approach because emissions can become quite large if the destruction device malfunctions, is not operated properly, or is not used for some other reason.

As noted above, EPA estimates that under this proposal, all HFC, PFC, SF_6, and NF_3 production facilities would be covered, and few or no anesthetics producing facilities would be covered. However, it is possible that EPA has underestimated total pre-control emissions from anesthetics. In its threshold analysis for fluorinated GHG production, EPA has assumed that emissions have GWPs similar to those of the product produced. However, fluorinated anesthetics are hydrofluoroethers, and other HFE production processes of which EPA is aware generate by-products with higher GWPs than the product. EPA requests comment on this issue.

A full discussion of the threshold selection analysis is available in the revised Fluorinated Gas Production TSD. For specific information on costs, including unamortized first year capital expenditures, please refer to the Economic Impact Analysis (EIA) for this rulemaking.

5. Selection of Proposed Monitoring Methods

a. Summary of Proposed Monitoring Methods

We are proposing to allow facilities to use either a mass-balance approach or a site-specific, process-vent-specific emission factor (PSEF) approach to estimate their fluorinated GHG emissions from fluorinated GHG production. Facilities would be required to use the PSEF approach to estimate their fluorinated GHG emissions from CFC and HCFC production or from fluorinated gas transformation. The mass-balance approach is similar to that proposed in April, 2009, but has been modified in some details in response to comments. Facilities using either approach would be required to perform a one-time scoping test to identify the fluorinated GHGs in certain emitted streams and to verify the destruction efficiency (DE) of any destruction devices every five years. These approaches are discussed in more detail below.

b. Initial Scoping Test of Potentially Emitted Fluorinated GHGs

In today's action, we are proposing that facilities that produce fluorinated gases perform an initial scoping test (proposed 40 CFR part 98.124(a)). The purpose of the scoping test is to ensure that all of the fluorinated GHGs that occur in emitted streams are properly identified. EPA is concerned that without the test, facilities could mischaracterize the set of fluorinated GHGs that was emitted, leading to inaccurate emissions estimates. We are aware that in general, facilities will have already identified most if not all of the fluorinated GHGs occurring in emitted streams during process design and bench and pilot scale testing. However, as noted above, we are also aware of

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[25] It is important to note that even if a threshold based on controlled emissions were adopted, failure to report as required when a source's actual emissions were above that threshold would be a violation of these regulations and the Clean Air Act. Lack of test data or other errors of omission do not excuse such violations as the Clean Air Act is a strict liability statute.

situations in which producers have analyzed process or emissions streams and found fluorinated GHGs that they were not expecting. Such by-product fluorinated GHGs can have high GWPs, making their CO_2-equivalent emissions significant.

Under this requirement, which would be one-time for any given process, facilities would be required to sample the vent(s) or stream(s) that, alone or together, would be expected to contain all the fluorinated GHG by-products of the process. Facilities would be required to use EPA Method 18 (GC/ECD, GC/MS), EPA Method 320 (FTIR), or ASTM D6348–03 (FTIR) to identify fluorinated GHGs that occur in concentrations above 0.1 percent in emitted streams.

For facilities using the mass-balance approach, the scoping test could be used to determine whether some emissions that are assumed to occur in the form of the product are actually occurring as by-products. For facilities using the process-vent-specific emission factor approach (PSEF), the test would identify by-products to measure in subsequent emissions testing to develop emission factors.

To avoid the need to survey a large number of processes with relatively small fluorinated GHG emissions, EPA is proposing to limit the scoping test requirement to processes that would emit more than one metric ton per year of fluorinated GHGs before the imposition of control technologies. We are proposing a limit in tons of fluorinated GHGs rather than in tons of CO_2e because the identities, and therefore the GWPs, of some fluorinated GHG constituents of the stream may not be known. Acquiring this information is the purpose of the test. We developed the one-ton limit by starting with a limit of 10,000 $mtCO_2e$ for each process and making the reasonably conservative assumption that the unknown fluorinated GHG could have a GWP of 10,000. For purposes of estimating the mass of fluorinated GHG emitted from the process, facilities could use the same types of engineering calculations that they would use to determine whether process vent testing was required under the PSEF approach (described in more detail below). They could assume that the mass of carbon, fluorine, or another relevant element is emitted in the form of fluorinated GHGs that were previously identified in bench- or pilot-scale testing.

We are proposing that the one-metric-ton trigger be applied to emissions before rather than after control because some byproducts, particularly CF_4, are very difficult to destroy. If these by-products occurred unexpectedly in a stream and if the trigger were applied to emissions after control, the facility would underestimate controlled emissions. Consequently, the facility could fail to undertake the scoping test when it was actually appropriate and could overlook the occurrence and emissions of the by-products.[26] We are proposing that facilities test the streams before the control device because emissions streams are often diluted during destruction processes (*e.g.,* due to fuel and air feeds), which would make it more difficult to detect and identify fluorinated GHGs that survived the destruction process. However, we request comment on this requirement as well as on the scoping test requirement as a whole.

c. Mass-Balance Approach

We are proposing that facilities producing fluorinated GHGs have the option of monitoring emissions using the mass-balance approach. In this approach, facilities would calculate the difference between the expected production of each fluorinated GHG based on the consumption of reactants and the measured production of that fluorinated GHG, accounting for yield losses related to byproducts (including intermediates permanently removed from the process) and wastes. Yield losses that could not be accounted for would be attributed to emissions of the fluorinated GHG product. This calculation could be performed for any fluorine- or carbon-containing reactant (*e.g.,* HF or hydrocarbon) to estimate emissions of the fluorinated GHG product for that reactant (*i.e.,* the mass balance may be based on a carbon balance or a fluorine balance). If fluorinated GHG byproducts were produced and were not completely recaptured or completely destroyed, facilities would also estimate emissions of each fluorinated GHG by-product.

Because the mass-balance approach assumes that losses from the process are emissions of the product, EPA believes that the mass-balance approach would only be appropriate for estimating emissions from fluorinated GHG production, not production of CFCs, HCFCs, or polymers. (In the last three situations, the product is not a fluorinated GHG.) However, EPA requests comment on this issue.

To be eligible to use the mass-balance approach, facilities would have to demonstrate that their planned measurements could meet a statistical error limit required in the rule (described below). If the facility could not demonstrate that it could meet the error limit, it would have to improve the accuracy and/or precision of its monitoring and measurement devices or opt to use another monitoring approach offered in the rule.

To carry out the mass-balance approach, the facility would choose a reactant for yield calculation purposes. The facility would then weigh or meter the mass of that reactant fed into the process, any primary fluorinated GHG produced by the process, the mass of the reactant permanently removed from the process (*i.e.,* sent to the thermal oxidizer or other equipment, not immediately recycled back into the process), any fluorinated GHG byproducts generated, and any streams that contain the product or fluorinated GHG byproducts and that are recaptured or destroyed. These measurements would be tracked monthly or more frequently and consolidated and recorded on a monthly basis. If monitored streams (including relevant process streams, emissions streams, and destroyed streams) included more than one component (product, byproducts, or other materials) in more than trace concentrations,[27] the facility would be required to monitor concentrations of products and byproducts in these streams. Finally, the facility would be required to perform monthly mass-balance calculations for each product produced.

Statistical Error Estimate. To estimate the statistical error associated with use of the mass-balance approach, facilities would be required to use error propagation, considering the accuracy and precision of their measurements and the calculation methods of the mass-balance approach. This approach is described in more detail in the TSD for this proposal. Under this approach, EPA would not specify precision and accuracy requirements for individual mass or concentration measurements. Instead, EPA would require that the error associated with the overall estimate of fluorinated GHG emissions fall under 30 percent (relative error) or under 3,000 $mtCO_2e$ (absolute error). (Both errors are expressed as halves of 95 percent confidence intervals; for normal distributions, this is quite close

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[26] For example, suppose that a facility believed that all of the fluorinated GHG by-products from a certain process consisted of HFCs, which its destruction device destroyed with a destruction efficiency of 99.9 percent, but that one of these by-products was actually CF_4, which the destruction device destroyed with an efficiency of only 50 percent. In this case, the facility could underestimate its fluorinated GHG emissions by more than an order of magnitude, neither seeking nor finding the CF_4 that it was actually emitting.

[27] EPA is proposing to define "trace concentration" as any concentration less than 0.1 percent by mass of the stream.

to two standard deviations). Facilities could achieve this level of precision however they chose.

We are proposing to require the error estimate to ensure that the use of the mass-balance approach yields accurate emission estimates. As observed by several groups that commented on the initial proposal, the mass-balance approach can result in large errors if measurements of the flow of fluorinated GHGs in one or more streams have significant errors.[28] We recognize that the proposed approach requires facilities to calculate the overall error of their own estimates, which adds complication and introduces opportunities for mistakes. We therefore plan to develop a calculation tool that would permit reporters to develop an error estimate, reducing both their burden and the likelihood of errors.

We are proposing a maximum relative error of 30 percent because this error is comparable to that cited by the facility that has used an emission factor approach to estimate its fluorinated GHG emissions.[29] It is also comparable to the error that EPA calculates for a facility with an emission rate of two percent and with good precisions and accuracies for its mass flow measurements (+/−0.2 percent) and for its concentration measurement (+/−10 percent) of a waste stream constituting five percent of the process's fluorinated GHG output flow.

For facilities whose emissions constitute a very small share of their inputs and outputs (*e.g.,* one percent or less), a relative error of 30 percent will be very difficult to achieve using a mass-balance approach. At the same time, the absolute error of such a facility's estimate may be smaller than the absolute error of a facility that meets the relative error test but that has a higher emission rate. EPA is therefore proposing a maximum permissible absolute error of 3,000 $mtCO_2e$ for facilities whose estimates have relative errors greater than 30 percent. This absolute error is equivalent to 30 percent of the 10,000 $mtCO_2e$ threshold that is used elsewhere in the subpart to establish requirements for different sources (*e.g.,* process vents). Under this approach, processes whose emissions were lower than 10,000 $mtCO_2e$ could have relative errors higher than 30 percent so long as they met the limit on absolute error. This approach avoids penalizing processes and facilities with low emissions. EPA requests comment on the absolute error limit of 3,000 $mtCO_2e$. EPA is also considering a higher limit, *e.g.,* 5,000 $mtCO_2e$.

Another approach that would avoid penalizing facilities with low emission rates would be to express the maximum relative error as a fraction of the total mass of reactants fed into (or consumed by) the process. For a given process, this mass would remain relatively constant regardless of the emission rate. For the model facility described above, with errors of 0.2 percent in its mass flow measurements and of 10 percent in its concentration measurements, the error of the emissions estimate relative to the total mass of reactants is about 0.3 percent. One advantage of this approach compared to the absolute limit is that this approach limits the relative errors for processes with small throughputs, while the absolute limit could permit very large relative errors for processes with small throughputs. EPA requests comment on this approach.

In developing the approach to specifying maximum absolute and/or relative errors for the overall emissions estimate, we considered the alternative of specifying the maximum allowable errors (precisions and accuracies) of the individual measurements that feed into the mass-balance equation. This is the approach that EPA took in the initial proposal. This approach limits error, but it also limits flexibility, a concern raised by several commenters. Even a facility with a relatively large error in one stream may be able to bring the total error of its emissions estimate to a tolerable level by improving the accuracy and precision of other measurements that are used in the mass-balance equation, such as the mass flows of reactants and products. Nevertheless, EPA requests comment on the option of reverting to specific tolerances for individual measurements that feed into the mass-balance equation, as originally proposed.

Choice of Reactant Whose Yield Is Measured. EPA is today proposing to allow facilities to estimate emissions under the mass-balance approach using one of the reactants rather than both as originally proposed.[30] Some fluorinated GHG producers noted that, for various reasons, it is sometimes considerably more difficult to track the yields of some reactants than others (*e.g.,* HF vs. an organic feedstock). EPA notes that facilities estimating their emissions based on the yield of one reactant would still need to be able to demonstrate that their estimate passed the statistical error test discussed above. EPA requests comment on this approach.

Frequency of Measurement and Calculation. In today's proposed rule, EPA is proposing to require that facilities using the mass-balance approach measure and calculate their emissions monthly. A number of fluorocarbon producers who commented on the initial proposal noted that daily measurements were burdensome and led to large errors in the estimates of daily emissions. They observed that many streams contain acidic and reactive constituents such as HF, and that sampling from these streams can create safety hazards. They also noted that daily yield measurements can vary significantly (sometimes exceeding 100 percent) for three reasons. First, when continuous processes are first started, there is a lag time between the time the reactants are fed into the process and the time products emerge. Second, even after the process has been running for a while, the quantity of material in the process can vary based on weather, changes in production rates, and other conditions. Third, the relatively large errors in measurements of in-process product holding tanks (*e.g.,* based on sight-glass readings) have a significant impact on daily mass balances. Over time, all of these effects smooth out, making longer term mass balances far more reliable than daily mass balances.

EPA has carefully considered these comments. The goal of the rule is to gather information on annual, not daily, emissions. The advantage of more frequent measurements and calculations is that, where mass flows and concentrations are variable, more frequent measurements and calculations will lead to more accurate and precise estimates than less frequent measurements and calculations. However, in this case the disadvantages of daily measurement and calculation

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[28] The mass-balance approach works by subtracting the masses of process outputs from those of process inputs. As a result, errors that are a relatively small share of these masses become a large share of the difference between them. Errors are particularly a concern for streams where the fluorinated GHG is only one component of the total flow, and where, therefore, fluorinated GHG concentrations must be measured. In general, the accuracy and precision of concentration measurements is expected to be approximately +/−10 percent, although this can be as low as five percent and as high as 20 percent, depending on the circumstances. If this 10 percent error applies to a stream that constitutes a significant input or (more likely) output of the process, it can lead to an emissions estimate with a high relative error.

[29] A 13 percent error expressed as a standard deviation translates into a 26 percent error expressed as one half of a 95 percent confidence interval.

[30] Under the initial proposed rule, facilities would have been required to perform the mass-balance calculations for each reactant (*e.g.,* both HF and the chlorocarbon or hydrocarbon) and to take the average of the two results as the emissions estimate. This would be expected to lead to the most robust estimate (*i.e.,* the estimate with the lowest uncertainty) if the uncertainties in both yield calculations were similar.

appear to outweigh the advantages. EPA believes that monthly mass-balance calculations will lead to acceptably accurate estimates at reasonable cost. Nevertheless, EPA requests comment on whether the variability of the mass flows or concentrations in some production processes may be sufficiently large to justify more frequent measurement and calculation, *e.g.,* weekly.

EPA also requests comment on whether annual or less frequent characterizations of fluorinated GHG concentrations in some streams should be permitted under the mass-balance approach. Some fluorinated GHG producers have stated that it is difficult to measure fluorinated GHG concentrations in some streams. In some cases, this is because waste streams contain hydrofluoric acid (HF), which, due to its acidity and reactivity, can damage sampling and analytical equipment. As discussed in the TSD, there may be technical solutions to this problem. To the extent that these approaches could be relatively difficult or expensive to implement, however, it might be appropriate to permit very infrequent measurements. The disadvantage of this approach is that it might lead to large errors, particularly for processes that vary over time. A series of measurements might be required to (1) reduce the error and (2) quantify the error for purposes of the statistical error test. Such measurements would be analogous to those used to develop emission factors.

Reactant and Byproduct Emissions. EPA recognizes that the proposed mass-balance approach would assume that all yield losses that are not accounted for are attributable to emissions of the fluorinated GHG product. In some cases, the losses may be untracked emissions (or other losses) of reactants or fluorinated by-products. In general, EPA understands that reactant flows are measured at the inlet to the reactor; thus, any losses of reactant that occur between the point of measurement and the reactor are likely to be small. However, reactants that are recovered from the process, whether they are recycled back into it or removed permanently, may experience some losses that the proposed method does not account for.

Fluorocarbon by-products, according to the IPCC Guidelines, generally have “radiative forcing properties similar to those of the desired fluorochemical.” However, EPA is aware of at least one facility where byproducts often have much larger GWPs than the products. In this case, assuming by-product emissions are product emissions would lead to large errors in estimating overall fluorinated GHG emissions. EPA believes that the initial scoping test of emitted streams that is discussed above would help to determine whether this was an issue for a given process.[31] If it was, then the facility could elect to pursue the PSEF approach rather than the mass-balance approach for that process, or, if the facility was still interested in pursuing the mass-balance approach, it could perform more emissions testing to develop a robust break-out among the fluorinated GHGs assumed to be emitted under the mass-balance approach. Such emissions testing would be similar to that performed for the PSEF approach below, except it would focus on the partitioning of emissions among the various fluorinated GHGs. This approach is discussed in more detail in the TSD. EPA requests comment on this and other possible approaches for distinguishing between emissions of fluorinated GHG products and emissions of fluorinated by-products under the mass-balance approach.

Alternative approach based on measurements of balanced element (e.g., total fluorine). EPA is considering an alternative to the mass-balance approach described above in which facilities would not be required to speciate their streams (including relevant process streams, destroyed streams, and emitted streams) monthly. Instead, they could make monthly measurements of the total fluorine (or other element of interest other than carbon) in the streams, *e.g.,* by burning them. This approach, which is described in more detail in the TSD, could be particularly useful for processes with multiple by-products. Facilities would still be required to perform an initial survey of the fluorinated GHGs in the stream(s) to identify the fluorinated GHG constituents. In addition, as discussed above, it may be appropriate to require facilities to perform emissions testing to ensure that emissions are properly allocated among the product and various by-products. However, facilities would perform this testing relatively infrequently (*e.g.,* every five years) rather than monthly. One potential concern regarding this variant of the mass-balance approach is the potential difficulty of performing analysis of combustion products that are likely to include HF and HCl. It may be appropriate to require facilities to validate this approach against the mass-balance method described above. EPA requests comment on this approach.

d. Process-Specific Emission Factor Approach

EPA is proposing an additional monitoring approach based on site-specific, process-specific emissions factors. This approach includes either calculation or measurement of process vent emission factors depending on the size and fate of the emissions from the vent. Under this approach, facilities would develop preliminary emissions estimates to determine the level of annual uncontrolled emissions from each process vent in processes subject to this subpart. For process vents with uncontrolled emissions of less than 10,000 mtCO$_2$e (or less than 1 metric ton for emissions that include a fluorinated GHG whose GWP does not appear in Table A–1 of subpart A), facilities could conduct either engineering calculations or emissions testing to develop emission factors. Facilities could also conduct either engineering calculations or emissions testing to develop emission factors for emissions that were vented to a destruction device demonstrated to achieve a destruction efficiency of 99.9 percent (for fluorinated GHGs), as long as equipment or procedures[32] were in place to ensure that uncontrolled emissions did not occur. For other vented emissions, facilities would be required to conduct emissions testing to determine the process vent emission factor.

To estimate annual fluorinated GHG emissions from each vent, facilities would multiply each emission factor by the appropriate activity data and account for the use (and uptime) of destruction devices. The fluorinated GHG emissions for all vents at the facility would be summed to obtain the total emissions from process vents for the facility as a whole.

To ensure that the emissions estimate encompassed all sources of emissions within the processes that would be subject to this subpart, facilities using the emission factor approach would also be required to estimate emissions from equipment leaks.[33] Leaks would be

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[31] For example, if the survey indicated that attributing all unaccounted-for losses to product emissions would lead to more than a ten percent error in the CO$_2$e emitted, the facility could be required to adjust its emissions estimate to account for by-product losses.

[32] Such equipment or procedures could include, for example, holding tank capacity, monitoring of by-pass streams, or compulsory process shutdowns in the event the destruction device remains off line.

[33] As noted above, process vents are only one of the sources of emissions from production, transformation, and destruction processes. Another source is equipment leaks, specifically, leaks from piping and connections. The mass-balance approach does not need to be supplemented with equipment leak assessment because it accounts for all emissions between the measurements of inputs

monitored annually using EPA Method 21 and the *Protocol for Equipment Leak Estimates* U.S. Environmental Protection Agency, EPA Publication No. EPA–453/R–95–017, November 1995.

EPA is proposing less demanding measurement requirements for small and destroyed emission streams to ensure that the effort and resources expended to measure emissions are commensurate with the size of those emissions. This principle has been adopted both for other source categories in the MRR and for numerous other EPA programs. However, EPA is requesting comment on some aspects of its proposed approaches.

First, we request comment on the appropriateness of the CO_2e cutoff below which calculations are permitted. One potential concern associated with this approach is that 10,000 $mtCO_2e$ equates to relatively low mass emissions of fluorinated GHGs with high GWPs. For example, 10,000 $mtCO_2e$ equates to 923 pounds of SF_6 and 1,282 pounds of NF_3. Our understanding is that SF_6 can be detected at extremely low emission rates and concentrations, but we request comment on whether emissions of other high-GWP compounds at this level may be difficult to detect. An option on which we are requesting comment is to relax the CO_2e emissions cutoff and to include an unweighted emissions cutoff (*i.e.,* in tons of fluorinated GHG) along with it. For example, for process vents with less than 25,000 $mtCO_2e$ uncontrolled and less than 10,000 pounds of fluorinated GHG uncontrolled, facilities would have the option to conduct emissions testing or engineering calculations or assessments.

Second, EPA requests comment on its criteria for allowing use of engineering calculations to characterize the emissions of process vents that vent to destruction devices. EPA understands that many and perhaps most destruction devices used at fluorinated GHG production facilities can achieve DEs of 99.9 percent or better. EPA also understands that many facilities have equipment or procedures in place to prevent uncontrolled emissions, though some do not. It is important to note that uncontrolled emissions during device downtime can reduce the effective (time-weighted average) DE to 90 percent or less, increasing emissions by a factor of 100 or more. However, one alternative to the proposed approach would be to allow the use of engineering calculations for any vent whose emissions, considering both the DE and the historical uptime of the destruction device, fell below the 10,000 $mtCO_2e$ cutoff. For purposes of this calculation, the annual time of uncontrolled emissions could be equated to the longest annual time of uncontrolled emissions observed over the previous five years. EPA requests comment on this alternative approach.

Preliminary estimates. To develop preliminary emissions estimates for each vent, facilities would be permitted to use the same types of previous measurements, engineering calculations, and engineering assessments that they would be permitted to use to develop emission calculation factors. These are described below under “Process-specific Emission Calculation Factor Approach.”

Process vent emissions testing. For process vent emissions testing, facilities would be required to use EPA reference methods, including EPA Method 18 and EPA Method 320, or ASTM D6348–03.[34] Alternative testing methods could be used if validated using EPA Method 301. EPA reference methods are included in the rule requirements for determining sample and velocity traverses, velocity and volumetric flow rates, gas analysis, and stack gas moisture, along with several alternative flow rate determination methods, such as OTM–24 and ALT–012. Commenters who have previously estimated their emissions of fluorinated GHGs stated that they used these approaches to do so.

The testing periods would be required to include representative process operation and to exclude atypical events (such as process upsets or malfunctions).[35] Within any given operating scenario (discussed further below), the full range of process operation would be required to be represented, *i.e.* the emissions data must be representative of typical process operation while also including process variability. Facilities would be required to consider process parameters that may potentially cause variability of the emissions, such as catalyst degradation, seasonal variability, raw material suppliers, *etc.* For example, where a facility uses a catalyst, test runs would have to be conducted at various points over the life of the catalyst. The production level during the testing periods would be required to be representative of normal operation.

To develop process-specific emissions factors, facilities would be required to conduct at least three test runs and to analyze the relative standard deviation (RSD) of the emission factors corresponding to each run to determine whether additional runs were necessary. The emission factors and their RSD would be calculated across all fluorinated GHGs emitted from the vent in CO_2e terms. If the RSD exceeded twenty percent, the facility would be required to conduct an additional three tests. The rationale for the RSD test is that if the variability of a population or parameter is large, then more samples are required to obtain a robust estimate of the mean (average) of that parameter. EPA estimates that at a relative standard deviation of 20 percent, an emission factor calculated as the mean of three test runs has a 95 percent chance of being within 50 percent of the actual mean emission rate of the process. The reasoning and calculations behind this conclusion are discussed in more detail in the TSD.

An alternative approach would be to conduct additional runs until the change in the running average emission factor fell under 10 percent. This approach is similar to requirements for measuring emission factors (slope coefficients) in subpart F (Primary Aluminum) and could provide representative emissions from the process and address variability. However, it has two potential drawbacks in the context of fluorinated gas production. First, for processes whose variability is predictable (*e.g.,* due to catalyst age) rather than random, the fourth sample could satisfy the running average requirement but lead to a biased emission factor, for example if two of the four samples were taken when the catalyst was new. Second, facilities could find it inconvenient to analyze samples and calculate emission factors between each test run after the first three. EPA requests comment on this alternative approach.

For continuous process vents, facilities would conduct 1-hour test runs, and for batch process vents, facilities would test during emissions episodes of the batch. We request comment on the appropriate number of test runs to conduct for continuous and batch process vents and the appropriate RSD that facilities should meet. We also request comment of the appropriateness

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and outputs, whether these emissions occur from vents or leaks. (This assumes that the production measurement used to estimate and report emissions under the mass-balance approach is the same as that used to report additions to the industrial gas supply. EPA is proposing that these two measurements be identical.)

[34] EPA Method 320 and the ASTM method are Fourier Transform Infrared (FTIR) methods. For such methods, compounds are identified by characteristic spectra, and libraries providing spectra for the range of compounds likely to be found in emissions streams can greatly facilitate analysis. EPA requests comment on whether such spectral libraries are available for fluorinated GHGs, and if not, on whether EPA might play a role in assembling a spectral library for fluorinated GHGs.

[35] EPA is proposing an exception if monitoring is sufficiently long to ensure that such events are not overrepresented in the emission factor.

of testing batch process vents during emissions episodes only. Another option is to require testing of vents for the full duration of the batch process, but this could significantly increase the expense of the emissions test without necessarily improving its accuracy.

Where multiple processes vent into a common vent or control device, EPA is proposing that facilities do one of the following: sample each process in the ducts before the emissions are combined, sample when only one process is operating, or sample the combined emissions at representative combinations of capacity utilizations for all the processes. If the last option were selected, facilities would be required to perform 3 times n test runs, where n is the number of processes feeding into the common vent or add-on control device. The emission factor would be calculated by dividing the total emissions by the summed activity across the processes venting to the common vent, and the PSEF would be applied whenever one or more of the processes was operating.

Process activity data would have to be collected simultaneously with the emissions data during the emissions test. The process activity data would be used to develop the emissions factor. Process activity data that could be used in development of the emissions factor includes raw material feed, amount of product produced, or other process activity known to have a direct effect on emissions.

Facilities would be required to define the operating scenario that encompasses the range of operating conditions that represent typical operation for the process and to develop representative emissions factors for each operating scenario. To define the process operating scenario, a facility would include information including the process description and the specific process equipment used; the process vents, emission episodes and durations, and the quantity of uncontrolled fluorinated GHG emissions; the control device or destruction device used to control emissions; and the manifolding of process vents within the process and from other processes. Alternative operating scenarios would also be defined for differences in operating conditions that affect emissions. Examples of situations where process differences may warrant separate operating scenarios include the following: Making small volumes of a product in one set of batch process equipment part of the year and making larger volumes in larger batch process equipment part of the year; use of two different types of catalyst in the same process; deliberate alterations in process conditions such as temperature or pressure to shift the reaction to a particular product; and making small volumes of a product in a batch process part of the year and making large volumes in a continuous process part of the year. A facility is required to develop a representative emissions factor for each process operating scenario because each operating scenario for a process will result in different emissions levels.

In general, emissions testing during process startups and shutdowns would not be expected to lead to representative emission factors, because emission rates tend to fluctuate during such events. Exceptions to this could include long-term monitoring that would not over-represent startup or shutdown conditions in the resulting emission factor, and monitoring specifically to obtain emission factors for startups and shutdowns conditions. Several companies indicated that they have analyzed the emissions profile during startup events and during shutdown events. They found that the emission rates during these events departed from those at steady state conditions, but that emissions profiles were consistent between one startup event and another.

The uncertainty of the process-vent-specific emission factor approach is anticipated to be roughly 10 percent; the uncertainty of the emissions testing is estimated to be approximately 10 percent (as calibration requirements for most test methods require ±10 percent accuracy and precision), and the uncertainty of the process activity measurement is ±1 percent. While emissions testing must continue if the first three test runs exhibit an RSD or 0.2 or greater, the RSD is expected to be a measure of the variability of the process rather than the error of the measurement.

EPA is proposing that emission factors would need to be developed before December 31, 2011, the end of the first year of reporting under this subpart. Throughout 2011, facilities would be responsible for gathering monthly activity data to which the emission factors, once developed, would be applied to estimate monthly and annual emissions from each process.

Updates to Emission Factors. After developing their initial process-vent-specific emission factors, facilities would be required to update them every 5 years or when there was a process or equipment change that would alter the process operating scenario. Process or equipment changes would include changes in raw materials, equipment, production levels, or operating conditions that would be expected to affect the level of emissions. EPA is proposing periodic updates of the emission factors because facilities that have measured and re-measured their emission factors over a period of several years have found that gradual, incremental changes to the process (*e.g.,* to improve yields) have significantly changed emission factors over time. The proposed five-year frequency is consistent with that required for some source categories covered in the MRR (*e.g.,* for process vents used in HCFC–22 production processes under subpart O) but is higher than that required for others (*e.g.,* the 10-year frequency for measurement of slope factors for aluminum processes). EPA requests comment on the proposed frequency of measurement.

An alternative to regular updates to emission factors would be updates triggered by changes to other indicators of emission rates, such as process yields. Under such an approach, facilities could calculate how their emission factor would change if the change in yield were attributable solely to a change in the emission rate. If this change exceeded 15 percent (as a fraction of the current emission factor), the emission factor would need to be re-measured. EPA requests comment on this alternative.

Measurements performed before the effective date of this rule. We are proposing that emission factor measurements performed before the effective date of this rule could be used to estimate GHG emissions if the measurements were performed in accordance with the requirements of the rule less than five years before the effective date. We believe that it may also be appropriate to permit use of previously measured emission factors whose measurement departed in some particulars from the requirements of the rule but still substantially met most of the requirements, making it likely that the emission factors were representative. In this case, facilities could submit information to EPA on areas where measurements departed from the requirements from the rule, and EPA could review the measurements to verify that they still substantially met most of the requirements. We request comment on this option.

Process-Specific Emission Calculation Factor Approach. As noted above, facilities could use engineering calculations to estimate emissions from vents that either (1) had annual emissions below 1,000 mtCO$_2$e or (2) vented to a control device with a destruction efficiency of 99.9 percent and had equipment and procedures in place to prevent uncontrolled emissions. We are proposing an emission factor approach that includes both emissions testing and engineering calculations, with the required approach depending on the magnitude of uncontrolled emissions from the process vent.

Engineering calculations use basic chemical engineering principles and component property data to calculate emissions (and develop emission factors) rather than actually measuring emissions. Calculations for various emissions episodes could be conducted using standard equations presented in EPA's Emissions Inventory Improvement Process guidance documents, Pharmaceutical NESHAP, and Miscellaneous Organic NESHAP. Calculations highlighted in these documents and in codified rule text include vapor displacement, purging, heating, depressurization, vacuum systems, gas evolution, air drying, and empty vessel purging.

Engineering assessments may be conducted using previous test data or other information available on the process. Engineering assessments include use of previous test reports where the emissions are representative of current operating practices; bench-scale or pilot-scale test data that are representative of full-scale process operating conditions; design analysis based on chemical engineering principles, measurable process parameters, or physical or chemical laws or properties. The data used in engineering assessments must be documented.

Process activity data must be measured in conjunction with the emissions estimate based on calculations and assessments. This process activity data is needed to develop the emissions calculation factor.

Just as for emission factor development, facilities are required to define the operating scenario for the emission calculation factor development. Alternative operating scenarios would also be defined for differences in operating conditions that affect emissions. As discussed previously for the emission factor approach, a facility would be required to develop a representative emission calculation factor for each process operating scenario because each operating scenario for a process will result in different emission levels (*see* discussion above).

Facilities would update the process-vent-specific emission calculation factors every five years or when there is a process or equipment change that would alter the process operating scenario.

Potential use of continuous emissions monitors to measure emissions from vents. Another option we are considering is to require that facilities measure emissions from fluorinated gas production facilities using continuous emissions monitors (CEMS). Under this approach, facilities would be required to install and operate CEMS capable of measuring fluorinated GHGs to measure process emissions. The requirements for the CEMs would be similar to those in subpart C, adjusted, as appropriate, to accommodate CEMS for fluorinated gases. One possible option is to use Fourier Transform Infrared Spectrometers (FTIRs) in scrubber stacks to measure emissions. FTIR spectroscopy is presently used to conduct short-term fluorinated GHG emission measurements from processes.

If properly selected and maintained, CEMS would be expected to provide estimates of emissions more accurate than either the mass-balance or the process-vent approach. However, potential drawbacks to requiring CEMS are that they would be relatively expensive to install and they may not tolerate the acidic and reactive environments found in vents at many fluorinated gas production facilities. (The latter concern might be mitigated by installing CEMS after a scrubber, if this is practicable.) Given these potential concerns, it may be appropriate to require CEMS for particularly large emission streams, *e.g.,* those resulting in emissions of more than 50,000 mtCO$_2$e annually. EPA requests comment on the use and implementation of CEMS at fluorinated gas production facilities. We also request data or other information evaluating the use of CEMS in fluorinated gas production facilities to determine fluorinated GHG emissions.

Equipment Leak Emissions Estimates. For completeness, EPA is proposing that monitoring of process vents be supplemented by monitoring of equipment leaks, whose emissions do not occur through process vents. To estimate emissions from equipment leaks, we would require use of EPA Method 21 and the *Protocol for Equipment Leak Estimates* (EPA–453/R–95–017). Leak monitoring would be performed annually. The *Protocol* includes four methods for estimating equipment leaks. These are, from least to most accurate, the Average Emission Factor Approach, the Screening Ranges Approach, EPA Correlation Approach, and the Unit-Specific Correlation Approach. We are proposing that the facility use one of the last three methods. To use these methods, the facility would need to have (or develop) Response Factors relating concentrations of the target fluorinated GHG (or surrogate gas co-occurring in the stream) to concentrations of the gas with which the leak detector is calibrated. Our understanding is that flame ionization detectors (FIDs) are generally insensitive to fluorinated GHGs, and that they are therefore not likely to be effective for detecting and quantifying fluorinated GHG leaks. An exception to this would be a situation in which the fluorinated GHG occurred in a stream along with a substance (*e.g.,* a hydrocarbon) to which the FID was sensitive; in this case, the other substance could be used as a surrogate to quantify leaks from the stream. We understand that at least two fluorocarbon producers currently use methods in the Protocol to quantify their emissions of fluorinated GHGs with different levels of accuracy and precision.[36] Other analytical techniques that are sensitive to fluorinated compounds may be available to monitor concentrations of equipment leaks, including photoionization, ultraviolet, infrared, and others. EPA requests comment on the availability and use of portable monitoring instruments for equipment leak monitoring of fluorinated GHG.

Another approach for monitoring leaks from pieces of equipment includes use of the Alternative Work Practice (AWP) for EPA Method 21 (similar to monitoring requirements under 40 CFR part 60, subpart A, 40 CFR part 60.18; 40 CFR part 63, subpart A, 40 CFR part 63.11; or 40 CFR part 65, subpart A, 40 CFR part 65.7). This approach would include monitoring leaking equipment with an optical gas imaging instrument. Emissions from those pieces of equipment found to be leaking could be estimated based on emission factors. Under this approach, facilities would be required to image each piece of equipment associated with processes covered under subpart L and in fluorinated GHG service, and all

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[36] One producer estimates HFC and other fluorocarbon emissions by using the Average Emission Factor Approach. This approach simply assigns an average emission factor to each component without any evaluation of whether or how much that component is actually leaking. The second producer estimates emissions using the Screening Ranges Approach, which assigns different emission factors to components based on whether the concentrations of the target chemical are above or below 10,000 ppmv. This producer has developed a Response Factor for HCFC–22, which is present in the same streams as the HFC–23 whose leaks are being estimated. (HFC–23 emissions are discussed in Section O of the October 30, 2009 MRR.)

emissions imaged by the optical gas imaging instrument would be considered leaks and would be subject to emissions estimation. EPA requests comment on the technical feasibility and accuracy of this approach for fluorinated GHG emissions.

Other Potentially Significant Emission Points. We are requesting comment on the inclusion of fluorinated GHG emissions from storage tanks, wastewater, and container filling, particularly where these emissions occur before the production measurement at fluorinated GHG production facilities. We anticipate that emissions from wastewater and storage tanks would be small to insignificant due to the low solubility of most fluorinated GHGs in water and the use of pressurized tanks for storage. However, we request comment on the emission levels expected from these emission points.

Our current understanding is that most fluorinated GHG production facilities measure their production before container filling, *e.g.,* by using flowmeters just upstream of the container connection to measure the mass flowing into the containers. If this is the case, emissions that occur during or after filling (*e.g.,* from hoses and connections) would have been included in the production (supply) measurement. However, if production is measured by weighing containers before and after filling, then emissions during container filling would not have been included in the production measurement. In these cases, facilities using the emission factor approach would need to quantify container filling emissions for completeness. Possible methods for tracking these emissions include engineering estimates, default or site-specific emission factors, and mass balances. These methods are discussed in more detail in the TSD.

Destruction Device Performance Testing. EPA is proposing to require fluorinated gas producers that destroy fluorinated GHGs to conduct an emissions test every five years to determine the destruction efficiency (DE) of the destruction device. As discussed further in the TSD, the testing for determining the DE would be similar to the emissions testing required to develop process-specific emission factors, described above. Facilities would be required to conduct their testing when operating at high loads reasonably expected to occur and when destroying the most-difficult-to-destroy fluorinated GHG fed into the device (or when destroying a surrogate that was more difficult to destroy than that fluorinated GHG). The last point is particularly important because some fluorinated GHGs (*e.g.,* CF_4 and SF_6) are extremely difficult to destroy; DEs determined for other fluorinated GHGs would overestimate the destruction of these fluorinated GHGs.

Facilities that have conducted an emissions test on their destruction device within the five years prior to the effective date of the rule would be allowed to use the DE determined during that test if the test was conducted in accordance with the proposed test requirements. Facilities could also use the DREs determined during principal organic hazardous constituent testing and hazardous waste combustor testing, provided those tests determined the DRE based on the most-difficult-to-destroy fluorinated GHG fed into the device (or based on a surrogate that was more difficult to destroy than the most-difficult-to-destroy fluorinated GHG).

EPA is proposing to require reporting of fluorinated GHG emissions from destruction of fluorinated GHGs; we request comment on whether we should also require reporting of by-product fluorinated GHG emissions from destruction of CFCs and HCFCs. Specifically, we request comment on the extent to which fluorinated GHGs may be generated and emitted during destruction of CFCs and HCFCs at facilities producing these chemicals. Testing of destruction devices used in the electronics sector has shown that destruction of one fluorinated compound can lead to the emission of others under some circumstances.

6. Selection of Procedures for Estimating Missing Data

In the event that a scale or flowmeter normally used to measure reactants, products, by-products, or wastes fails to meet a test to verify its accuracy or precision, malfunctions, or is rendered inoperable, we are proposing that facilities be required to estimate these quantities using other measurements where these data are available. For example, facilities that ordinarily measure production by metering the flow into the day tank could use the weight of product charged into shipping containers for sale and distribution as a substitute. It is our understanding that the types of flowmeters and scales used to measure fluorocarbon production (*e.g.,* Coriolis meters) are generally quite reliable, and therefore that it should rarely be necessary to rely solely on secondary production measurements. In general, production facilities rely on accurate monitoring and reporting of the inputs and outputs of the production process. Nevertheless, EPA is also proposing that if a secondary mass measurement for the stream is not available, producers can use a related parameter and the historical relationship between the related parameter and the missing parameter to estimate the flow.

If concentration measurements are unavailable for some period, we are proposing that the facility use the average of the concentration measurements from just before and just after the period of missing data.

We request comment on these proposed methods for estimating missing data.

7. Selection of Data Reporting Requirements

Under the proposed rule, owners and operators of facilities producing fluorinated gases would be required to report both their fluorinated GHG emissions and the quantities used to estimate them on a process-specific basis. They would also be required to report the results of each scoping study, specifically, the chemical identities of the contents of potentially emitted streams. Facilities using the mass-balance approach would report the masses of the reactants, products, by-products, and wastes, and, if applicable, the quantities of any product in the by-products and/or wastes (if that product is emitted at the facility). The chemical identities of reactants, products, and by-products would also be reported, along with the chemical equations used to estimate emissions. Facilities using the emission factor approach would report the activity data used to calculate emissions (*e.g.,* the quantity produced, transformed, or destroyed) and the emission factors used to estimate them. We are proposing that owners and operators report annual totals of these quantities by process and facility.

Where fluorinated GHG production facilities have estimated missing data, the facility would be required to 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.

We propose that facilities report these data because the data are necessary to verify facilities' calculations of fluorinated GHG emissions. We request comment on these proposed reporting requirements.

8. Selection of Records That Must Be Retained

Maintaining records of the information used to determine the reported GHG emissions is necessary to enable us to verify that the GHG emissions monitoring and calculations were done correctly. Under the proposed rule, owners and operators of facilities producing fluorinated GHGs would be required to retain records documenting the data reported, including records of monthly emission estimation calculations, all data that went in to the calculations, calibration records for flowmeters, scales, and gas chromatographs, and documentation of emission factor development activities. These records are necessary to verify that the GHG emissions monitoring and calculations were performed correctly.

C. Electric Transmission and Distribution Equipment Use

In the April 2009 proposed MRR (74 FR 16448; April 10, 2009), EPA proposed mandatory reporting of SF_6 and PFC emissions from electric power transmission and distribution system equipment in subpart DD. As initially proposed, this source category would comprise electric power transmission and distribution systems that operate using gas-insulated substations, circuit breakers and other switchgear, or power transformers containing sulfur hexafluoride (SF_6) or perfluorocarbons (PFCs) and emissions would represent the annual facility-wide emissions of SF_6 and PFCs for the reporting facility.

EPA received comment from approximately 22 entities, many of whom requested elaboration on what is included in an electric power system for purposes of this source category as well as the relationship of an electric power system to a facility. The requirements of 40 CFR part 98 apply to owners and operators of any "facility".[37] EPA is issuing this supplemental proposal to provide additional detail on this source category.

In doing so, our objective is to clarify and solicit further comment on the scope of an "electric power system" and what constitutes a facility for this subpart. We also provide further detail on options we considered. We are proposing to integrate the Energy Information Administration of the Department of Energy (EIA) list of examples of electric power entities into the definition of a facility for this subpart. The EIA lists the following as electric power entities: "a company; an electric cooperative; a public electric supply corporation as the Tennessee Valley authority; a similar Federal department or agency such as the Bonneville Power Administration; the Bureau of Reclamation or the Corps of Engineers; a municipally owned electric department offering service to the public; or an electric public utility district (a "PUD"); also a jointly owned electric supply project such as the Keystone."[38] We are proposing to incorporate the EIA list of electric power entities because it is widely used in the industry and includes the spectrum of energy supply participants with relevant operations, *i.e.,* vertically integrated, generate and transmit only, transmit and distribute only, transmit only and distribute only.

We are also seeking comment on whether it would be appropriate to use the Regional Greenhouse Gas Initiative (RGGI) definition of a transmission and/or distribution entity in our definition of electric power system.[39] RGGI defines an entity as "the assets and equipment used to transmit and distribute electricity from an electric generator to the electrical load of a customer." It includes all related assets and equipment located within the service territory of the entity, defined as the service territory of a load-serving entity specified by the applicable State regulatory agency. In particular, EPA seeks comment on whether the RGGI definition includes the spectrum of entities identified in the EIA list and captures the full universe of SF_6-emitting entities in the United States.

EPA is requesting comments on only 40 CFR 98.300 Definition of the Source Category in proposed subpart DD. EPA is not seeking further comment on other elements of the initial proposal such as the selection of the threshold and the proposed monitoring methods.

1. Definition of the Source Category

EPA proposes to define the source category as follows: "The electric equipment use source category includes electric power systems as described in this paragraph. Notwithstanding the definition of facility in subpart A, for purposes of this subpart, "facility" means an electric power system. Electric power system means the collection of SF_6- and PFC-insulated equipment linked through electric power transmission or distribution lines and operated as an integrated unit by one electric power entity or several entities that have a single owner. SF_6- and PFC-insulated equipment includes gas-insulated substations, circuit breakers, other switchgear, gas-insulated lines, and power transformers containing SF_6 or PFCs. Equipment also includes gas containers such as pressurized cylinders, gas carts, new equipment owned but not yet installed, or other containers."

The largest use of SF_6 is as an electrical insulator and interrupter in equipment intended for use in connection with generation, transmission, distribution, and conversion of electric energy. The gas has been employed by the electric power industry in the United States since the 1950s because of its dielectric strength and arc-quenching characteristics. SF_6 has replaced flammable insulating oils in many applications and allows for more compact substations in dense urban areas. It has also facilitated expansion of the electric power grid through long-distance transmission at high and extra-high voltages. SF_6 is used in gas-insulated substations, circuit breakers and other switchgear, transformers, and gas-insulated lines. The types and location of gas-insulated equipment used varies depending on a number of technical, system design, geographic and historic factors. Currently, there are no available substitutes for SF_6 in high-voltage applications. For further information, *see* the SF_6 from Electrical Equipment TSD in the docket for this rulemaking (EPA–HQ–OAR–2009–0927).

Since SF_6 is used in pressurized equipment, unintended emissions of SF_6 occur over the life cycle of the equipment. SF_6 can escape from gas-insulated substations and switchgear through seals, especially from older equipment. The gas can also be released during installation, servicing, and equipment disposal. Emissions of SF_6 from electric power systems were estimated to be 12.4 million metric tons of CO_2e in 2006. Emissions from electrical equipment manufacture and refurbishing are being covered in subpart SS.

PFCs are sometimes used as dielectric and as heat transfer fluids in power transformers. PFCs are also used for retrofitting CFC–113 cooled transformers. The common PFC used in this application is perfluorohexane (C_6F_{14}). In terms of both absolute and carbon-weighted emissions, PFC emissions from electrical equipment are generally believed to be much smaller than SF_6 emissions. EPA does not currently have an estimate of PFC emissions from this source category.

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[37] Unless otherwise specified in an individual subpart, facility means any physical property, plant, building, structure, source, or stationary equipment located on one or more contiguous or adjacent properties in actual physical contact or separated solely by a public roadway or other public right-of-way and under common ownership or common control, that emits or may emit any greenhouse gas. Operators of military installations may classify such installations as more than a single facility based on distinct and independent functional groupings within contiguous military properties.

[38] Energy Information Administration of the U.S. Department of Energy, Energy Glossary: Energy terms and definitions; *http://www.eia.gov/glossary.*

[39] Regional Greenhouse Gas Initiative Model Rule, 2008.

PFCs, however, are very potent and persistent greenhouse gases and an accurate inventory of use and emissions from all sources is important. Consequently, as stated in our initial proposal, we are proposing to include emissions of PFCs in this subpart. Reference to gas-insulated equipment implies SF_6 and PFCs.

The electric transmission and distribution equipment use source category includes all gas-insulated electrical equipment such as gas-insulated substations, circuit breakers, other switchgear, gas-insulated lines, and power transformers. This equipment is used as part of an interconnected group of electric transmission lines and associated equipment for the movement or transfer of electric energy in bulk between points of supply and points at which it is transformed for delivery to the ultimate customer. This equipment, along with lines and other associated equipment used for the movement or transfer of electric energy, operates as part of a contemporaneous network in real-time and in a synchronous manner to provide stable and reliable electricity to customers.

A clear definition of a facility for this source category is important in order to determine whether a collection of electrical equipment meets the reporting threshold and to ensure that double or under reporting of emissions is minimized. In defining a facility, we reviewed current definitions used in the CAA and by the Federal Energy Regulatory Commission (FERC), North American Energy Reliability Corporation (NERC), California Air Resources Board (CARB), RGGI and EIA; consulted with industry; and reviewed current regulations relevant to the industry. Typically, the various regulations under the CAA define a facility as a group of emissions sources all located in a contiguous area and under the control of the same person (or persons under common control). The subpart A definition of facility would require all SF_6 equipment included in the facility be located on contiguous or adjacent properties. We are proposing not to use the exact definition of "facility" found in subpart A because the completeness and accuracy of emissions data for this source category are dependent on reporting on all equipment regardless of location. For completeness, reporting needs to account for and report on all sources and activities within the facility. The purpose of transmission is to move energy over long distances. Similarly, distribution can occur over large geographical areas. Therefore, it is neither practical nor appropriate to exclude certain types of equipment solely based on its lack of physical proximity. Emissions from gas-insulated equipment occur during installation, operation, servicing and decommissioning. Accuracy of reporting requires that emissions are systematically neither over nor under actual emissions; consequently including all equipment at all periods of the life cycle is necessary. Thus, EPA has concluded that strict adherence to the subpart A definition is not appropriate for this source category.

In deciding where to draw the boundary between one facility and the next, we considered the following levels of reporting: Per piece of equipment, by substation or switchyard, corporate-level, and aggregation of total equipment by system. Reporting per piece of equipment was deemed costly and highly impractical for reporters. Reporting by substation or switchyard, where multiple pieces of equipment is often located, would also be burdensome, given that a specific reporting protocol using the proposed mass-balance reporting method would have to be set up for each substation, requiring cylinder inventory and other data collection to be done on a per substation basis. Although this may be practical for some system owners, others have responsibility for dozens or hundreds of substations. Finally, EPA considered corporate-level reporting based on comments submitted on our initial proposal. We concluded, however, that given the complex and varied corporate structures within the electric power industry that approach would not be practical and appropriate for this source. The full results of our assessment can be found in the SF_6 from Electrical Equipment TSD.

For this source category, EPA is proposing to define the facility as an "electric power system," which would mean that reporting would occur at a "system-wide" level. The electric power system would be defined as all electric power equipment insulated with SF_6 or PFCs regardless of location linked through electric power transmission or distribution lines and operated as an integrated unit by one electric power entity or several entities that have a single owner. Reporting by the electric power system would comprise all gas-insulated equipment located between the point of generation and the point at which the ultimate customer receives the electricity. Such equipment includes gas-insulated substations, circuit breakers, other switchgear, gas-insulated lines, or power transformers containing SF_6 or PFCs. EPA proposes to define an electric power entity as a company; an electric cooperative; a public electric supply corporation as the Tennessee Valley Authority; a similar Federal department or agency such as the Bonneville Power Administration; the Bureau of Reclamation or the Corps of Engineers; a municipally owned electric department offering service to the public; or an electric public utility district (a "PUD"); also a jointly owned electric supply project such as the Keystone. Although the size of these facilities will vary, and some are expected to cross State lines, a facility is likely to encompass more than a thousand miles of lines and hundreds of pieces of equipment located at multiple substations or switchyards. Equipment also includes gas containers such as pressurized cylinders, gas carts, new equipment owned but not yet installed, or other containers.

EPA believes the proposed definition of "facility" for this source category is appropriate and analogous to the 40 CFR part 98 subpart A definition of a "facility" used for other source categories due to the physical interconnection and operational dependence of the components of the system. It is also consistent with the concept of a "transmission and distribution system," which is a standard term used by the industry. The transfer of energy is dependent on the collective functioning of all components of the system which must operate as a contemporaneous network in real-time and in a synchronous manner. Without system-wide use of gas-insulated equipment, operation and system reliability is not possible. Furthermore, system-wide reporting is consistent with the reported servicing and maintenance practices of many SF_6-insulated equipment owners making this approach less burdensome and more efficient than using a substation or per piece of equipment source definition. This is also consistent with the approach used by over 80 systems from across the United States that are participating in the "EPA SF_6 Emission Reduction Partnership for Electric Power Systems", and has proven to be a practical and reasonable approach for the collection of emissions data. In addition, the burden of using the mass-balance method proposed for monitoring is lowest at a system-wide level.

EPA is requesting comment on whether one electric power system should be distinguished from the next on the basis of operation, ownership, or some combination of the two. EPA is proposing that the electric power system be the collection of equipment operated as an integrated unit by one electric power entity or several entities that have a single owner because it best reflects the functional aspect of the system (transmitting and distributing power) and emphasizes the physical interconnection and operational dependence of the system components. It also reflects current voluntary best practices for GHG reporting from this source category. This proposed definition would not relieve entities that own but do not operate equipment of the obligation to report under 40 CFR 98.3. Regardless of the role that operation or ownership plays in the final source category definition, the obligation to report will apply to both owners and operators.

Under the proposed definition of facility, total emissions would be derived from the entire collection of servicing inventory (cylinders stored) and gas-insulated equipment. Reporting would be based on the aggregation of emissions of all servicing inventory and equipment.

Installation of Electrical Equipment at Electric Power Systems. In section E below, EPA is requesting comment on two issues related to equipment installation and commissioning that is performed by equipment manufacturers at electric power systems. These issues affect both users and manufacturers of electrical equipment and could affect the calculation methods required under both subpart DD and subpart SS. Please *see* section E for a discussion of these issues.

D. Imports and Exports of Fluorinated GHGs Inside Pre-Charged Equipment and Closed-Cell Foams

1. Overview of Reporting Requirements

Under today's proposed rule, importers and exporters of pre-charged equipment and closed-cell foams would be required to report their imports and exports to EPA if either their imports or their exports contained a total of more than 25,000 $mtCO_2e$ of fluorinated GHGs. The reports would be similar to those required of importers and exporters of bulk GHGs under subpart OO of the final MRR published on October 28, 2009. In addition, equipment importers would be required to report the types and charge sizes of equipment and the number of pieces of each type of equipment that they imported or exported, while foam importers would be required to report the volume of foam and fluorinated GHG density of the foam that they imported. Importers and exporters would report at the corporate level.

2. Summary of Initial Proposed Rule and Comments Received

In the proposed MRR published on April 10, 2009, we did not propose to require reporting of the quantities of GHGs imported and exported inside products. We were concerned that it would be difficult for importers and exporters to identify and quantify the quantities of GHGs inside some products and that the number of importers and exporters would be high. However, we requested comment on the option of requiring reporting of imports and exports of HFCs and SF_6 contained in pre-charged air-conditioning, refrigeration, and electrical equipment and in closed cell foams. We noted that for these products, information on the size and chemical identity of the charge or blowing agent is likely to be readily available to importers and exporters (*e.g.,* from nameplates affixed to equipment, servicing manuals, and product information for foams). Moreover, as noted above, the total quantities of imported and exported fluorinated GHGs in pre-charged equipment and foams are significant.

We received a range of comments on whether or not we should require reporting of fluorinated GHGs imported or exported inside of pre-charged equipment and closed-cell foams. Several manufacturers and importers of fluorinated GHGs supported such a requirement, noting that the identities and quantities of fluorinated GHGs inside equipment and foams are well-known, that imported and exported quantities are significant in aggregate, that the number of importers and exporters is small, and that information on fluorinated GHGs imported or exported inside of equipment could help to inform legislation being considered by Congress, which would include fluorinated GHGs imported in pre-charged equipment under emissions caps. Some of these commenters stated that failure to require reporting of imported equipment and foams would be unfair to domestic manufacturers, who would be subject to reporting from which foreign manufacturers would be exempted. They observed that this inequity could drive production offshore, harming the U.S. economy and possibly increasing global GHG emissions if less efficient manufacturers in developing countries took over the lost U.S. production.

Equipment importers and a fluorocarbon producer opposed a requirement to report imports and exports of fluorinated GHGs in pre-charged equipment and foams, stating that such a requirement would be unnecessary and costly. 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 extremely small because the systems are hermetically sealed.

After carefully considering the comments and available information on imports and exports of fluorinated GHGs inside pre-charged equipment and closed-cell foams, we are proposing to require reporting of these imports and exports.

3. Definition of the Source Category

This source category includes importers and exporters of pre-charged equipment and closed-cell foams that contain fluorinated GHGs. Pre-charged equipment includes air-conditioning equipment or equipment components that contain HFCs and electrical equipment or equipment components that contain SF_6 or PFCs. Closed-cell foams include closed-cell foams blown with HFC blowing agents.

Air-conditioning and refrigeration equipment generally uses HFC refrigerants. In this application, HFCs serve as substitutes for ozone-depleting substances (ODSs), which are being phased out under the Montreal Protocol and Title VI of the CAA. Because some ODSs (*i.e.*, HCFCs) are only beginning to be phased out, the use of HFCs in equipment such as window and residential air-conditioners is expected to grow very quickly over the next decade. Imports and exports of HFC pre-charged equipment may grow as well. Although the quantities of chemical contained in each unit are small in absolute terms (*i.e.*, a few pounds or less), they are more significant in CO_2-equivalent terms, ranging up to eleven $mtCO_2e$ per unit for pre-charged commercial air-conditioners. This significance is due to the high GWPs of the HFCs.

HFCs are also used as blowing agents during the manufacture of foams. Open-cell foams are assumed to emit 100 percent of the blowing agent in the year they are manufactured, whereas closed-cell foams emit only a fraction of their total HFC content upon manufacture. Foam products that are closed-cell and imported or exported as a finished foam product therefore have potential to emit the blowing agent remaining in the foam after manufacture. Closed cell foams that are imported or exported include: polyurethane (PU) rigid foam used as insulation in domestic refrigerators and freezers; commercial refrigeration foam; PU rigid sandwich panel continuous and discontinuous foam; extruded polystyrene (XPS) sheet foam; and XPS boardstock foam.

SF_6 is used as an electrical insulator and arc-quenching gas in electrical transmission equipment, including circuit breakers and gas-insulated substations. Again, the quantities of SF_6 in each unit are often small in absolute terms (around 14 pounds per circuit breaker), but are larger in CO_2-equivalent terms (around 150 $mtCO_2e$ per circuit breaker).[40]

Our analysis indicates that the quantities of fluorinated GHGs imported and exported inside of pre-charged equipment and foams are significant. Imports are estimated to total about 21 million $mtCO_2e$, while exports are estimated to total about 8 million $mtCO_2e$. For further information, please *see* the TSD for Imports and Exports of Pre-Charged Equipment and Foams (Revised) in the docket for this rulemaking (EPA–HQ–OAR–2009–0927).

We are proposing to require reporting for a number of reasons. First, we have determined that exports and particularly imports of pre-charged equipment and foam have a substantial impact on the total U.S. supply of fluorinated GHGs and of industrial GHGs generally. Based on the estimates above, imports constitute between seven and ten percent of the net U.S. supply of fluorinated GHGs, while exports are equivalent to between three and four percent of that total. (The range is based on slightly different estimates of the net U.S. supply based on bottom-up and top-down approaches.) We estimate that 22 million pieces of equipment and 66 million board-feet of foam are imported annually. Although the quantities of HFCs and SF_6 in individual pieces of equipment may be small in terms of the mass of chemical, the high GWPs of these chemicals can make them significant in CO_2-equivalent terms. For example, a pre-charged residential air conditioner (unitary) contains about 7 tons of CO_2e, while an average size circuit breaker with a shipping charge of SF_6 (20 percent of a full, operational charge) contains over 150 tons of CO_2e.

Imported and exported fluorinated GHGs are added to or subtracted from the U.S. supply of fluorinated GHGs regardless of whether they are imported in bulk or in equipment. Every year, a part of the U.S. fluorinated GHG supply is used to charge new equipment or to blow closed-cell foams. If equipment is imported already containing a charge, that charge offsets demand that would otherwise have occurred for fluorinated GHGs that are produced domestically or imported in bulk. Accounting for the quantities of fluorinated GHGs in equipment therefore significantly improves our understanding of the U.S. supply of fluorinated GHGs. Although commenters who opposed reporting noted that leak rates from some types of imported equipment are low, this does not distinguish fluorinated GHGs imported inside of equipment from fluorinated GHGs that are charged into the same type of equipment after its import or domestic manufacture. Any imported or domestically produced fluorinated GHG may be stored for many years inside equipment before being emitted or destroyed.[41]

The second reason that we are proposing to require reporting of imports and exports of fluorinated GHGs inside pre-charged equipment and foams is that discussions with industry experts indicate that the numbers of importers and exporters are relatively small, limiting the administrative burden of the rule and increasing the cost-effectiveness of the data gathering. Experts from the air-conditioning and refrigeration industry estimate that there are approximately 50 importers and 25 exporters of pre-charged air-conditioning and refrigeration equipment, and experts from the electrical equipment industry estimate that there are approximately 8 importers and 10 exporters of pre-charged electrical equipment. Based on the membership of various trade organizations including foam manufacturers and distributors, EPA estimates that there are approximately 50 entities that import and 25 entities that export foams. These numbers are considerably smaller than the number of importers and exporters of bulk fluorinated GHGs that are covered by the final rule published October 30, 2009.

Third, we estimate that the costs associated with identifying, quantifying, and reporting the quantities of fluorinated GHGs imported and exported inside pre-charged products and foams are reasonably modest. As noted above, information on the chemical identities and sizes of equipment charges should be readily available to importers and exporters, and the same is true for the identities and densities of the HFCs in foams, which strongly influence the insulating capacities of the foams.

Inclusion of other products that contain fluorinated GHGs. EPA's understanding is that pre-charged equipment and closed-cell foams account for the great majority of fluorinated GHGs that are imported in or exported from the United States inside of products. However, a variety of products containing fluorinated greenhouse gases (fluorinated GHGs), nitrous oxide (N_2O), and carbon dioxide (CO_2) are imported into and exported from the United States, including, for example, aerosols containing HFCs. EPA requests comment on the magnitude of imports and exports of these other products and on whether such imports and exports should be reported under this subpart.

4. Selection of Reporting Threshold

We are proposing to require that importers and exporters of fluorinated GHGs contained in pre-charged equipment and closed cell foams report their imports and exports if either their total imports or their total exports, in equipment, foams, and in bulk, exceed 25,000 $mtCO_2e$ per year. This threshold is the same as that for bulk imports and exports.

Tables 9 and 10 of this preamble show the estimated imports and exports (in $mtCO_2e$) and facilities (corporations) that would be covered under the various thresholds for imports and exports of equipment and foam.

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[40] Emissions from use and manufacture of electrical equipment are addressed under subparts DD and SS of this rule; subpart QQ addresses only the import and export of such equipment.

[41] Even if the fluorinated GHG is recovered from the equipment at the end of the equipment's life, it will ultimately be either emitted or destroyed. Recycling delays emission or destruction (and reduces demand for new fluorinated GHG), but it does not avoid it.

TABLE 9—THRESHOLD ANALYSIS FOR FLUORINATED GHGS IMPORTED INSIDE PRE-CHARGED EQUIPMENT AND CLOSED-CELL FOAMS

Threshold level	HFC refrigeration/AC equipment		SF_6 electrical equipment		Closed-cell foams	
	Imports covered	Importers covered	Imports covered	Importers covered	Imports covered	Importers covered
1,000	15,733,523	50	1,888,932	8	3,025,285	50
10,000	15,733,523	50	1,888,932	8	3,025,285	50
25,000	15,733,523	50	1,888,932	8	3,025,285	50
100,000	15,733,523	50	1,888,932	8	0	0

TABLE 10—THRESHOLD ANALYSIS FOR FLUORINATED GHGS EXPORTED INSIDE PRE-CHARGED EQUIPMENT AND CLOSED-CELL FOAMS

Threshold level	Exports covered	Exporters covered	Exports covered	Exporters covered	Exports covered	Exporters covered
1,000	5,247,905	25	153,323	10	3,025,285	25
10,000	5,247,905	25	107,326	5	3,025,285	25
25,000	5,247,905	25	0	....	3,025,285	25
100,000	5,247,905	25	0	....	3,025,285	25

In the absence of importer- and exporter-specific information, we assumed that within the three general categories of products, each importer and exporter imported or exported the same quantity of fluorinated GHGs. (Exports of SF_6 in electrical equipment were the sole exception to this.) This assumption led to the conclusion that 100 percent of imported and exported pre-charged equipment and foams (except exported electrical equipment) would be reported at the 25,000 $mtCO_2e$ threshold. In fact, imports and exports are likely to be concentrated among a subset of importers and exporters, and fewer entities are therefore likely to report at the 25,000 $mtCO_2e$ threshold. We request comment on the distribution of imports and exports among importers and exporters and on the likely coverage (in percentage terms) of imported and exported equipment and foams at the 25,000 $mtCO_2e$ threshold. An alternative approach would be to lower the threshold or to require reporting by all importers and exporters of pre-charged equipment and closed cell foams, but EPA is concerned that this approach could burden many small importers and exporters with reporting while gaining little additional coverage of imports and exports in equipment and foams.

5. Selection of Proposed Monitoring Methods

We are proposing to require importers and exporters of equipment and foams to estimate their imports and exports of each fluorinated GHG by multiplying the mass of the fluorinated GHG contained in each type of equipment or foam by the number of pieces of equipment or by the volume of foam, as appropriate. As noted above, we believe that information on fluorinated GHG identity and charge size (or density, for foams) should be readily available to importers and exporters.

Under the current MRR, bulk importers and exporters of fluorinated GHGs are not required to report individual shipments totaling less than 250 $mtCO_2e$ of fluorinated GHGs. This exemption was intended to exclude small shipments, *e.g.*, of chemical samples being shipped for analysis, from reporting. We established the exemption after an analysis of import and export shipments showed that it would decrease reporting by less than 0.1 percent. We are not proposing a similar exemption for small shipments of equipment and foams because we do not believe it would be necessary and because we are concerned that it might lead to the exclusion of a significant share of imports and exports of these products. We do not believe the small-shipment exemption would be necessary because the definition of import in subpart A already excludes the bringing into the United States of household effects such as refrigerators and window air conditioners. We are concerned that the exemption may result in excluding a significant share of imports and exports because 250 $mtCO_2e$ equates to a large number of pieces of some types of equipment (*e.g.*, over 1,300 household refrigerators).

6. Selection of Data To Be Reported

EPA is proposing to require importers and exporters of pre-charged equipment and closed cell foams to report the following:

(1) The total mass in metric tons of each fluorinated GHG imported or exported in pre-charged equipment or closed-cell foams.

(2) For each type of pre-charged equipment, the identity of the fluorinated GHG used as a refrigerant or electrical insulator, charge size (holding charge,[42] if applicable), and number imported or exported.

(3) For closed-cell foams that are imported or exported inside of appliances, the identity of the fluorinated GHG contained in the foam, the quantity of fluorinated GHG contained in the foam in each appliance, and the number of appliances imported for each type of appliance.

(4) For closed cell-foams that are not inside of appliances, the identity of the fluorinated GHG, the density of the fluorinated GHG in the foam (kg fluorinated GHG/cubic foot), and the quantity of foam imported or exported (cubic feet) for each type of closed-cell foam.

(5) Dates on which the pre-charged equipment or closed-cell foams were imported or exported.

(6) Ports of entry through which the pre-charged equipment or closed-cell foams passed.

(7) Countries from or to which the pre-charged equipment or closed-cell foams were imported or exported.

We are proposing to collect this information because it is necessary either to understand the total volume of fluorinated GHGs imported or exported

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[42] This refers to any holding charge consisting of a fluorinated GHG. Holding charges consisting of other gases, such as nitrogen, are not included.

inside of pre-charged equipment and foams (and thereby contributing to the U.S. supply of fluorinated GHGs) or to verify submitted information.

7. Selection of Recordkeeping Requirements

EPA is proposing to require importers and exporters of equipment and closed cell foams to retain the following records:

(1) A copy of the bill of lading for the import or export,

(2) The invoice for the import or export, and

(3) For imports, the U.S. Customs entry form.

This information is necessary to verify submitted information.

E. Electrical Equipment Manufacture or Refurbishment

1. Definition of the Source Category

This source category comprises 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).

Electrical equipment employed to transmit and distribute electricity constitutes the largest use of SF_6 in the world. The dielectric strength and arc-quenching characteristics of SF_6 make it an extremely effective electrical insulator and interrupter. For this reason, the electric power industry in the United States has used this gas since the 1950s in both closed-pressure and sealed-pressure equipment including gas-insulated substations, circuit breakers and other switchgear, and gas-insulated lines. Closed-pressure equipment requires periodic refilling (topping up) with gas during its lifetime, whereas sealed-pressure equipment generally does not. SF_6 has replaced flammable insulating oils in many applications and allows for more compact substations in dense urban areas. SF_6 insulated equipment has also made expansion of the grid through transmission over significantly longer distances economically practical. Currently, there are no available substitutes for SF_6 in this application. For further information, *see* the SF_6 from Electrical Equipment Manufacturers TSD in the docket for this rulemaking (EPA–HQ–OAR–2009–0927).

Manufacturers of gas insulated electrical equipment purchase bulk SF_6 gas to: (1) Install a holding or shipping charge in high-voltage closed-pressure equipment, (2) ship alongside closed-pressure equipment for topping off at installation site, (3) fill sealed-pressure equipment with its intended lifetime supply of SF_6, and (4) develop and test equipment.

Emissions of SF_6 from equipment manufacturers can occur during the development and testing of equipment and during equipment filling, but emissions can also occur during the other uses of SF_6 at manufacturing facilities. Refurbishment of equipment generally occurs at facilities used to manufacture new equipment and emissions typically occur during the leak test operations for gas-containing components as well as the disassembly and reassembly of equipment.

PFCs are sometimes used as dielectrics and heat transfer fluids in power transformers. PFCs are also used for retrofitting CFC–113 cooled transformers. The most common PFC used in this application is perfluorohexane (C_6F_{14}). In terms of both absolute and carbon-weighted emissions, PFC emissions from electrical equipment are generally believed to be much smaller than SF_6 emissions from electrical equipment.

According to the U.S. Inventory of Greenhouse Gas Emissions and Sinks: 1990–2007 (EPA 2009), total U.S. estimated emissions of SF_6 from electrical equipment manufacturers were 0.81 million metric tons CO_2e in 2006. EPA is proposing to require reporting from electrical equipment manufacture and refurbishment facilities because these operations represent a significant source, approximately 5 percent of U.S. SF_6 emissions. It is estimated that ten equipment manufacturers were responsible for these emissions.

EPA is seeking comment on whether transformers using PFCs are currently manufactured in the United States EPA is also seeking comment on whether PFC emissions associated with the production of this equipment occur at the same rate as SF_6 emissions from equipment manufacture and whether emissions occur during the same processes. EPA is proposing to include emissions of PFCs emitted during the manufacture or refurbishment of PFC-containing power transformers because while PFCs are known to be used in this application, the National Inventory has no information on the magnitude of this source. PFCs are very potent and persistent greenhouse gases and an accurate inventory of use and emissions from all sources is important.

2. Selection of Reporting Threshold

We propose to require electrical equipment manufacturers to report their SF_6 and PFC emissions if their total annual purchases of SF_6 and PFCs exceed 23,000 lbs. This consumption-based threshold is equivalent to an emissions-based threshold of 25,000 metric tons CO_2 Eq., assuming an average manufacturer emission rate of 10 percent.[43]

In developing this proposed threshold, we considered several emission-based threshold options including 1,000 metric tons CO_2e; 10,000 metric tons CO_2e; 25,000 metric tons CO_2e: and 100,000 metric tons CO_2e. SF_6 and PFC consumption thresholds of 922; 9,220; and 92,200 lbs of SF_6 and PFC were also considered, corresponding to the emission threshold options of 1,000; 10,000; and 100,000 metric tons CO_2e, respectively. Summaries of the threshold options (consumption-based and emissions-based) and the number of equipment manufacturers and emissions covered under each threshold are presented in Table 11 of this preamble.

TABLE 11—THRESHOLD ANALYSIS FOR ELECTRICAL EQUIPMENT MANUFACTURE

Emission threshold level (metric tons CO_2e/yr)	Total national emissions	Total number of facilities	Emissions covered		Facilities covered	
			Metric tons CO_2e/yr	Percent	Facilities	Percent
1,000	814,128	10	814,128	100	10	100
10,000	814,128	10	814,128	100	10	100
25,000	814,128	10	814,128	100	10	100

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[43] The 10 percent emission rate is the average of the "ideal" and "realistic" manufacturing emission rates (4 percent and 17 percent, respectively) identified in a paper prepared under the auspices of the International Council on Large Electric Systems (CIGRE) in February 2002 (O'Connell *et al.* 2002).

TABLE 11—THRESHOLD ANALYSIS FOR ELECTRICAL EQUIPMENT MANUFACTURE—Continued

Emission threshold level (metric tons CO_2e/yr)	Total national emissions	Total number of facilities	Emissions covered		Facilities covered	
			Metric tons CO_2e/yr	Percent	Facilities	Percent
100,000	814,128	5	569,890	70	5	50

The proposed consumption threshold and the corresponding emissions threshold level is consistent with general requirements of the Final MRR (74 FR 56260) and provides comprehensive coverage of emissions for this sector. A consumption-based threshold was selected because it permits equipment manufacturers to quickly determine whether they are covered by referring to SF_6 and PFC purchase records.

3. Selection of Proposed Monitoring Methods

We are proposing that all electrical equipment manufacturing facilities where SF_6 and PFC purchases exceed 23,000 lbs per year report all SF_6 and PFC emissions using a mass-balance approach. This would include all emissions from equipment testing, manufacturing (including filling), decommissioning and disposal, refurbishing, and from storage cylinders. We are proposing this approach because it is the most accurate and because all equipment manufacturers should be able to conduct the mass-balance analysis using readily available information.

The proposed monitoring methods are similar to the methodologies described in the 2006 IPCC Guidelines Tier 3 methods for emissions from electrical equipment manufacturing. These methodologies outline a mass-balance approach that is comparable to the proposed approach for subpart DD *Electric Power System Equipment.*

The mass-balance approach we are proposing for electrical equipment manufacturers works by tracking and systematically accounting for all facility uses of SF_6 and PFCs during the reporting year. The quantities of SF_6 and PFCs that cannot be accounted for are assumed to have been emitted to the atmosphere. The emissions of SF_6 and PFCs would be estimated and reported separately.

The following equation describes the proposed facility-level mass-balance approach. (For brevity, the equation refers only to SF_6; however, the method would also apply to PFCs in power transformers.)

Equipment Manufacturing Emissions = Decrease in SF_6 Inventory + Acquisitions of SF_6 − Disbursements of SF_6

Where:

Decrease in SF_6 Inventory = SF_6 stored in containers at the beginning of the year − SF_6 stored in containers at the end of the year

Acquisitions of SF_6 = SF_6 purchased from chemical producers or distributors in bulk + SF_6 returned by equipment users or distributors with or inside equipment + SF_6 returned to site after off-site recycling

Disbursements of SF_6 = SF_6 contained in new equipment delivered to customers + SF_6 delivered to equipment users in containers + SF_6 returned to suppliers + SF_6 sent off-site for recycling + SF_6 sent to destruction facilities.

EPA is seeking comment on the proposed methods for determining disbursements of SF_6 or PFCs, specifically, with respect to SF_6 or PFCs contained in new equipment delivered to customers and SF_6 or PFCs delivered to equipment users in cylinders. Two methods are being proposed. Disbursement of SF_6 or PFCs to customers in new equipment or cylinders could be estimated by weighing containers before and after gas from the containers was used to fill equipment or cylinders, or by using flow meters to measure the amount of gas used to fill equipment or cylinders. EPA requests comment on these two options.

Alone, both of these options would inappropriately count as "disbursements" emissions that occurred between the flow meter or weighed container and the equipment being filled. These emissions could include losses from coupling and decoupling of fill valves and leaks from hoses or other flow lines that connect the container to the equipment that being filled. EPA is therefore proposing to require that these emissions be quantified and subtracted from the disbursement total.

Specifically, EPA is proposing to require that these emissions 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 could be based on, as applicable, the internal volume of the hose or line that was open to the atmosphere during coupling and decoupling activities, the internal pressure of the hose or line, the time the hose or line was open to the atmosphere during coupling and decoupling activities, the frequency with which the hose or line was purged and the flow rate during purges. Such methods could also include the use of leak detection methods (*e.g.,* EPA Method 21 and the *Protocol for Equipment Leak Emission Estimates*) to determine a loss factor appropriate to calculate emissions. Unexpected or accidental emissions from the filling lines or hoses would be required to be included in the total.

EPA is seeking comment on the specific methods that should be employed to estimate emission losses from hoses or flow lines and on whether a particular method or set of methods should be required for this estimate. In addition, EPA requests comment on whether emissions downstream of the containers dispensing the SF_6 or PFCs consist solely of emissions from lines or hoses. EPA's understanding is that electrical equipment is at a vacuum and is sealed prior to being filled with SF_6 or PFCs; however, if it contains air or nitrogen and this gas is purged during the filling process, then the method should also account for SF_6 and PFC emissions that occur during such purging.

EPA is also considering other options for accurately measuring the quantities of SF_6 or PFCs disbursed to equipment users in equipment. (These options are described in more detail in the TSD.) One option being considered is to assume that the mass of SF_6 or PFCs disbursed to customers in equipment is equal to the nameplate capacity of the equipment (or, where the equipment is shipped with a partial charge, equal to the nameplate capacity of the equipment times the ratio of the densities of the partial charge and the full charge.) Although the nominal nameplate capacity could be used for this calculation, EPA is concerned that the actual mass of SF_6 or PFCs charged into each piece of equipment may vary by a few percent from the nominal capacity (*e.g.,* because there is some variability in the internal volume of the equipment or in the density to which the equipment is charged). Because the mass-balance approach requires precise inputs, inaccuracies of even two or three percent could lead to very large inaccuracies in the facility's emissions estimate.

One way of developing a more precise estimate of the nameplate capacity of equipment would be to fill the equipment with a fluid and then to carefully recover the fluid, measuring what was recovered. This fluid could be SF_6, another gas, or a liquid. If SF_6 was used, the equipment would be charged to its operational or shipping SF_6 density using the facility's usual methods and then emptied. The mass of the SF_6 recovered, adjusted slightly for the residual pressure of the SF_6 that would remain in the equipment even at a deep vacuum, could be equated to the full or shipping charge, as applicable. One advantage of this approach is that it would reflect the actual SF_6 charging practices of the facility; one disadvantage is that it could result in small SF_6 emissions during the charging and recovery steps.

If a liquid was used, the equipment would be filled carefully, ensuring that the full volume was filled, and then emptied. The volume of the liquid recovered would be equated to the internal volume of the equipment.[44] This volume times the SF_6 density at the full charge would yield the nameplate capacity of the equipment.

To account for variability, a certain number of these measurements would need to be performed to develop a robust and representative average nameplate capacity (or shipping charge) for each make and model. The specific number of measurements would depend on the variability of the nameplate capacity within each make and model, as discussed in the TSD. It may be appropriate to select equipment samples filled at different times to reflect day-to-day variability in the facility's filling practices and conditions. EPA seeks comment on these other options for accurately measuring the quantities of SF_6 and PFCs disbursed to customers in equipment and/or cylinders.

Another option is to require that the equipment filled with SF_6 or the PFC from the container be weighed before and after filling. The tare weight of the equipment would then be subtracted from the weight of the filled equipment to determine the weight of the gas in the equipment, and therefore, the weight of the actual disbursement. One potential concern regarding this option is that the mass of the SF_6 or PFC charged into the equipment is likely to be low relative to the mass of the equipment; thus, it may be difficult to obtain a precise measurement of the mass of the SF_6 or PFC using this method (*i.e.*, within 1 percent) even if the scale is precise and accurate to within 1 percent of full scale. EPA requests comment on this approach.

Installation of Electrical Equipment at Electric Power Systems. EPA also requests comment on two issues related to equipment installation and commissioning that is performed by equipment manufacturers at electric power systems. The first issue is whether an equipment installation mass-balance equation is required to measure emissions from equipment installation and commissioning that is performed by equipment manufacturers at utility locations. Where the manufacturer filled the equipment before transferring custody to the equipment user, EPA is assuming that the manufacturer would be responsible for the associated emissions. This would also apply to equipment that was filled at the factory but whose charge leaked out before being delivered to the customer. Quantitative methods for addressing these issues are discussed in more detail in the TSD.

The second issue is whether manufacturers should be required to certify to equipment users the actual quantity (mass) of SF_6 or PFCs charged into the equipment at installation. EPA understands that in some cases, manufacturers may deliberately exceed the nameplate capacity of equipment when charging it, *e.g.*, to postpone the re-fill of the equipment in the event that the equipment develops a leak. If this is the case, then the actual initial charge of the equipment should be conveyed clearly to the equipment user, and the mass-balance approach used by the equipment user should be adjusted to reflect the over-charge. If it is not, the user will underestimate emissions. (These issues are discussed in more detail in the TSD.) EPA requests comment on how frequently equipment is over-charged at installation, and on quantitative methods for compensating for this overcharge in user emissions estimates (*i.e.*, under proposed subpart DD).

Other Options Considered. In developing the proposed approach, we reviewed the 2006 IPCC Guidelines, the United States GHG Inventory, DOE 1605(b), EPA's Climate Leaders Program, and The Climate Registry. In our review of the IPCC Guidelines, we also considered the IPCC Tier 1 and the IPCC Tier 2 methods for calculating and reporting SF_6 and PFC emissions. Although the IPCC Tier 1 and IPCC Tier 2 methods are simple, IPCC does not provide default emission factors for the United States due to lack of data. Furthermore, SF_6 use in electrical equipment manufacturing is largely dependent on the type of equipment being produced and the specific handling practices at facilities. Applying an emission factor to all equipment manufacturers would not take into account the different types of equipment being produced at each facility or the variation in handling practices among facilities. Nor would it provide data of sufficient accuracy for the source or on a per facility basis. As a result, we are not proposing the IPCC Tier 1 or Tier 2 method.

We are not proposing to require continuous emissions monitoring (CEMs) because of insufficient information on which to base a decision and because CEMs is not expected to be practical for this source category at this time due to the intermittent and widespread nature of the emissions. EPA seeks comment on whether continuous emissions monitoring is technically feasible for this source category.

4. Selection of Procedures for Estimating Missing Data

It is expected that equipment manufacturers should be able to obtain 100 percent of the data needed to perform the mass-balance calculations for both SF_6 and PFCs. The use of the mass-balance approach requires correct records for all inputs. However, if needed, missing data can be replaced using data from similar manufacturing operations, and from similar equipment testing and decommissioning activities for which data are available.

5. QA/QC Requirements

We propose that electrical equipment manufacturers be required to use flowmeters or scales that are accurate and precise to within one percent of full scale. In addition, we are proposing to require manufacturers to establish procedures for and document their measurements and calculations under this subpart, including check-out sheets and weigh-in procedures for cylinders, residual gas amounts in cylinders sent back to suppliers, invoices for gas and equipment purchases or sales, and documentation of recycling and destruction. The records that are being proposed are the minimum needed to reproduce and confirm emission calculations.

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[44] The temperature of the liquid would need to be kept constant throughout this exercise to obtain an accurate measurement of the volume.

6. Selection of Data Reporting Requirements

We propose annual reporting for the electrical equipment manufacturing and refurbishing industry. Equipment manufacturers would report all SF_6 and PFC emissions, including those from equipment testing, equipment manufacturing, and bulk SF_6 and PFC handling. However, the emissions would not need to be broken down and reported separately for testing, manufacturing, or bulk SF_6 and PFC handling. Along with their emissions, electrical equipment manufacturers would be required to submit the following supplemental data: SF_6 and PFCs with or inside equipment delivered to customers, the nameplate capacity of the equipment delivered to customers, SF_6 and PFCs returned by customers with or inside equipment, bulk SF_6 and PFC purchases, SF_6 and PFCs sent off-site for destruction or to be recycled, SF_6 and PFCs returned from offsite after recycling, SF_6 and PFCs stored in containers at the beginning and end of the year, SF_6 and PFCs returned to suppliers. For any missing data, manufacturers would be required to report the reason the data were missing, the length of time the data were missing, the method used to estimate emissions in their absence, and the quantity of emissions thereby estimated.

These data would be submitted because they are the minimum data that are needed to understand and reproduce the emission calculations that are the basis of the reported emissions.

7. Selection of Records That Must Be Retained

We propose that electrical equipment manufacturers be required to keep records documenting (1) their adherence to the QA/QC requirements specified in the proposed rule, and (2) the data that would be included in their emission reports, as specified above.

F. Subpart A Revisions

Amendments to the General Provisions. In a separate rulemaking package that was recently published (March 16, 2010), EPA issued minor harmonizing changes to the general provisions for the GHG reporting rule (40 CFR part 98, subpart A) to accommodate the addition of source categories not included in the 2009 final rule (*e.g.*, subparts proposed in April 2009 but not finalized in 2009, any new subparts that may be proposed in the future). The changes update 98.2(a) on rule applicability and 98.3 regarding the reporting schedule to accommodate any additional subparts and the schedule for their reporting obligations (*e.g.*, source categories finalized in 2010 would not begin data collection until 2011 and reporting in 2012).

In particular, we restructured 40 CFR 98.2(a) to move the lists of source categories from the text into tables. A table format improves clarity and facilitates the addition of source categories that were not included in calendar year 2010 reporting and would begin reporting in future years. A table, versus list, approach allows other sections of the rule to be updated automatically when the table is updated; a list approach requires separate updates to the various list references each time the list is changed. In addition to reformatting the 98.2(a)(1)–(2) lists into tables, other sections of subpart A were reworded to refer to the source category tables because the tables make it clear which source categories are to be considered for determining the applicability threshold and reporting requirements for calendar years 2010, 2011, and future years.

The source categories proposed in this notice would be added within 40 CFR 98.2 as follows. The following source categories would be added to the list of "all-in" source categories referenced in 40 CFR 98.2(a)(1), because they have a production capacity or gas consumption threshold rather than a CO_2e emission threshold:

- Electric power systems that include electrical equipment with a total nameplate capacity that exceeds 17,820 lbs (7,838 kg) of SF_6 or perfluorocarbons (PFCs) (subpart DD).
- Electric power equipment manufacturing with total annual SF_6 and PFC purchases (combined) that exceed 23,000 lbs per year (subpart SS).

The following source categories would be subject to the rule if facility emissions exceed 25,000 metric tons CO_2e per year. Therefore, these source categories would be added to the list of emission threshold source categories referenced in 40 CFR 98.2(a)(2).

- Fluorinated gas production facilities whose emissions would exceed 25,000 $mtCO_2e$ in the absence of control technologies (subpart L).
- Facilities with electronics manufacturing processes (as defined in proposed 40 CFR part 98, subpart I).

In addition, importers and exporters of pre-charged equipment or closed-cell foam products containing fluorinated GHGs, N_2O, or CO_2 would be added to the list of suppliers referenced in 40 CFR 98.2(a)(4). For all of these source categories, facilities would be required to begin collecting data in 2011 for reporting in 2012.

Today's proposed rule includes a number of definitions applicable to specific source categories. The agency is not planning to add these definitions to the definitions section in Subpart A because these definitions relate to these specific subparts and do not have broader applicability to EPA's mandatory reporting regulations. Instead, EPA intends to include these definitions in the applicable subparts. EPA has sought to avoid any conflict between these subpart-specific definitions and the definitions in Subpart A. In one instance, the supplemental proposal for electric power systems, EPA is proposing to use a category-specific definition of facility rather than the general definition of facility in the General Provisions. The reasons for this category-specific definition of facility are set forth in section II.C of this preamble. The remaining definitions are intended as supplements to the definitions section in the General Provisions. EPA does not believe these definitions create conflicts with the General Provisions, although it welcomes comments on this issue. To the extent regulated entities are in doubt as to which definition applies, they should assume that the category-specific definitions are controlling.

We propose to amend 40 CFR 98.7 (incorporation by reference) to include standard methods used in the proposed subparts. In particular, we would add the 2006 International SEMATECH Manufacturing Initiative's Guidelines for Environmental Characterization of Semiconductor Process Equipment and SEMI E10–0304 Specification for Definition and Measurement of Equipment Reliability, Availability, and Maintainability (2006), which are referenced in proposed 40 CFR 98.94 (Monitoring and QA/QC Requirements for 40 CFR part 98, subpart I, electronics manufacturing) and 40 CFR 98.97 (Records that must be retained). In addition, we propose to revise the paragraphs listing several ASME standards that are already contained in 40 CFR 98.7 to indicate that these standards are also referenced by proposed 40 CFR 98.124 (Monitoring and QA/QC requirements in proposed 40 CFR part 98, subpart L, fluorinated gas production).

III. Economic Impacts of the Rule

This section of the preamble examines the costs and economic impacts of the proposed rulemaking 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 proposed 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. 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 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 reporting 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 would be approximately $6.1 million in the first year and $3.9 million in subsequent years ($2006). This includes a public sector burden estimate of $384,000 for program implementation and verification activities. EPA also considered an alternative national cost scenario in order to assess national cost estimates if selected subpart I facilities validate the DRE of abatement devices. Under this scenario, the total annualized costs incurred under the fluorinated GHG reporting rule would be approximately $1.7 million higher (or $7.8 million first year; $5.6 million subsequent years). Table 12 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$	$/ton	Share (%)	Millions 2006$	$/ton	Share (%)
Subpart I—Electronics Industry	$2.9	$0.51	42	$2.6	$0.45	67
Subpart L—Fluorinated Gas Production	2.1	0.20	47	0.3	0.08	7
Subpart OO—Imports and Exports of Fluorinated GHGs	0.7	0.02	10	0.6	0.02	16
Subpart SS—Electrical Equipment Manufacture and Refurbishment and Manufacturing of Electrical Components	0.02	0.01	0.3	0.02	0.01	1
Private Sector, Total	5.7		94	3.5		90
Public Sector, Total	0.4		6	0.4		10
Total	6.1		100	3.9		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 the proposed 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 1 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$]

NAICS	NAICS description	Subpart	Average cost per entity ($/entity)	All enter-prises
334413	Semiconductor and Related Device Manufacturing (Semiconductors)	I	$31,748	0.05%

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

[First Year, 2006$]

NAICS	NAICS description	Subpart	Average cost per entity ($/entity)	All enterprises
334413	Semiconductor and Related Device Manufacturing (MEMS)	I	5,239	0.01
334413	Semiconductor and Related Device Manufacturing (LCD)	I	7,598	0.01
334119	Other Computer Peripheral Equipment Manufacturing (Photovoltaics)	I	8,777	0.04
325120	Industrial Gas Manufacturing	L	151,045	1.44
326140	Polystyrene Foam Product Manufacturing	OO	3,364	0.03
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	OO	3,364	0.03
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.	OO	3,364	0.01
335313	Switchgear and Switchboard Apparatus Manufacturing	OO	3,364	0.02
336391	Motor Vehicle Air-Conditioning Manufacturing	OO	3,364	0.01
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers.	OO	3,364	0.05
423620	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers.	OO	3,364	0.02
423720	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers.	OO	3,364	0.05
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers.	OO	3,364	0.07
423740	Refrigeration Equipment and Supplies Merchant Wholesalers	OO	3,364	0.10
443111	Household Appliance Stores	OO	3,364	0.27
443112	Radio, Television and Other Electronics Stores	OO	3,364	0.15
424610 [b]	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers	OO	3,364	0.04
33361	Engine, Turbine, and Power Transmission Equipment Manufacturing	SS	2,213	0.01
33531	Electrical Equipment Manufacturing	SS	2,213	0.02

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

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

1. Summary of Impacts on Small Businesses

As required by the RFA and 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	Subpart	SBA size standard (effective March 11, 2008)	Average cost per entity ($/entity)	All enterprises	Owned by enterprises with:					
						1 to 20 employees	20 to 99 employees	100 to 499 employees	500 to 749 employees	750 to 999 employees	1,000 to 1,499 employees
334413	Semiconductor and Related Device Manufacturing (Semiconductors).	I	500	$31,748	0.05%	2.07%	0.40%	0.12%	0.08%	0.02%	0.04%
334413	Semiconductor and Related Device Manufacturing (MEMS).	I	500	5,239	0.01%	0.34%	0.07%	0.02%	0.01%	0.00%	0.01%
334413	Semiconductor and Related Device Manufacturing (LCD).	I	500	7,598	0.01%	0.50%	0.10%	0.03%	0.02%	0.01%	0.01%

TABLE 14—ESTIMATED COST-TO-SALES RATIOS BY INDUSTRY AND ENTERPRISE SIZE—Continued

[First Year, 2006$] [a]

NAICS	NAICS description	Subpart	SBA size standard (effective March 11, 2008)	Average cost per entity ($/entity)	All enterprises	Owned by enterprises with:					
						1 to 20 employees	20 to 99 employees	100 to 499 employees	500 to 749 employees	750 to 999 employees	1,000 to 1,499 employees
334119	Other Computer Peripheral Equipment Manufacturing (Photovoltaics).	I	1,000	8,777	0.04%	0.56%	0.09%	0.03%	0.01%	0.02%	0.01%
325120	Industrial Gas Manufacturing.	L	1,000	151,045	1.44%	31.03%	1.03%	4.26%	NA	NA	NA
326140	Polystyrene Foam Product Manufacturing.	OO	500	3,364	0.03%	0.28%	0.07%	0.04%	NA	NA	0.01%
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing.	OO	500	3,364	0.03%	0.21%	0.06%	0.02%	0.02%	NA	NA
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.	OO	750	3,364	0.01%	0.25%	0.04%	0.02%	0.01%	0.01%	0.01%
335313	Switchgear and Switchboard Apparatus Manufacturing.	OO	750	3,364	0.02%	0.26%	0.06%	0.02%	NA	NA	NA
336391	Motor Vehicle Air-Conditioning Manufacturing.	OO	750	3,364	0.01%	0.37%	0.08%	NA	NA	NA	NA
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers.	OO	100	3,364	0.05%	0.11%	0.03%	0.04%	0.05%	0.03%	0.04%
423620	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers.	OO	100	3,364	0.02%	0.08%	0.02%	0.01%	0.00%	0.01%	0.01%
423720	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers.	OO	100	3,364	0.05%	0.12%	0.02%	0.04%	0.07%	0.03%	0.10%
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers.	OO	100	3,364	0.07%	0.15%	0.06%	0.06%	0.12%	0.03%	NA
423740	Refrigeration Equipment and Supplies Merchant Wholesalers.	OO	100	3,364	0.10%	0.18%	0.05%	0.11%	0.09%	0.05%	NA
443111	Household Appliance Stores.	OO	$9 M	3,364	0.27%	0.47%	0.10%	0.08%	NA	NA	NA
443112	Radio, Television and Other Electronics Stores.	OO	$9 M	3,364	0.15%	0.59%	0.17%	0.26%	NA	NA	NA
424610[b]	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers.	OO	100	3,364	0.04%	0.10%	0.03%	0.02%	0.01%	0.01%	0.06%
33361	Engine, Turbine, and Power Transmission Equipment Manufacturing.	SS	500–1,000	2,213	0.01%	0.19%	0.03%	0.01%	0.01%	0.01%	0.01%
33531	Electrical Equipment Manufacturing.	SS	750–1,000	2,213	0.02%	0.22%	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 enterprise definition above 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.

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. 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 the proposed rule. 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), 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 employees 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 proposed 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. For example, EPA is proposing monitoring and reporting requirements that build off of the UIC program. In addition, EPA is proposing equipment and methods that may already be in use by a facility for compliance with its UIC permit. Also, EPA is requiring annual reporting instead of more frequent reporting.

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

E. What are the 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, 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. For example, in the EU's Emissions Trading System, a lack of accurate monitoring at the facility level before establishing CO_2 allowance permits resulted in allocation of permits for emissions levels an average of 15 percent above actual levels in every country except the United Kingdom.

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 Section 3(f)(1) of Executive Order 12866 (58 FR 51735, October 4, 1993), this proposed action is not by itself an "economically significant regulatory action" because it is unlikely to have an annual economic effect of less than $100 million. EPA's cost analysis, presented in Section 4 of the Economic Impact Analysis (EIA), estimates that for the minimum reporting under the recommended regulatory option, the total annualized cost of the rule will be approximately $6.1 million (in 2006$) during the first year of the program and $3.9 million in subsequent years (including $0.4 million of programmatic costs to the Agency). This proposed action adds subparts I, L, OO, and SS to the MRR, which was a significant regulatory action. Thus, EPA has chosen to analyze the impacts of this proposed rule as if it were significant. EPA submitted this proposed 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 proposed action.

In addition, EPA prepared an analysis of the potential costs associated with this proposed 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, OO, 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 would 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.

B. Paperwork Reduction Act

The information collection requirements in this proposed 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 [2373.01].

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, emissions information collected under CAA section 114 generally cannot be claimed as CBI and will be made public.[45]

The projected cost and hour respondent burden in the ICR, averaged over the first three years after promulgation, is $4.51 million and 81,500 hours per year. The estimated average burden per response is 272 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 276. 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 $44,000 per year) a total operation and maintenance component (averaging $24,000 per year), and a labor cost component (averaging $4.44 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.

To comment on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, EPA has established a public docket for this proposed rule, which includes this ICR, under Docket ID number EPA–HQ–OAR–2009–0927. Submit any comments related to the ICR to EPA and OMB. *See* **ADDRESSES** section at the beginning of this notice for where to submit comments to EPA. Send comments to OMB at the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th Street, NW., Washington, DC 20503, Attention: Desk Office for EPA. Since OMB is required to make a decision concerning the ICR between 30 and 60 days after [date of publication], a comment to OMB is best assured of having its full effect if OMB receives it by [publication plus 30]. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

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 today's rule on small entities, For the fluorinated GHG Reporting Rule, 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. Small entity criteria range from total number of employees at the firm fewer than 100 to number of employees fewer than 1000; one affected NAICS, 44311, defines small entities as those with sales below $9 million. EIA tables 5–11 and 5–12 present small business criteria and enterprise size distribution data for affected NAICS.EPA assessed the potential impacts of the proposed 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 examine the average establishment's total annualized mandatory reporting costs to the average establishment receipts for enterprises within several employment categories.[46] 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-receipt ratio for establishments owned by small businesses, because the reporting costs are likely lower than average entity estimates provided by the engineering cost analysis.

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[45] 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 emissions data that cannot be considered CBI (956 FR 7042–7043, February 21, 1991). As discussed in Section II.R of the preamble to the Final MRR, EPA will be initiating a separate notice and comment process to make CBI determinations for the data collected under this proposed rulemaking.

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

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, the costs exceed 1 percent of sales for the 1–20 employee size category; for these NAICS, a more detailed assessment was conducted. For NAICS 334413, 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 with fewer than 20 employees are generally not expected to be affected by the proposed 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 proposed 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 proposed rule. 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 EA), EPA determined the small entity's cost-to-sales ratio is below one percent.

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

Although this rule would 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. The Agency also selected a hybrid method for reporting, which provides flexibility to entities and helps minimize reporting costs.

In addition to the public hearing that EPA plans to hold, EPA has an open door policy, similar to the outreach conducted during the development of the proposed and final MRR.

Details of these meetings are available in the docket (EPA–HQ–OAR–2009–0927).

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 proposed 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 proposed rule are approximately $6.1 million in the first year, and $3.9 million per year in subsequent years. Thus, this proposed rule is not subject to the requirements of sections 202 or 205 of UMRA.

This proposed 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 proposed rule include facilities that manufacture, sell, import or export fluorinated GHG related products. None of the facilities currently known to undertake these activities are owned by small governments.

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 facilities that manufacture, sell, import, or export fluorinated GHG related products. Few State or local government facilities would 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.

In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between EPA and State and local governments, EPA specifically solicits comment on this proposed action from State and local officials.

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 proposed rule is not expected to have Tribal implications, as specified in Executive Order 13175. This regulation applies to facilities that manufacture, sell, import, or export fluorinated GHG related products. Few facilities expected to be affected by the rule are likely to be owned by Tribal governments. Thus, Executive Order 13175 does not apply to this proposed rule.

Although Executive Order 13175 does not apply to this proposed 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 the mandatory reporting rule, 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 proposed rule. 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 rule

(EPA–HQ–OAR–2008–0508–055). In addition to the consultation activities supporting the MRR, EPA continues to provide requested information to Tribal governments and representatives during development of the Track II rules such as this proposed rulemaking. EPA specifically solicits additional comment on this proposed action from Tribal officials.

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

EPA interprets EO 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 EO has the potential to influence the regulation. This proposed action is not subject to EO 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 proposed rule is not a "significant energy action" as defined in EO 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 proposed rule is not likely to have any adverse energy effects. This proposed rule relates to monitoring, reporting and recordkeeping at facilities that manufacture, sell, import, or export fluorinated GHG related products and does not impact energy supply, distribution or use. Therefore, we conclude that this proposed 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 proposed rulemaking involves technical standards. EPA will use voluntary consensus standards from at least seven different voluntary consensus standards bodies, including the following: ASTM, ASME, ISO, Gas Processors Association, American Gas Association, American Petroleum Institute, and National Lime Association. These voluntary consensus standards will help facilities monitor, report, and keep records of GHG emissions. No new test methods were developed for this proposed 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 gauge and measure petroleum and petroleum products. The test methods are incorporated by reference into the proposed rule and are available as specified in 40 CFR 98.7.

By incorporating voluntary consensus standards into this proposed rule, EPA is both meeting the requirements of the NTTAA and presenting multiple options and flexibility in complying with the proposed rule. EPA welcomes comments on this aspect of the proposed rulemaking and, specifically, invites the public to identify potentially-applicable voluntary consensus standards and to explain why such standards should be used in this proposed regulation.

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

EO 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.

Mandatory Reporting of Greenhouse Gases: Additional Sources of Fluorinated GHGs (Page 229 of 363)

EPA has determined that this proposed 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 proposed 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.

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: March 22, 2010.

Lisa P. Jackson,

Administrator.

For the reasons stated in the preamble, title 40, chapter I, of the Code of Federal Regulations is proposed to be 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.*

2. Section 98.7 is amended as follows:

a. By revising paragraph (d)(1).
b. By revising paragraph (d)(2).
c. By revising paragraph (d)(3).
d. By revising paragraph (d)(4).
e. By revising paragraph (d)(5).
f. By revising paragraph (d)(6).
g. By revising paragraph (d)(7).
h. By revising paragraph (d)(8).
i. By revising paragraph (e)(30).
j. By adding paragraph (k).
k. By adding paragraph (l).

§ 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(k), § 98.244(b), § 98.254(c), § 98.344(c), 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(k), § 98.244(b), § 98.254(c), § 98.344(c), 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(k), and § 98.244(b).

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

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

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

* * * * *

(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, IBR approved for § 98.54(b), § 98.124(c), and § 98.224(b).

* * * * *

(k) The following material is available from the International SEMATECH Manufacturing Initiative, *http://ismi.sematech.org*.

(1) Guideline for Environmental Characterization of Semiconductor Process Equipment, International SEMATECH Manufacturing Initiative Technology Transfer #06124825B–ENG. (2006).

(l) The following material is available for purchase from SEMI, 3081 Zanker Road, San Jose, CA 95134, (408) 943–6900, *http://www.semi.org*.

(1) SEMI E10–0304 Specification for Definition and Measurement of Equipment Reliability, Availability, and Maintainability (2004).

(2) [Reserved]

3. 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.
Table I–1 of Subpart I—Default Emission Factors for Threshold Applicability Determination
Table I–2 of Subpart I—Examples of Fluorinated GHGs Used by the Electronics Industry
Table I–3 of Subpart I—Default Emission Factors for MEMS Manufacturing
Table I–4 of Subpart I—Default Emission Factors for LCD Manufacturing
Table I–5 of Subpart I—Default Emission Factors for PV Manufacturing
Table I–6 of Subpart I–Default Emission Factors for Refined Process Categories for Semiconductor Manufacturing for 150 mm Wafer Size
Table I–7 of Subpart I–Default Emission Factors for Refined Process Categories for Semiconductor Manufacturing for 200 mm Wafer Size
Table I–8 of Subpart I–Default Emission Factors for Refined Process Categories for Semiconductor Manufacturing for 300 mm Wafer Size

Subpart I—Electronics Manufacturing

§ 98.90 Definition of the source category.

(a) The electronics source category consists of any of the processes listed in paragraphs (a)(1) through (a)(6) of this section. Electronics manufacturing facilities include, but are not limited to, facilities that manufacture semiconductors, liquid crystal displays (LCDs), micro-electro-mechanical systems (MEMS), and photovoltaic cells (PV).

(1) Each electronics manufacturing production process 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) and silicon to selectively remove portions of material.

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

(3) Each 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.

(4) Each electronics manufacturing production process in which some fluorinated compounds can be transformed in the plasma processes into different fluorinated compounds which are then exhausted, unless abated, into the atmosphere.

(5) Each electronics manufacturing production process in which the chemical vapor deposition process or other manufacturing processes use N_2O.

(6) Each electronics manufacturing production process in which fluorinated GHGs are used as heat transfer fluids to cool process equipment, control temperature during device testing, and solder semiconductor devices to circuit boards.

(b) [Reserved]

§ 98.91 Reporting threshold.

You must report GHG emissions under this subpart if your facility contains an electronics manufacturing process 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 paragraph § 98.2(a)(2), calculate process emissions from electronics manufacture by using either paragraph (a), (b), (c), or (d) of this section, as appropriate.

(a) Semiconductor manufacturers shall calculate process emissions for applicability purposes using the default emission factors shown in Table I–1 of this subpart and Equation I–1 of this section.

$$E_T = 1.1 * \sum_i S * EF_i * 0.001 \qquad \text{(Eq. I-1)}$$

Where:

E_T = Total annual process emissions for applicability purposes (metric tons).
1.1 = Factor accounting for heat transfer fluid emissions, estimated as 10 percent of total clean and etch emissions at a facility.
S = 100 percent of manufacturing capacity of a facility (m^2).
EF_i = Emission factor for input gas i.
0.001 = Conversion factor from kg to metric tons.

(b) LCD manufacturers shall calculate process emissions for applicability purposes using the default emission factors shown in Table I–1 of this subpart and Equation I–2 of this section.

$$E_T = \sum_i S * EF_i * 0.000001 \qquad \text{(Eq. I-2)}$$

Where:

E_T = Total annual process emissions for applicability purposes (metric tons).
S = 100 percent of manufacturing capacity of a facility (m^2).
EF_i = Emission factor for input gas i.
0.000001 = Conversion factor from g to metric tons.

(c) MEMS manufacturers shall calculate process emissions for applicability purposes using the default emission factors shown in Table I–1 of this subpart and Equation I–3 of this section.

$$E_T = \sum_i S * EF_i * 0.001 \qquad \text{(Eq. I-3)}$$

Where:

E_T = Total annual process emissions for applicability purposes (metric tons).
S = 100 percent of manufacturing capacity of a facility (m^2).
EF_i = Emission factor for input gas i.
0.001 = Conversion factor from kg to metric tons.

(d) PV manufacturers shall calculate process emissions for applicability purposes using gas-appropriate GWP values shown in Table A–1 to subpart A and equation I–4 of this section.

$$E_T = \sum_i C_i * GWP_i * 0.001 \qquad \text{(Eq. I-4)}$$

Where:

E_T = Total annual process emissions for applicability purposes (metric tons).
C_i = Annual fluorinated GHG (gas i) purchases or consumption (kg).
GWP_i = Gas-appropriate GWP.
0.001 = Conversion factor from kg to metric tons.

§ 98.92 GHGs to report.

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

(1) Fluorinated GHGs from plasma etching.

(2) Fluorinated GHGs from chamber cleaning.

(3) Fluorinated GHGs from wafer cleaning.

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

(5) Fluorinated GHGs from heat transfer fluid use.

(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.

§ 98.93 Calculating GHG emissions.

(a) You shall calculate annual facility-level emissions for each fluorinated GHG used at your facility, for each process type used at your facility (plasma etching, chamber cleaning, or wafer cleaning) as appropriate, using equations I–5 and I–6 of this section and according to the procedures in paragraph (a)(1), (a)(2), or (a)(3) of this section.

$$processtypeE_i = \sum_{j=1}^{N} E_{ij} \qquad \text{(Eq. I-5)}$$

Where:

$processtypeE_i$ = Annual emissions of input gas i from the processes type (metric tons).
E_{ij} = Annual emissions of input gas i from individual process j or process category j (metric tons).
N = The total number of individual processes j or process categories j, which depend on the electronics manufacturing facility and emission calculation methodology.

$$processtypeBE_k = \sum_{j=1}^{N} \sum_i BE_{kij} \qquad \text{(Eq. I-6)}$$

Where:

$processtypeBE_k$ = Annual emissions of by-product gas k from the processes type (metric tons).
BE_{kij} = Annual emissions of by-product k formed from input gas i during individual process j or process category j (metric tons).
N = The total number of individual processes j or process categories j, which depend on the electronics manufacturing facility and emission calculation methodology.

(1) Semiconductor facilities that fabricate devices on wafers measuring 300 mm or less in diameter shall calculate annual facility-level emissions of each fluorinated GHG used at a facility for each fluorinated GHG-using process type, either from all individual processes at that facility in accordance with § 98.94(d), or from process categories as defined in this paragraph (a)(1).

(i) All etching process categories for which annual fluorinated GHG emissions shall be calculated are defined in this paragraph (a)(1)(i).

(A) Oxide etch means any process using fluorinated GHG reagents to selectively remove SiO_2, SiO_x-based or fully organic-based thin-film material that has been deposited on a wafer during semiconductor device manufacturing.

(B) Nitride etch means any process using fluorinated GHG reagents to selectively remove 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 can be some other element such as carbon) that has been deposited on a wafer during semiconductor manufacturing.

(C) Silicon etch also often called polysilicon etch means any process using fluorinated GHG reagents to selectively remove silicon during semiconductor manufacturing.

(D) Metal etch means any process using fluorinated GHG reagents associated with removing metal films (such as aluminum or tungsten) that have been deposited on a wafer during semiconductor manufacturing.

(ii) All chamber cleaning process categories for which annual fluorinated GHG emissions shall be calculated are defined in this paragraph (a)(1)(ii).

(A) In situ plasma means cleaning thin-film production chambers, after processing one or more wafers, with a fluorinated GHG cleaning reagent that is dissociated into its cleaning constituents by a plasma generated inside the chamber where the film was produced.

(B) Remote plasma system means cleaning thin-film production chambers, after processing one or more wafers, with a fluorinated GHG cleaning reagent dissociated by a remotely located (*e.g.,* upstream) plasma source.

(C) In situ thermal means cleaning thin-film production chambers, after processing one or more wafers, with a fluorinated GHG cleaning reagent that is thermally dissociated into its cleaning constituents inside the chamber where the thin-film (or thin films) was (were) produced.

(iii) All wafer cleaning process categories for which annual fluorinated GHG emissions shall be calculated are defined in this paragraph (a)(1)(iii).

(A) Bevel cleaning means any process using fluorinated GHG reagents with plasma to clean the edges of wafers during semiconductor manufacture.

(B) Ashing means any process using fluorinated GHG reagents with plasma to remove photoresist materials during wafer manufacture.

(2) Semiconductor facilities that fabricate devices on wafers measuring greater than 300 mm in diameter shall calculate annual facility-level emissions of each fluorinated GHG used at a facility for all individual processes at that facility in accordance with § 98.94(d).

(3) All other electronics facilities shall calculate annual facility-level emissions of each fluorinated GHG used at a facility for each process type, including etching and chemical vapor deposition chamber cleaning.

(b) You shall calculate annual facility-level emissions for each fluorinated GHG used at your facility, for each individual process, process category, or process type used at your facility as appropriate, using Equations I–7 and I–8 of this section, and according to the procedures in either paragraph (b)(1), (b)(2), or (b)(3) of this section.

$$E_{ij} = C_{ij} * \left(1 - U_{ij}\right) * \left(1 - a_{ij} * d_{ij}\right) * 0.001 \qquad \text{(Eq. I-7)}$$

Where:

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

C_{ij} = Amount of input gas i consumed in individual process, process category, or process type j, as calculated in Equation I–10 (kg) of this section and apportioned pursuant to § 98.94(c).

U_{ij} = Process utilization for input gas i during individual process, process category, or process type j.

a_{ij} = Fraction of input gas i used in individual process, process category, or process type j with abatement systems.

d_{ij} = Fraction of input gas i destroyed in abatement systems connected to individual process, process category, or process type j, accounting for uptime as specified in § 98.94(f)(2). This is zero unless the facility adheres to requirements in § 98.94(f).

0.001 = Conversion factor from kg to metric tons.

$$BE_{ijk} = B_{ijk} * C_{ij} * \left(1 - a_{ij} * d_{kj}\right) * 0.001 \qquad \text{(Eq. I-8)}$$

Where:

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

B_{ijk} = Amount of gas k created as a by-product per amount of input gas i (kg) consumed in individual process, process category, or process type j (kg).

C_{ij} = Amount of input gas i consumed in individual process, process category, or process type j, as calculated in Equation I–10 of this section (kg) and apportioned pursuant to § 98.94(c).

a_{ij} = Fraction of input gas i used in individual process, process category, or process type j with abatement systems.

d_{kj} = Fraction of by-product gas k destroyed in abatement systems connected to individual process, process category, or process type j, accounting for uptime as specified in § 98.94(f)(2). This is zero unless the facility adheres to requirements in § 98.94(f).

0.001 = Conversion factor from kg to metric tons.

(1) Semiconductor facilities that fabricate devices on wafers measuring 300 mm or less in diameter shall use the procedures in either paragraph (b)(1)(i) or (b)(1)(ii) of this section.

(i) Except as provided in paragraph (b)(1)(ii), you shall use default process category emission factors for process utilization and by-product formation rates shown in Tables I–6, I–7, and I–8 of this subpart as appropriate.

(ii) You may use recipe-specific measurements instead of the process category default factors provided that you follow methods in § 98.94(d).

(2) Semiconductor facilities that fabricate devices on wafers measuring greater than 300 mm in diameter shall use recipe-specific measurements and follow methods in § 98.94(d) to calculate emissions from each fluorinated GHG-using process type. You shall use Equations I–5 through I–8 of this section to calculate fluorinated GHG emissions from all fluorinated GHG-using process recipes.

(3) All other electronics facilities shall use the default process type-specific emission factors for process utilization and by-product formation rates shown in Tables I–3, I–4, and I–5 of this subpart for MEMS, LCD, and PV manufacturing, respectively.

(c) You shall calculate annual facility-level N_2O emissions from electronics manufacturing processes, using Equation I–9 of this section and the methods in this paragraph (c).

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

(i) You shall develop a facility-specific N_2O utilization factor averaged over all N_2O-using recipes used for chemical vapor deposition processes in accordance with § 98.94(e).

(ii) If you do not use a facility-specific N_2O utilization factor for chemical vapor deposition processes, you shall use 20 percent as the default utilization factor for N_2O from chemical vapor deposition processes.

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

(i) You shall develop a facility-specific N_2O utilization factor averaged over all N_2O-using recipes used for manufacturing processes other than chemical vapor deposition processes in accordance with § 98.94(e).

(ii) If you do not use a facility-specific N_2O utilization factor for manufacturing processes other than chemical vapor deposition, you shall use the default utilization factor of 0 percent for N_2O from manufacturing processes other than chemical vapor deposition.

(3) If your facility employs abatement systems and you wish to quantify and document N_2O emission reductions due to these systems, you must adhere to the requirements in § 98.94(f).

(4) You shall calculate annual facility-level N_2O emissions for all processes at your facility using Equation I–9 of this section.

$$E\left(N_2O\right) = \sum_{j} C_{N_2O,j} * \left(1 - U_{N_2O,j}\right) * \left(1 - a_{N_2O,j} * d_{N_2O,j}\right) * 0.001 \qquad \text{(Eq. I-9)}$$

Where:

$E(N_2O)$ = Annual emissions of N_2O (metric tons/year).

$C_{N_2O,j}$ = Amount of N_2O consumed for N_2O-using process j, as calculated in Equation I–10 of this section and apportioned to N_2O process j (kg).

$U_{N_2O,j}$ = Process utilization for N_2O-using process j.

$a_{N_2O,j}$ = Fraction of N_2O used in N_2O-using process j with abatement systems.

$d_{N_2O,j}$ = Fraction of N_2O for N_2O-using process j destroyed by abatement systems connected to process j, accounting for uptime as specified in § 98.94(f)(2). This is zero unless the facility adheres to requirements in § 98.94(f).

0.001 = Conversion factor from kg to metric tons.

(d) You shall calculate gas consumption for each fluorinated GHG and N_2O used at your facility using facility-wide gas-specific heel factors, as determined in § 98.94(b), and using Equation I–10 of this section.

$$C_i = \left(I_{Bi} - I_{Ei} + A_i - D_i\right) * 0.001 \qquad \text{(Eq. I-10)}$$

Where:

C_i = Annual consumption of input gas i (metric tons/year).

I_{Bi} = Inventory of input gas i stored in cylinders or other containers at the beginning of the year, including heels (kg).

I_{Ei} = Inventory of input gas i stored in cylinders or other containers at the end of the year, including heels (kg).

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

D_i = Disbursements under exceptional circumstances of gas i through sales or other transactions during the year, including heels in cylinders or other containers returned by the electronics manufacturing facility to the chemical supplier, calculated using equation I–11 of this section (kg).

0.001 = Conversion factor from kg to metric tons.

(e) You shall calculate disbursements of gas i using Equation I–11 of this section.

$$D_i = h_i * N_i * F_i + X_i \qquad \text{(Eq. I-11)}$$

Where:

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

h_i = Facility-wide gas-specific heel factor for input gas i (%), as determined in § 98.94(b) of this subpart.

N_i = Number of cylinders or other containers returned to the gas distributor containing the standard heel of gas i.

F_i = Full capacity of cylinders or other containers containing gas i (kg).

X_i = Disbursements under exceptional circumstances of gas i through sales or other transactions during the year. These include returns of containers whose contents have been weighed due to an exceptional circumstance as specified in § 98.94(b)(5) of this subpart (kg).

(f) For facilities that use fluorinated heat transfer fluids, you shall report the annual emissions of fluorinated GHG heat transfer fluids using the mass balance approach described in Equation I–12 of this section.

$$EH_i = density * \left(I_{io} + P_{it} - N_{it} + R_{it} - I_{it} - D_{it}\right) * 0.001 \qquad \text{(Eq. I-12)}$$

Where:

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

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

I_{io} = Inventory of fluorinated heat transfer fluid i (kg) (in containers, not equipment) at the beginning of the reporting year (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_{it} = Acquisitions of fluorinated heat transfer fluid i (kg) during the current reporting year (l). Includes 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_{it} = 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 (kg).

R_{it} = Total nameplate capacity (full and proper charge) of equipment that uses fluorinated heat transfer fluid i and that is removed from service during the current reporting year (kg).

I_{it} = Inventory of fluorinated heat transfer fluid i (kg) (in containers, not equipment) at the end of current reporting year (l).

D_{it} = Disbursements of fluorinated heat transfer fluid i (kg) during the current reporting year (l). Includes amounts returned to chemical suppliers, sold with or inside of equipment, and sent off site for verifiable recycling or destruction. 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.

§ 98.94 Monitoring and QA/QC requirements.

(a) For calendar year 2011 monitoring, you may follow the provisions of § 98.3(d)(1) through (d)(3) for best available monitoring methods rather than follow the monitoring requirements of this section. For purposes of subpart I, any reference to the year 2010 in § 98.3(d)(1) through (d)(3) shall mean 2011.

(b) For purposes of Equation I–10 of this section, you must estimate facility-wide gas-specific heel factors for each cylinder/container type for each gas used according to the procedures in paragraphs (b)(1) through (b)(6) of this section.

(1) You shall base your facility-wide gas-specific heel factors on the residual weight or pressure of a gas cylinder/container that your facility uses to change out that cylinder/container for each cylinder/container type for each gas used.

(2) The residual weight or pressure you use for § 98.94(b)(1) shall be determined by monitoring the mass or the pressure of your cylinders/containers. If you monitor the pressure, you shall convert the pressure to mass using the ideal gas law, as displayed in Equation I–13 of this section, with an appropriately selected Z value.

$$pV = ZnRT \qquad \text{(Eq. I-13)}$$

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) You shall use the facility-wide gas–specific cylinder/container residual mass, determined from § 98.94(b)(1) and (b)(2), to calculate the unused gas for each container, which when expressed as fraction of the initial mass in the cylinder/container is the heel factor.

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

(5) In the exceptional circumstance that you change a cylinder/container at a residual mass or pressure that differs by more than 20 percent from your facility-wide gas-specific determined values, you shall weigh that cylinder, or measure the pressure of that cylinder with a pressure gauge, in place of using a heel factor.

(6) You shall recalculate facility-wide gas-specific heel factors applied at your facility in the event that the residual weight or pressure of the gas cylinder/container that your facility uses to change out that cylinder/container differs by more than 1 percentage point from that used to calculate the previous gas-specific heel factor.

(c) Semiconductor facilities shall apportion fluorinated GHG consumption by process category, as defined in § 98.93(a)(1)(i) through (a)(1)(iii), or by individual process using a facility-specific engineering model based on wafer passes.

(d) If you use factors for fluorinated GHG process utilization and by-product formation rates other than the defaults provided in Tables I–6 through I–8 of this subpart, you must use factors that have been measured using the International SEMATECH Manufacturing Initiative's Guideline for Environmental Characterization of Semiconductor Process Equipment (December 2006). You may use factors for fluorinated GHG process utilization and by-product formation rates measured by manufacturing equipment suppliers if the conditions in paragraphs (d)(1) and (d)(2) of this section are met.

(1) The manufacturing equipment supplier has measured the GHG emission factors for process utilization and by-product formation rates using the International SEMATECH Manufacturing Initiative's Guideline for Environmental Characterization of Semiconductor Process Equipment (December 2006).

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

(e) If you use N_2O utilization factors other than those defaults provided in § 98.93(c)(1)(ii) or (c)(2)(ii), you must use factors that have been measured using the International SEMATECH Manufacturing Initiative's Guideline for Environmental Characterization of Semiconductor Process Equipment (December 2006). You may use utilization factors measured by manufacturing equipment suppliers if the conditions in paragraphs (e)(1) and (e)(2) of this section are met.

(1) The manufacturing equipment supplier has measured the N_2O utilization factors using the International SEMATECH Manufacturing Initiative's Guideline for Environmental Characterization of Semiconductor Process Equipment (December 2006).

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

(f) If your facility employs abatement systems and you wish to reflect emission reductions due to these systems in appropriate 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, 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 systems are properly installed, operated, and maintained according to manufacturers' specifications by adhering to the procedures in paragraphs (f)(1)(i) and (f)(1)(ii) of this section.

(i) Proper installation must be verified by certifying the systems are installed in accordance with the manufacturers' specifications.

(ii) Proper operation and maintenance must be verified by certifying the systems are operated and maintained in accordance with the manufacturers' specifications.

(2) You shall take into account and report the uptime of abatement systems when using destruction or removal efficiencies to reflect emission reductions. Abatement system uptime is expressed as the sum of an abatement system's operational productive, standby, and engineering times divided by the total operations time of its associated manufacturing tool(s) as referenced in SEMI Standard E–10–0340 Specification for Definition and Measurement of Equipment Reliability, Availability, and Maintainability (2004).

(3) To report controlled emissions using the default destruction or removal efficiency, you shall certify and document that the abatement systems at the facility for which you are reporting controlled emissions are specifically designed for fluorinated GHG and N_2O abatement and you shall use a default destruction or removal efficiency of 60 percent for those abatement systems.

(4) If you do not use the default destruction or removal efficiency value to report controlled emissions, you shall use either a properly measured destruction or removal efficiency, or a class average of properly measured destruction or removal efficiencies during a reporting year, determined in accordance with procedures in paragraphs (f)(4)(i) through (f)(4)(v) of this section.

(i) Destruction or removal efficiencies must be properly measured in accordance with EPA's Protocol for Measuring Destruction or Removal Efficiency of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing (March 2010).

(ii) A facility 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)(3)(ii)(A) and (f)(3)(ii)(B) of this section.

(A) Each reporting year a random sample of three or 20 percent of installed abatement systems, whichever is greater, for each abatement system class shall be tested. In instances where 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 shall be determined by rounding up to the nearest integer.

(B) You shall select the random sample each reporting year for the RSASTP without repetition of systems in the sample, until all systems in each class are properly measured in a 5-year period.

(iii) If a facility has measured the destruction or removal efficiency of a particular abatement system during the previous two-year period, the facility shall calculate emissions from that system using the destruction or removal efficiency most recently measured for that particular system.

(iv) If an individual abatement system has not yet undergone proper destruction or removal efficiency testing during the previous two-year period, the facility may apply a simple average of the properly measured destruction or removal efficiencies for all systems of that class, in accordance with the RSASTP. The facility shall maintain or exceed the RSASTP schedule and regime if it wishes to apply class average destruction or removal efficiency factors to abatement systems that have not been properly measured as per the RSASTP.

(v) In instances where redundant abatement systems are used, the facility may account for the total abatement system uptime calculated for a specific exhaust stream during the reporting year.

(g) You shall adhere to the QA/QC procedures of this paragraph when estimating fluorinated GHG and N_2O emissions from all electronics manufacturing processes:

(1) You shall follow the QA/QC procedures in the International SEMATECH Manufacturing Initiative's Guideline for Environmental Characterization of Semiconductor Process Equipment (December 2006) when estimating facility-specific, recipe-specific fluorinated GHG and N_2O utilization and by-product formation rates.

(2) You shall follow the QA/QC procedures in EPA's Protocol for Measuring Destruction or Removal Efficiency of Fluorinated Greenhouse Gas Abatement Equipment in

Electronics Manufacturing (March 2010) when estimating abatement systems destruction or removal efficiency.

(3) You shall certify that gas consumption is tracked to a high degree of precision as part of normal facility operations ensuring that the inventory at the beginning of the reporting is the same as the inventory at the end of the previous year.

(h) You shall adhere to the QA/QC procedures of this paragraph when estimating fluorinated GHG emissions from heat transfer fluid use and annual gas consumption for each fluorinated GHG and N_2O used at your facility:

(1) You shall review all inputs to Equations I–10 and I–12 of this section to ensure that all inputs and outputs to the facility's system are accounted for.

(2) You shall not enter negative inputs into the mass balance Equations I–10 and I–12 of this section and shall ensure that no negative emissions are calculated.

(3) You shall ensure that the beginning of year inventory matches the end of year inventory from the previous year.

(i) All instruments (*e.g.*, mass spectrometers and fourier transform infrared measuring systems) used to determine the concentration of fluorinated GHG and N_2O in process streams shall be calibrated just prior to destruction or removal efficiency, gas utilization, or by-product formation measurement through analysis of certified standards with known concentrations of the same chemicals in the same ranges (fractions by mass) as the process samples. Calibration gases prepared from a high-concentration certified standard using a gas dilution system that meets the requirements specified in Method 205, 40 CFR part 51, Appendix M may also be used.

(j) 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 shall 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 § 98.95(b), 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–12 of this subpart, you shall estimate heat transfer fluid emissions using the arithmetic average of the emission rates for the 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 shall document the method used and values estimated for all missing data values.

§ 98.96 Data reporting requirements.

In addition to the information required by § 98.3(c), you shall include in each annual report the following information for each electronics facility.

(a) Annual emissions of each fluorinated GHG and N_2O emitted from each individual process, process category, or process type as applicable and from all heat transfer fluid use as applicable.

(b) The method of emissions calculation used in § 98.93.

(c) Production in terms of substrate surface area (*e.g.*, silicon, PV-cell, LCD).

(d) Emission factors used for process utilization and by-product formation rates and the source for each factor for each fluorinated GHG and N_2O.

(e) Where process categories for semiconductor facilities as defined in § 98.93(a)(1)(i) through (a)(1)(iii) are not used, descriptions of individual processes or process categories used to estimate emissions.

(f) For each fluorinated GHG and N_2O, annual gas consumed during the reporting year and facility-wide gas-specific heel-factors used.

(g) The apportioning factors for each process category (*i.e.*, fractions of each gas fed into each individual process or process category used to calculate fluorinated GHG and N_2O emissions) and a description of the engineering model used for apportioning gas usage per § 98.94(c). If the method used to develop the apportioning factors permits the development of facility-wide consumption estimates that are independent of the estimates calculated in Equation I–10 of this subpart (*e.g.*, that are based on wafer passes for each individual process or process category), you shall report the independent facility-wide consumption estimate for each fluorinated GHG and N_2O.

(h) Fraction of each gas fed into each process type that is fed into tools with abatement systems.

(i) 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, manufacturers guaranteed destruction or removal efficiencies, if any, and record of destruction or removal efficiency measurements over its in-use life. The inventory of abatement systems shall also include a description of the associated tools and/or processes for which these systems treat exhaust.

(j) 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 used at your facility is installed, maintained, and operated in accordance with manufacturers' specifications.

(2) The uptime and the calculations to determine uptime for that reporting year.

(3) The default destruction or removal efficiency value or properly measured destruction or removal efficiencies for each abatement system used in that reporting year to reflect controlled emissions.

(4) Where the default destruction or removal efficiency value is used to report controlled emissions, certification that the abatement systems for which controlled emissions are being reported are specifically 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 to report controlled emissions, the following:

(i) A description of the class including the abatement system manufacturer and model number, and the fluorinated GHG and N_2O in the process 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 measured in that class for the reporting year.

(iv) A description of the calculation used to determine the class average, including all inputs of the calculation.

(vi) A description of method of randomly selecting class members for testing.

(k) For heat transfer fluid emissions, inputs in the mass-balance equation, Equation I–12 of this subpart for each fluorinated GHG.

(l) Example calculations for fluorinated GHG, N_2O, and heat transfer fluid emissions.

§ 98.97 Records that must be retained.

In addition to the information required by § 98.3(g), you must retain the following records:

(a) Data and copies of calculations used to estimate 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, recipe-specific gas utilization and by-product formation rates, the following records must be retained:

(1) Documentation that these were measured using the International SEMATECH Manufacturing Initiative's Guideline for Environmental Characterization of Semiconductor Process Equipment (December 2006).

(2) Documentation that the measurements made are representative of fluorinated GHG and N_2O emitting processes at your facility.

(3) The date and results of the initial and any subsequent tests to determine process tool gas utilization and by-product formation rates.

(c) For each abatement system through which fluorinated GHGs or N_2O flows at your facility, for which you are reporting controlled emissions, the following:

(1) Documentation to certify that each abatement system used at your facility is installed, maintained, and operated in accordance with manufacturers' specifications.

(2) Records of the uptime and the calculations to determine how the uptime was accounted for at your facility.

(3) Abatement system calibration and maintenance records.

(4) Where the default destruction or removal efficiency value was used, documentation from the abatement system supplier describing the equipment's designed purpose and emission control capabilities.

(5) Where properly measured destruction or removal efficiency is used to report controlled emissions, dated certification by the technician who made the measurement that the destruction or removal efficiency was calculated according to methods in EPA's Protocol for Measuring Destruction or Removal Efficiency of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing, complete documentation of the results of any initial and subsequent tests, and the final report as specified in EPA's Protocol for Measuring Destruction or Removal Efficiency of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing (March 2010).

(d) Purchase records for gas purchased.

(e) Invoices for gas purchases and sales.

§ 98.98 Definitions.

Except as provided below, 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.

Abatement system means a device or equipment that destroys or removes fluorinated GHGs and/or N_2O in waste streams from one or more electronics manufacturing tool chamber(s).

By-product formation means the creation of fluorinated GHGs during electronics manufacturing processes or the creation of fluorinated GHGs by an abatement system. By-product formation is expressed as rate of the mass of the by-product formed to the mass of the fluorinated GHG used with the largest flow rate.

Destruction or removal efficiency means the efficiency of a control 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 emission abatement system to the mass of GHG entering the emission abatement system. When fluorinated 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.

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 manufacturing processes.

Heat transfer fluids are fluorinated GHGs used for temperature control, device testing, and soldering in certain types of electronic manufacturing. Heat transfer fluids used in the electronics sector include perfluoropolyethers, perfluoroalkanes, perfluoroethers, tertiary perfluoroamines, and perfluorocyclic ethers. Heat transfer fluids commonly used in electronics manufacturing include those sold under the trade names "Galden®" and "Fluorinert™." 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 cylinder or container after it is discharged or off-loaded (this may vary by cylinder or container type and facility).

Nameplate capacity means the full and proper charge of gas 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.

Proper destruction or removal efficiency measurement means measured in accordance with EPA's Protocol for Measuring Destruction or Removal Efficiency of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing (March 2010).

Uptime means the total time during the reporting year when the abatement system for which controlled emissions will be reported was properly installed, operated, and maintained.

Wafer passes is a count of the number of times a silicon wafer is processed in a specific process category. The total number of wafer passes over a reporting year is the number of wafer passes per tool times the number of operational process tools in use during the reporting year.

Process category is a set of similar manufacturing steps, performed for the same purpose, associated with substrate (*e.g.,* wafer) processing during device manufacture for which fluorinated GHG and N_2O emissions and fluorinated GHG and N_2O usages are calculated and reported.

TABLE I–1 OF SUBPART I—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/m^2 Si)	0.90	1.00	0.04	0.05	0.04	0.20
LCD (g/m^2 LCD)	0.50	NA	NA	NA	0.90	4.00
MEMs (kg/m^2 Si)	NA	NA	NA	NA	NA	1.02

Notes: NA denotes not applicable based on currently available information.

Table I–2 of Subpart I—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 (CF3-(O-CF(CF3)-CF2)n-(O-CF2)m-O-CF3, CnF2n+2, CnF2n+1(O)CmF2m+1, CnF2nO, (CnF2n+1)3N).

Table I–3 of Subpart I—Default Emission Factors 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_6[a]	C_5F_8[a]	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–4 of Subpart I—Default Emission Factors 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–5 of Subpart I—Default Emission Factors 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–6 OF SUBPART I—DEFAULT EMISSION FACTORS FOR REFINED PROCESS CATEGORIES FOR SEMICONDUCTOR MANUFACTURING FOR 150 MM WAFER SIZE

Refined process category	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
PATTERNING/ETCHING											
Oxide etch:											
$1-U_i$	0.2–0.8	0.2–0.7	0.2–0.7	0.02–0.3	NA	0.1–0.3	0.1–0.4	0.1–0.4	0.05–0.2	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.01–0.8	0.05–0.1	NA	0.01–0.3	NA	NA	0.02–0.4	0.02–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.01–0.3	NA	NA	0.02–0.3	0.02–0.3	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitride etch:											
$1-U_i$	0.2–0.8	0.2–0.7	0.2–0.7	0.02–0.3	NA	0.1–0.3	0.1–0.4	0.1–0.4	0.05–0.2	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.01–0.8	0.05–0.1	NA	0.01–0.3	NA	NA	0.02–0.4	0.02–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.01–0.3	NA	NA	0.02–0.3	0.02–0.3	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silicon etch:											
$1-U_i$	0.2–0.8	0.2–0.7	0.2–0.7	0.02–0.3	NA	0.1–0.3	0.1–0.4	0.1–0.4	0.05–0.2	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.01–0.8	0.05–0.1	NA	0.01–0.3	NA	NA	0.02–0.4	0.02–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.01–0.3	NA	NA	0.02–0.3	0.02–0.3	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metal etch:											
$1-U_i$	0.2–0.8	0.2–0.7	0.2–0.7	0.02–0.3	NA	0.1–0.3	0.1–0.4	0.1–0.4	0.05–0.2	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.01–0.8	0.05–0.1	NA	0.01–0.3	NA	NA	0.02–0.4	0.02–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.01–0.3	NA	NA	0.02–0.3	0.02–0.3	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CHAMBER CLEANING											
In situ plasma cleaning:											
$1-U_i$	0.8–0.95	0.4–0.8	NA	NA	0.2–0.6	0.05–0.3	0.05–0.3	NA	NA	0.05–0.2	0.05–0.2
BCF_4	NA	0.05–0.2	NA	NA	0.05–0.2	0.05–0.2	0.05–0.2	NA	NA	0.05–0.2	0.05–0.2
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	0.02–0.08
Remote plasma 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
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											
Bevel 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
Ashing:											
$1-U_i$	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

TABLE I–6 OF SUBPART I—DEFAULT EMISSION FACTORS FOR REFINED PROCESS CATEGORIES FOR SEMICONDUCTOR MANUFACTURING FOR 150 MM WAFER SIZE—Continued

Refined process category	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
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–7 OF SUBPART I—DEFAULT EMISSION FACTORS FOR REFINED PROCESS CATEGORIES FOR SEMICONDUCTOR MANUFACTURING FOR 200 MM WAFER SIZE

Refined process category	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
PATTERNING/ETCHING											
Oxide etch:											
$1-U_i$	0.2–0.8	0.2–0.7	0.2–0.7	0.02–0.3	NA	0.1–0.3	0.1–0.4	0.1–0.4	0.05–0.5	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.01–0.8	0.05–0.1	NA	0.01–0.3	NA	NA	0.02–0.4	0.02–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.01–0.3	NA	NA	0.02–0.3	0.02–0.3	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitride etch:											
$1-U_i$	0.2–0.8	0.2–0.7	0.1–0.7	0.02–0.3	NA	0.05–0.3	0.1–0.4	0.1–0.4	0.05–0.2	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.01–0.8	0.05–0.1	NA	0.02–0.3	NA	NA	0.02–0.4	0.02–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.005–0.3	NA	NA	0.02–0.3	0.02–0.3	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silicon etch:											
$1-U_i$	0.2–0.8	0.2–0.7	0.2–0.7	0.02–0.3	NA	0.1–0.3	0.1–0.4	0.1–0.4	0.05–0.2	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.01–0.8	0.05–0.1	NA	0.01–0.3	NA	NA	0.02–0.4	0.02–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.01–0.3	NA	NA	0.02–0.3	0.02–0.3	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metal etch:											
$1-U_i$	0.2–0.8	0.2–0.7	0.2–0.7	0.02–0.3	NA	0.1–0.3	0.1–0.4	0.1–0.4	0.05–0.2	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.01–0.8	0.05–0.1	NA	0.01–0.3	NA	NA	0.02–0.4	0.02–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.01–0.3	NA	NA	0.02–0.3	0.02–0.3	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CHAMBER CLEANING											
In situ plasma cleaning:											
$1-U_i$	0.8–0.95	0.4–0.8	NA	NA	0.2–0.6	005–0.3	0.05–0.2	NA	NA	0.05–0.2	0.05–0.2
BCF_4	NA	0.05–0.2	NA	NA	0.05–0.2	0.05–0.2	0.05–0.1	NA	NA	0.05–0.2	0.05–0.2
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	0.02–0.08
Remote plasma cleaning:											
$1-U_i$	NA	NA	NA	NA	NA	NA	0.005–0.03	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.0001–0.2	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											
Bevel 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
Ashing:											
$1-U_i$	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

Note: NA denotes not applicable based on currently available information.

TABLE I–8 OF SUBPART I—DEFAULT EMISSION FACTORS FOR REFINED PROCESS CATEGORIES FOR SEMICONDUCTOR MANUFACTURING FOR 300 MM WAFER SIZE

Refined process category	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
PATTERNING/ETCHING											
Oxide etch:											
$1-U_i$	0.2–0.8	0.2–0.7	0.2–0.4	0.1–0.8	NA	0.05–0.3	0.1–0.4	0.1–0.4	0.05–0.3	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.005–0.03	0.001–0.01	NA	0.005–0.1	NA	NA	0.02–0.4	0.02–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.005–0.1	NA	NA	0.02–0.3	0.02–0.3	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitride etch:											
$1-U_i$	0.2–0.8	0.2–0.7	0.2–0.4	0.1–0.8	NA	0.08–0.3	0.1–0.4	0.1–0.4	0.05–0.2	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.003–0.1	0.01–0.1	NA	0.02–0.3	NA	NA	0.05–0.4	0.05–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.02–0.3	NA	NA	0.05–0.4	0.05–0.4	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE I–8 OF SUBPART I—DEFAULT EMISSION FACTORS FOR REFINED PROCESS CATEGORIES FOR SEMICONDUCTOR MANUFACTURING FOR 300 MM WAFER SIZE—Continued

Refined process category	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
Silicon etch:											
1-U_i	0.2–0.8	0.2–0.7	0.2–0.7	0.02–0.3	NA	0.1–0.3	0.1–0.4	0.1–0.4	0.05–0.2	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.01–0.8	0.05–0.1	NA	0.01–0.3	NA	NA	0.02–0.4	0.02–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.01–0.3	NA	NA	0.02–0.3	0.02–0.3	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metal etch:											
1-U_i	0.2–0.8	0.2–0.7	0.2–0.7	0.02–0.3	NA	0.1–0.3	0.1–0.4	0.1–0.4	0.05–0.2	0.05–0.3	NA
BCF_4	NA	0.05–0.5	0.01–0.8	0.05–0.1	NA	0.01–0.3	NA	NA	0.02–0.4	0.02–0.4	NA
BC_2F_6	NA	NA	NA	NA	NA	0.01–0.3	NA	NA	0.02–0.3	0.02–0.3	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	0.1–0.4	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.001–0.6	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	NA	NA	0.002–0.03	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.001–0.05	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	0.1–0.4	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.005-.05	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											
Bevel cleaning:											
1-U_i	0.3–0.8	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
Ashing:											
1-U_i	0.3–0.8	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

Notes: NA denotes not applicable based on currently available information.

4. 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 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, or the creation of by-products that are released or destroyed at the production facility.

§ 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) of this part. 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 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.

(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.

§ 98.123 Calculating GHG emissions.

For fluorinated GHG production processes, you must calculate the fluorinated GHG emissions from each process using either the mass balance method specified in paragraph (a) of this section or the emission factor or emission calculation factor method specified in paragraphs (b), (c), and (d) of this section, as appropriate. For processes that manufacture CFCs or HCFCs or that transform fluorinated gases into substances other than fluorinated GHGs, you must use the procedures in paragraphs (b), (c), and (d) of this section. For destruction processes that destroy fluorinated GHGs that were previously “produced” as defined at 98.410(b), you must use the procedures in paragraph (e) of this section.

(a) *Mass balance method.* Before using the mass balance approach to estimate your fluorinated GHG emissions from a process, 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–7 through L–12 of this section. If this calculation shows that use of the mass-balance approach to estimate emissions from the process will result in an absolute error exceeding 3,000 metric tons CO_2e per year and a relative error exceeding 30 percent, then you cannot use the mass-balance approach to estimate emissions from the process. Instead, you must use the emission factor approach detailed in paragraphs (b), (c), and (d) of this section to estimate emissions from the process. To perform the calculation, you shall first calculate the absolute and relative errors associated with the quantities calculated using Equations L–8 through L–11. Once errors have been calculated for the quantities in these equations, those errors shall be used to calculate the errors in Equations L–7 and L–12. Where the measured quantity is a mass, the error in the mass shall 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. Where the measured quantity is a concentration, the error of the concentration shall be equated to the accuracy or precision (whichever is larger) of the analytical technique used to measure the concentration at the concentration measured.

(1) 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):

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

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.

(2) Equation L–2 of this section provides the general formula for calculating the relative errors of sums and differences:

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

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.

(3) Equation L–3 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):

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

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.

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

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

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.

(5) The total mass of each fluorinated GHG product emitted annually from all fluorinated gas production processes shall be estimated by using Equation L–5 of this section:

$$E_p = \sum_{p=1}^{n} \sum_{i=1}^{m} E_{Pip} \qquad \text{(Eq. L-5)}$$

Where:

E_P = Total mass of each fluorinated GHG product emitted annually from all production processes (metric tons).
E_{Pip} = Total mass of the fluorinated GHG product emitted from production process i over the period p (metric tons, defined in Equation L–7 of this section).
n = Number of concentration and flow measurement periods for the year.
m = Number of production processes.

(6) The total mass of fluorinated GHG by-product k emitted annually from all fluorinated gas production processes shall be estimated by using Equation L–6 of this section:

$$E_{Bk} = \sum_{p=1}^{n} \sum_{i=1}^{m} E_{Bkip} \qquad \text{(Eq. L-6)}$$

Where:

E_{Bk} = Total mass of fluorinated GHG by-product k emitted annually from all production processes (metric tons).
E_{Bkip} = Total mass of fluorinated GHG by-product k emitted from production process i over the period p (metric tons, defined in Equation L–8 on this section).
n = Number of concentration and flow measurement periods for the year.
m = Number of production processes.

(7) The total mass of each fluorinated GHG product emitted from production process i over the period p shall be estimated at least monthly by calculating the difference between the expected production of the fluorinated GHG based on the consumption of one of the reactants (*e.g.,* HF or a chlorocarbon reactant) and the measured production of the fluorinated GHG, accounting for yield losses related to by-products and wastes. This calculation shall be performed using Equation L–7 of this section.

$$E_{Pip} = \frac{R * MW_P * SC_P}{MW_R * SC_R} - P - \sum_{j=1}^{q} \left(C_P * W_{Dj} \right) - \sum_{k=1}^{u} L_{Bkip} \qquad \text{(Eq. L-7)}$$

Where:

E_{Pip} = Total mass of each fluorinated GHG product emitted from production process i over the period p (metric tons).
P = Total mass of the fluorinated GHG produced by production process i over the period p (metric tons).
R = Total mass of the reactant that is consumed by production process i over the period p (metric tons, defined in Equation L–8 of this section).
MW_P = Molecular weight of the fluorinated GHG produced.
MW_R = Molecular weight of the reactant.
SC_P = Stoichiometric coefficient of the fluorinated GHG produced.
SC_R = Stoichiometric coefficient of the reactant.
C_P = Concentration (mass fraction) of the fluorinated GHG product in stream j of destroyed wastes. If this concentration is only a trace concentration, C_P is equal to zero.
W_{Dj} = Mass of wastes removed from production process i in stream j and destroyed over the period p (metric tons, defined in Equation L–9 of this section).
L_{Bkip} = Yield loss related to by-product k for production process i over the period p (metric tons, defined in Equation L–10 of this section).
q = Number of waste streams destroyed in production process i.
u = Number of by-products generated in production process i.

(8) The total mass of the reactant that is consumed by production process i over the period p shall be estimated by using Equation L–8 of this section:

$$R = R_F - R_R \qquad \text{(Eq. L-8)}$$

Where:

R = Total mass of the reactant that is consumed by production process i over the period p (metric tons).
R_F = Total mass of the reactant that is fed into production process i over the period p (metric tons).
R_R = Total mass of the reactant that is permanently removed from production process i over the period p (metric tons).

(9) The mass of wastes removed from production process i in stream j and destroyed over the period p shall be estimated using Equation L–9 of this section:

$$W_{Dj} = W_{Fj} * DE \qquad \text{(Eq. L-9)}$$

Where:

W_{Dj} = The mass of wastes removed from production process i in stream j and destroyed over the period p (metric tons).
W_{Fj} = The total mass of wastes removed from production process i in stream j and fed into the destruction device over the period p (metric tons).
DE = Destruction efficiency of the destruction device (fraction).

(10) Yield loss related to by-product k for production process i over period p shall be estimated using Equation L–10 of this section:

$$L_{Bkip} = \frac{\left(B_{kip} * MW_P * ME_{Bk} \right)}{\left(MW_{Bk} * ME_p \right)} \qquad \text{(Eq. L-10)}$$

Where:

L_{Bkip} = Yield loss related to by-product k for production process i over the period p (metric tons).
B_{kip} = Mass of by-product k generated by production process i over the period p (metric tons, defined in Equation L–11 of this section).
MW_P = Molecular weight of the fluorinated GHG produced.
ME_{Bk} = Moles of the element shared by the reactant, product, and by-product k per mole of by-product k.
MW_{Bk} = Molecular weight of by-product k.
ME_P = Moles of the element shared by the reactant, product, and by-product k per mole of the product.

(11) If by-product k is responsible for yield loss in production process i and occurs in any stream (including process streams, emissions streams, or destroyed streams) in more than trace concentrations, the mass of by-product k generated by production process i over the period p shall be estimated using Equation L–11 of this section:

$$B_{kip} = \sum_{j}^{q} c_{Bjk} * S_j \qquad \text{(Eq. L-11)}$$

Where:

B_{kip} = Mass of by-product k generated by production process i over the period p (metric tons).
c_{Bkj} = Concentration (mass fraction) of the by-product k in stream j of production process i over the period p. If this concentration is only a trace concentration, c_{Bkj} is equal to zero.
S_j = Mass flow of stream j of production process i over the period p.

q = Number of streams in production process i.

(12) If by-product k is responsible for yield loss, is a fluorinated GHG, occurs in any stream (including process streams, emissions streams, or destroyed streams) in more than trace concentrations, and is not completely recaptured or completely destroyed; the total mass of by-product k emitted from production process i over the period p shall be estimated at least monthly using Equation L–12 of this section:

$$E_{Bkip} = B_{kip} - \sum_{j=1}^{q} c_{Bkj} * W_{Dj} - \sum_{l=1}^{x} c_{Bkl} * S_{Rl} \qquad \text{(Eq. L-12)}$$

Where:

E_{Bkip} = Mass of by-product k emitted from production process i over the period p (metric tons).

B_{kip} = Mass of by-product k generated by production process i over the period p (metric tons).

c_{Bkj} = Concentration (mass fraction) of the by-product k in stream j of destroyed wastes over the period p. If this concentration is only a trace concentration, c_{Bjk} is equal to zero.

W_{Dj} = The mass of wastes that are removed from production process i in stream j and that are destroyed over the period p (metric tons, defined in Equation L–9 of this section).

c_{Bkl} = The concentration (mass fraction) of the by-product k in stream l of recaptured material over the period p. If this concentration is only a trace concentration, c_{Bkl} is equal to zero.

S_{Rl} = The mass of materials that are removed from production process i in stream l and that are recaptured over the period p.

q = Number of waste streams destroyed in production process i.

x = Number of streams recaptured in production process i.

(b) *Emission factor and emission calculation factor methods.* To use the method in this paragraph, you must first make a preliminary estimate of the emissions from each individual process vent under paragraph (b)(1) of this section. Then, compare the preliminary estimate to the criteria in paragraph (b)(2) of this section to determine whether the process vent meets the criteria for using the emission factor method described in paragraph (b)(3) of this section or whether the process vent meets the criteria for using the emission calculation factor method described in paragraph (b)(4) of this section.

(1) *Preliminary estimate of emissions by process vent.* You must estimate the annual uncontrolled emissions of fluorinated GHG for each process vent within a process. You may determine uncontrolled emissions of fluorinated GHG by process vent using existing measurements and/or calculations based on chemical engineering principles and chemical property data or you may conduct an engineering assessment. You must document all data, assumptions, and procedures used in the calculations or engineering assessment and keep a record of the uncontrolled emissions determination (in § 98.127(a)).

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

(A) Emissions Inventory Improvement Process, Volume II: Chapter 16, Methods for Estimating Air Emissions from Chemical Manufacturing Facilities. U.S. Environmental Protection Agency, August 2007.

(B) You 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), except as specified in paragraphs (b)(1)(i)(B)(*1*) through (b)(1)(i)(B)(*7*) of this section. For the purposes of this subpart, use of the term "HAP" in § 63.1257(d)(2)(i) shall mean "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*).

(*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*).

(*3*) To calculate emissions from vacuum systems, the terms used in Equation 33 to 40 CFR part 63, subpart GGG, 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*) $MW_{\text{Fluorinated GHG}}$ = 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 uncontrolled emissions when a vessel is equipped with a process condenser, you must use the procedures in 40 CFR 63.1257(d)(3)(i)(B), 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 ($MW_{\text{Fluorinated GHG}}$) 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.

(*iv*) For the emissions from gas evolution, the term for time, t, must be used in Equation 12 to 40 CFR part 63, subpart GGG.

(*v*) Emissions from empty vessel purging shall be calculated using Equation 36 to 40 CFR part 63, subpart GGG 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, including the calculation methodologies in paragraphs (b)(1)(i)(A) and (B) of this section.

(ii) *Engineering assessments.* For process vent emissions determinations, you may conduct an engineering assessment to calculate uncontrolled emissions for each emission episode. 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 under representative 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.

(2) Process vent annual mass limit and control determination.

(i) If the individual process vent meets the criteria in either paragraph (b)(2)(i)(A) or (b)(2)(i)(B) of this section, then you may comply with either paragraph (b)(3) (Emission Factor approach) or paragraph (b)(4) (Emission Calculation Factor approach).

(A) Uncontrolled fluorinated GHG emissions for the individual process vent as estimated using procedures in paragraph (b)(1) of this section are less than 10,000 metric tons CO_2e per year or, for emissions including fluorinated GHGs whose GWPs are not listed in Table A–1, 1 metric ton per year.

(B) The individual process vent is vented to a destruction device demonstrated to achieve a destruction efficiency of 99.9 percent for the fluorinated GHGs in the vent stream, and the facility has equipment (*e.g.,* holding tank capacity; monitoring of bypass streams) or procedures (*e.g.,* compulsory process shutdowns) in place that ensure that uncontrolled emissions do not occur. For each process, you should either track the amount of production or other process activity that is vented to the destruction device or track production or other process activity that by-passes the destruction device.

(ii) If the individual process vent does not meet the criteria in either paragraph (b)(2)(i)(A) or (b)(2)(i)(B) of this section, then the facility must comply with the emission factor method specified in paragraph (b)(3) of this section.

(3) *Process-vent-specific emission factor method.* For each process vent, conduct an emission test and measure uncontrolled 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 (b)(3). All emissions test data and procedures used in developing emission factors shall be documented according to § 98.127.

(i) 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 according to the procedures in § 98.124 and calculate the rate for the test period, in kg per hour or in kg per batch.

(ii) For continuous processes, you must calculate the hourly uncontrolled fluorinated GHG emission rate using Equation L–13 of this section and determine the hourly uncontrolled fluorinated GHG emission rate per process vent for the test run. For batch processes, you must calculate the uncontrolled fluorinated GHG emissions during each emission episode over the batch using Equation L–14 of this section and determine the fluorinated GHG emissions per process based on the batch runs conducted for the test.

$$E_{ContPV} = \frac{C_{PV}}{10^6} * MW * Q_{PV} * \frac{1}{SV} * \frac{1}{10^3} * \frac{60}{1} \qquad \text{(Eq. L-13)}$$

Where:

E_{ContPV} = Mass of fluorinated GHG f emitted from process vent v from production process i 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 gram).

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

$$E_{BatchPV} = \frac{\sum_{1}^{ee} C_{PV\text{-}ee} * Q_{PV\text{-}ee} * D_{ee}}{10^6} * MW * \frac{1}{SV} * \frac{1}{10^3} \qquad \text{(Eq. L-14)}$$

Where:

$E_{BatchPV}$ = Mass of fluorinated GHG f emitted from process vent v from production process i during the emission test during test run r (kg/batch).

$C_{PV\text{-}ee}$ = Concentration of fluorinated GHG f during emission episode ee during test run r of the emission test (ppmv).

$Q_{PV\text{-}ee}$ = Flow rate of the process vent stream during emission episode ee during test run r of the emission test (m^3/min).

D_{ee} = Duration of emission episode ee during test run r of the emission test (minutes).

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

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 gram).

ee = Number of emission episodes ee from process vent v during process i.

(iii) You must calculate a site-specific, process-vent-specific emission factor for each process vent, in kg of uncontrolled fluorinated GHG per process activity rate (*e.g.,* kg of feed or production), as applicable, using Equation L–15 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. For batch processes, divide the fluorinated GHG emissions by the process activity rate for the batch runs.

$$EF_{PV} = \frac{\sum_{1}^{r} \left(\frac{E_{PV}}{Activity_{EmissionTest}} \right)}{r} \qquad \text{(Eq. L-15)}$$

Where:

EF_{PV} = Average emission factor for fluorinated GHG f emitted from process vent v during production process i (kg emitted/kg product).

E_{PV} = Mass of fluorinated GHG f emitted from process vent v from production process i 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 during the emission test during test run r (*e.g.,* kg product/hr for continuous, calculated in Equation L–13 of this section, kg product/batch for batch, calculated in Equation L–14 of this section).

r = Number of test runs (*i.e.,* batches) performed during the emission test.

(iv) You must calculate fluorinated GHG emissions for the process vent for the reporting period by multiplying the process-vent-specific emission factor by the total process activity, as applicable, for the reporting period, using Equation L–16 of this section.

$$E_{PV\text{-}RptPeriod} = EF_{PV} * Activity_{RptPeriod} \qquad \text{(Eq. L-16)}$$

Where:

$E_{PV-RptPeriod}$ = Mass of fluorinated GHG f emitted from process vent v from production process i, for the reporting period, either monthly or annually (kg/month or kg/year).

EF_{PV} = Average emission factor for fluorinated GHG f emitted from process vent v during production process i (kg emitted/activity) (*e.g.,* kg emitted/kg product).

$Activity_{RptPeriod}$ = Process feed, process production, or other process activity during the reporting period.

(v) 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, using Equation L–17 of this section. You may apply the destruction efficiency only to the portion of the process activity that is vented to the destruction device (*i.e.,* controlled).

$$E_{PV\text{-}RptPeriod} = EF_{PV} * \left(Activity_{RptPeriod\text{-}U} + Activity_{RptPeriod\text{-}C} * (1-DE)\right) \qquad \text{(Eq. L-17)}$$

Where:

$E_{PV-RptPeriod}$ = Mass of fluorinated GHG f emitted from process vent v from production process i, for the reporting period, either monthly or annually, considering destruction efficiency (kg/month or kg/year).

EF_{PV} = Emission factor for fluorinated GHG f emitted from process vent v during production process i (kg emitted/kg product).

$Activity_{RptPeriod-U}$ = Total process feed, process production, or other process activity during the reporting period for which the process vent is not vented to the destruction device (*e.g.,* kg product).

$Activity_{RptPeriod-C}$ = Total process feed, process production, or other process activity during the reporting period for which the process vent is vented to the destruction device (*e.g.,* kg product).

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

(vi) Sum the emissions from all process vents in the process for the reporting period to estimate total fluorinated GHG process emissions, using Equation L–18 of this section.

$$E_{Pfi} = \sum_{1}^{v} E_{PV\text{-}RptPeriod} \qquad \text{(Eq. L-18)}$$

Where:

E_{Pfi} = Mass of fluorinated GHG f emitted from production process i, for the reporting period, either monthly or annually (kg).

$E_{PV-RptPeriod}$ = Mass of fluorinated GHG f emitted from process vent v from production process i, for the reporting period, either monthly or annually, considering destruction efficiency (kg/month or kg/year).

v = Number of process vents in production process i.

(vii) Sum the emissions from all processes for the reporting period to estimate total fluorinated GHG process vent emissions, using Equation L–19 of this section.

$$E_P = \sum_{1}^{i} E_{Pfi} \qquad \text{(Eq. L-19)}$$

Where:

E_P = Mass of fluorinated GHG f emitted from all process vents at the facility, for the reporting period, either monthly or annually (kg).

E_{Pij} = Mass of fluorinated GHG f emitted from production process i, for the reporting period, either monthly or annually (kg).

i = Number of production processes i at the facility.

(4) *Process-vent-specific emission calculation factor method.* For each process vent, 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}, using measurements and/or calculations based on chemical engineering principles and chemical property data or you may conduct an engineering assessment, using the procedures in paragraphs (b)(1)(i) or (ii) of this section, except paragraph (b)(1)(ii)(C) of this section. 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. All data, assumptions, and procedures used in the calculations or engineering assessment shall be documented according to § 98.127.

(ii) You must calculate a site-specific, process-vent-specific emission calculation factor for each process vent, in kg of fluorinated GHG per activity rate (*e.g.,* kg of feed or production) as applicable, using Equation L–20 of this section.

$$ECF_{PV} = \frac{E_{PV}}{Activity_{\text{Re}\,presentative}} \qquad \text{(Eq. L-20)}$$

Where:

ECF_{PV} = Emission calculation factor for fluorinated GHG f emitted from process vent v during production process i (kg emitted/kg product).

E_{PV} = Average mass of fluorinated GHG f emitted, based on calculations, from process vent v from production process i 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 fluorinated GHG emissions for the process vent for the reporting period by multiplying the process-vent-specific emission calculation factor by the total process activity, as applicable, for the reporting period, using Equation L–21 of this section.

$$E_{PV\text{-}RptPeriod} = ECF_{PV} * Activity_{RptPeriod} \qquad \text{(Eq. L-21)}$$

Where:

$E_{PV\text{–}RptPeriod}$ = Mass of fluorinated GHG f emitted from process vent v from production process i, for the reporting period, either monthly or annually (kg/month or kg/year).

ECF_{PV} = Emission calculation factor for fluorinated GHG f emitted from process vent v during production process i (kg emitted/activity) (*e.g.,* kg emitted/kg product).

$Activity_{RptPeriod}$ = Process feed, process production, or other process activity during the reporting period.

(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, using Equation L–22 of this section. You may apply the destruction efficiency only to the portion of the process activity that is vented to the destruction device (*i.e.,* controlled).

$$E_{PV\text{-}RptPeriod} = ECF_{PV} * \left(Activity_{RptPeriod\text{-}U} + Activity_{RptPeriod\text{-}C} * (1 - DE) \right) \qquad \text{(Eq. L-22)}$$

Where:

$E_{PV\text{–}RptPeriod}$ = Mass of fluorinated GHG f emitted from process vent v from production process i, for the reporting period, either monthly or annually, considering destruction efficiency (kg/month or kg/year).

ECF_{PV} = Emission calculation factor for fluorinated GHG f emitted from process vent v during production process i (kg emitted/kg product).

$Activity_{RptPeriod\text{-}U}$ = Total process feed, process production, or other process activity during the reporting period for which the process vent is not vented to the destruction device (*e.g.,* kg product).

$Activity_{RptPeriod\text{-}C}$ = Total process feed, process production, or other process activity during the reporting period for which the process vent is vented to the destruction device (*e.g.,* kg product).

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

(v) Sum the fluorinated GHG emissions from all process vents in the process for the reporting period to estimate total process emissions, using Equation L–23 of this section.

$$E_{Pfi} = \sum_{1}^{v} E_{PV\text{-}RptPeriod} \qquad \text{(Eq. L-23)}$$

Where:

E_{Pfi} = Mass of fluorinated GHG f emitted from production process i, for the reporting period, either monthly or annually (kg).

$E_{PV\text{–}RptPeriod}$ = Mass of fluorinated GHG f emitted from process vent v from production process i, for the reporting period, either monthly or annually, considering destruction efficiency (kg/month or kg/year).

v = Number of process vents in production process i.

(vi) Sum the emissions from all processes for the reporting period to estimate total fluorinated GHG process emissions, using Equation L–24 of this section.

$$E_P = \sum_{1}^{i} E_{Pfi} \qquad \text{(Eq. L-24)}$$

Where:

E_P = Mass of fluorinated GHG f emitted from all processes at the facility, for the reporting period, either monthly or annually (kg).

E_{Pij} = Mass of fluorinated GHG f emitted from production process i, for the reporting period, either monthly or annually (kg).

i = Number of production processes i at the facility.

(c) *Calculate fluorinated GHG emissions for equipment leaks (EL).* If you comply with paragraph (b) 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. The emissions from equipment leaks must be calculated using one of the following methods in the *Protocol for Equipment Leak Emission Estimates,* U.S. Environmental Protection Agency, EPA Publication No. EPA–453/R–95–017, November 1995: the Screening Ranges Approach; the EPA Correlation Approach; or the Unit-Specific Correlation Approach. You may not use the procedure in the protocol for Average Emission Factor Approach.

(1) You must develop response factors for each fluorinated GHG or for each surrogate to be measured using EPA Method 21, 40 CFR part 60, Appendix A–7. For each fluorinated GHG measured, the response factor shall be less than 10. The response factor is the ratio of the known concentration of a fluorinated GHG to the observed meter reading when measured using an instrument calibrated with the reference compound.

(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 must 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; and 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 kg/yr for equipment pieces for all processes, E_{EL}.

(d) *Calculate total fluorinated GHG emissions for the facility/source category.* Estimate annually the total mass of fluorinated GHG emissions from process vents in either paragraph (c)(3) or (c)(4) of this section, as appropriate, and from equipment leak emissions in paragraph (d) using Equation L–25 of this section.

$$E = E_P + E_{EL} \qquad \text{(Eq. L-25)}$$

Where:

E = Total mass of each fluorinated GHG f emitted from the facility, annual basis (kg/year).

E_P = Mass of fluorinated GHG f emitted from all process vents at the facility, annually (kg).

E_{EL} = Mass of fluorinated GHG f emitted from equipment leaks for pieces of equipment for the facility, annually (kg/year).

(e) *Calculate fluorinated GHG emissions from destruction of fluorinated GHGs that were previously "produced" as defined at 98.410(b).* 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–26 of this section:

$$E_D = RE_D * (1 - DE) \qquad \text{(Eq. L-26)}$$

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).

§ 98.124 Monitoring and QA/QC requirements.

(a) *Initial scoping test for fluorinated GHGs.* You must conduct an initial scoping test to identify all fluorinated GHGs that may be generated from processes that are subject to this subpart and that have uncontrolled emissions (*i.e.,* pre-control emissions levels) of 1.0 metric ton or more of fluorinated GHGs. For each process, you must conduct the initial scoping test on 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. Initial scoping testing must be conducted according to the procedures in paragraph (c)(4)(v) of this section.

(b) *Mass Balance monitoring.* If you determine fluorinated GHG emissions using the mass balance method under § 98.123(a), you must estimate the total mass of each fluorinated GHG emitted from the process at least monthly.

(1) You must conduct the following mass measurements on a monthly or more frequent basis using flowmeters, weigh scales, or a combination of volumetric and density measurements with accuracy and precision that allow the facility to meet the error criteria in § 98.123(a):

(i) Total mass of each fluorinated GHG produced shall be estimated using the methods and measurements set forth in § 98.413(a) and (b) and in § 98.414(a) and (b). For each fluorinated GHG, the mass produced used for the mass-balance calculation shall be the same as the mass produced that is reported under subpart OO.

(ii) Total mass of each reactant fed into the production process shall be measured.

(iii) Total mass of each reactant permanently removed from the production process shall be measured.

(iv) If the waste permanently removed from the production process and fed into the destruction device contains more than trace concentrations of fluorinated GHG product, then the mass of waste fed into the destruction device shall be measured.

(v) If a by-product is responsible for yield loss and occurs in any stream (including process steams, emissions streams, or destroyed streams) in more than trace concentrations, then the mass flow of each stream that contains more than trace concentrations of the by-product shall be measured.

(vi) If a by-product is a fluorinated GHG (other than HFC-23 generated during HCFC-22 production), occurs in more than trace concentrations in any stream (including process streams, emissions streams, or destroyed streams), occurs in more than trace concentrations in any stream that is recaptured or is fed into a destruction device, and is not completely recaptured or completely destroyed, then the mass flow of each stream that contains more than trace concentrations of the by-product and that is recaptured or is fed into the destruction device shall be measured.

(2) The following concentration measurements shall be measured on a regular basis using equipment and methods (*e.g.,* gas chromatography) with an accuracy and precision that allow the facility to meet the error criteria in § 98.123(a):

(i) If the waste permanently removed from the production process and fed into the destruction device contains more than trace concentrations of fluorinated GHG product and if the stream mass includes more than trace concentrations of materials other than the product, then the concentration of the product shall be measured.

(ii) If a by-product is responsible for yield loss and occurs in any stream (including process streams, emissions streams, or destroyed streams) in more than trace concentrations and if the stream mass includes more than trace concentrations of materials other than the by-product, then the concentration of the by-product shall be measured.

(iii) If a by-product is a fluorinated GHG, occurs in more than trace concentrations in any stream (including process streams, emissions streams, or destroyed streams), occurs in more than trace concentrations in any stream that is recaptured or is fed into a destruction device, and is not completely recaptured or completely destroyed, and if the measured stream mass includes more than trace concentrations of materials other than the by-product, then the concentration of the by-product shall be measured.

(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 every 5 years that is based on representative performance (*i.e.,* performance based on the normal operating scenario) of the affected process. For each continuous process vent, develop a process-vent-specific emission factor for the representative operating scenario. For each batch process vent, develop a process-vent-specific emission factor for the representative operating scenario, *i.e.,* the typical batch process. Atypical events, such as process shutdowns or startups, may be included in the monitoring for batch processes and may be included for continuous process, if the monitoring is sufficiently long or comprehensive to ensure that such events are not overrepresented in the emission factor. Malfunction events shall not be included in the monitoring.

(2) *Different operating conditions.* Develop separate process-vent-specific emission factor for other operating scenarios as needed. If your process operates under different conditions as part of normal operations, you must perform emission testing and develop separate emission factors for these different process operating scenarios. For continuous process vents, determine the emissions based on the process activity at each specific different condition. For batch process vents, determine emissions based on the process feed rate, process production rate, or other process activity rate for each typical batch operating scenario (*i.e.,* each specific condition).

(3) *Number of runs.* For continuous processes, sample the process vent for a minimum of 3 runs of 1 hour each. For batch processes, sample the process vent for all emission episodes over a minimum of 3 complete batch cycles. If the RSD of the emission factor

calculated based on the first 3 runs is greater than or equal to 0.2 for the emissions factor, continue to sample the process vent for an additional 3 runs of 1 hour each or an additional 3 batch cycles. If more than one fluorinated GHG is measured, and if all measured fluorinated GHGs have GWPs listed in Table A–1, the emissions factor and RSD shall be expressed in terms of total CO_2 equivalents. Otherwise, the emissions factor and RSD shall be expressed in terms of kilograms of each species.

(4) *Emission Test Methods.* Conduct the emissions testing using the following methods:

(i) Sample and velocity traverses. Use EPA Method 1 or 1A in Appendix A–1 of 40 CFR part 60.

(ii) Velocity and volumetric flow rates. Use EPA Method 2, 2A, 2B, 2C, or 2D, 2F, or 2G in Appendix A–1 of 40 CFR part 60. Alternatives that may be used for determining flow rates include Other Test Method 24 (OTM–24) (incorporated by reference, *see* § 98.7) and Emission Measurement Center Alternative Test Method (EMC ALT–012) (incorporated by reference, *see* § 98.7).

(iii) Gas analysis. Use EPA Method 3, 3A, or 3B in Appendix A–1 of 40 CFR part 60.

(iv) Stack gas moisture. Use EPA Method 4 in Appendix A–1 of 40 CFR part 60.

(v) Fluorinated GHG concentrations. Use EPA Method 18 (with GC and either MS or ECD) in Appendix A–1 of 40 CFR part 60; EPA Method 320 in Appendix A of 40 CFR part 63; Draft EPA DRE Protocol; or ASTM D6348–03 (incorporated by reference in § 98.7).

(vi) Alternative fluorinated GHG concentration methods. Alternatives that may be used for determining fluorinated GHG concentrations include EPA TO–15 or other alternative test methods conducted in conjunction with EPA Method 301 for validation.

(5) *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.

(6) *Sample each process.* If process vents from separate processes are manifolded together to a common vent or to a common destruction device, you must sample each process in the ducts before the emissions are combined, sample when only one process is operating, or sample the combined emissions at representative combinations of capacity utilizations for all the processes. If the last option is selected, 3 times n test runs shall be required, where n is the number of processes feeding into the common vent or destruction device, and the process-vent-specific emission factor shall be applied whenever one or more of the processes is operating. In this case, calculate the emission factor for each sample by dividing the total emissions by the summed process activity across the processes venting to the common vent. Derive the process-vent-specific emission factor by averaging the 3n emission factors.

(7) *Emission test results.* The results of an emission test must include the analysis of samples, determination of emissions, and raw data. 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).

(8) *Previous measurements.* If you have conducted an emissions test less than 5 years before the effective date of this rule, and the emissions testing meets the requirements in paragraph (c)(1) through (7) of this section, you may use the previous emissions testing to develop process-vent-specific emission factors.

(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)(3) of this section.

(1) Revise the emission calculation factor for each process every 5 years based on representative operation (*i.e.,* performance based on the normal operating scenario) of the affected process. For each continuous process vent, develop the emission calculation factor for the representative operating scenario. For each batch process vent, develop the emission calculation factor for the representative operating scenario, *i.e.,* the typical batch process.

(2) *Different operating conditions.* You must develop separate emissions calculation factors for other operating scenarios as needed. If your process operates under different conditions as part of normal operations, you must conduct emissions calculations and develop separate emission factors for these different process operating scenarios. For continuous process vents, determine the emissions based on the process activity at each specific different condition. For batch process vents, determine emissions based on the process feed rate, process production rate, or other process activity rate for each typical batch operating scenario and for each non-typical batch operating scenario (*i.e.,* each specific condition).

(3) *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.

(e) *Emission monitoring for pieces of equipment.* Conduct the screening level concentration measurements using EPA Method 21 in 40 CFR part 60, appendix A–7 to determine the screening level concentration data or actual screening level concentration data for the Screening Ranges Approach or the EPA Correlation Approach. Conduct the screening level concentration measurements using EPA Method 21 and the bagging procedures to measure mass emissions for developing the Unit-Specific Correlation Approach in the *Protocol for Equipment Leak Emission Estimates,* U.S. Environmental Protection Agency, EPA Publication No. EPA–453/R–95–017, November 1995. Concentration measurements of bagged samples must be conducted using gas chromatography following EPA Method 18 analytical procedures. Use methane as the calibration gas.

(f) *Destruction device performance testing.* If you vent fluorinated GHG emissions or otherwise feed fluorinated GHGs into a destruction device and apply the destruction efficiency of the device in § 98.123, you must conduct an emissions test every 5 years to determine the destruction efficiency.

(1) 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 (c)(4) of this section. To determine the destruction efficiency, emission testing shall 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.

(2) *Previous testing.* If you have conducted an emissions test within the last 5 years prior to the effective date of this rule, and the emissions testing meets the requirements in paragraph (f)(1) of this section, you may use the destruction efficiency determined during this previous emissions testing.

(3) *Part 264, 266, and 270 principal organic hazardous constituent (POHC) testing.* If a destruction device used to destroy fluorinated GHG is subject to 40 CFR part 264 or 266 and is permitted under 40 CFR part 270 with a demonstrated DRE of at least 99.99 percent for the most-difficult-to-destroy fluorinated GHG fed into the device from the processes subject to this subpart, the emissions testing under paragraph (f)(1) of this section is not required and you may use the destruction efficiency determined during this previous testing.

(4) *Hazardous Waste Combustor testing.* If a destruction device used to destroy fluorinated GHG is subject to 40 CFR part 63, subpart EEE and has a demonstrated DRE of at least 99.99 percent for the most-difficult-to-destroy fluorinated GHG fed into the device from the processes subject to this subpart, the emissions testing under paragraph (f)(1) of this section is not required and you may use the destruction efficiency determined during this previous testing.

(5) *Process change.* For process changes that require a new or revised operating scenario, you must determine whether the concentrations and the fluorinated gas compounds vented to the destruction device following the process change affects the DE (*i.e.,* compare the post-process-change fluorinated GHG load and the most-difficult-to-combust fluorinated GHG with the test conditions). If the operating conditions and DE demonstrated in the destruction device performance testing are not sufficient to achieve the DE for the concentrations and fluorinated gas compounds vented to the destruction device following the process change then, you must conduct another emissions test to demonstrate the DE.

(g) *Mass of previously produced fluorinated GHGs fed into destruction device.* You must measure the mass of fluorinated GHGs that are fed into the destruction device and that were 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 concentrations of 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.

(h) *Emissions due to deviations of destruction device.* In their estimates of the mass of fluorinated GHG destroyed, fluorinated GHG production facilities that destroy fluorinated GHGs shall account for any temporary reductions in the destruction efficiency that result from any malfunctions of the destruction device, including deviations from the operating conditions defined in State or local permitting requirements and/or oxidizer manufacturer specifications.

(i) *Emissions due to process startup, shutdown, or malfunctions.* Fluorinated GHG production facilities shall 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.

(j) Initial scoping testing, emissions testing, and emissions factor development must be completed by December 31, 2011.

(k) 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).

(l) All analytical equipment, including gas chromatographs, GC/MS, GC/ECD, FTIR and NMR devices, used to determine the concentration of fluorinated GHG in streams shall be calibrated at least monthly through analysis of certified standards with known concentrations of the same chemicals in the same ranges (fractions by mass) as the process samples. Calibration gases prepared from a high-concentration certified standard using a gas dilution system that meets the requirements specified in Method 205, 40 CFR Part 51, Appendix M may also be used.

(m) For calendar year 2011 monitoring, you may follow the provisions of § 98.3(d)(1) through (3) for best available monitoring methods rather than follow the monitoring requirements of this section. For purposes of subpart L, any reference to the year 2010 in § 98.3(d)(1) through (3) shall mean 2011.

§ 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 shall be used in the calculations as specified in 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, the substitute data value shall 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, fed into destruction devices, sent to another facility for transformation, or sent to another facility for destruction, the substitute value of that parameter shall 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 shall 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 shall report the following information.

(1) The chemical identities of the contents of the stream(s) (including process, emissions, and destroyed streams) analyzed under the initial scoping test of fluorinated GHG at § 98.124(a), by process.

(2) The location and function of the stream(s) (including process streams, emissions streams, and destroyed streams) that were analyzed under the initial scoping test of fluorinated GHG at § 98.124(a), by process.

(3) The annual emissions of each fluorinated GHG by process, for equipment leaks, and for the facility as a whole.

(4) 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.

(5) 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(a), you shall report the following for each process:

(1) The absolute and relative uncertainties calculated under paragraphs § 98.123(a)(1) through (a)(4), as well as the data (including quantities and their uncertainties) used in these calculations.

(2) The balanced chemical equation that describes the reaction used to manufacture the fluorinated GHG product (specifically, the equation that provides the stoichiometric coefficients in Equation L–7 of this subpart).

(3) The total mass and chemical formula of each reactant fed into the production process in metric tons, by chemical.

(4) The total mass of each reactant permanently removed from the production process in metric tons, by chemical.

(5) The total mass of the fluorinated GHG product removed from the production process and destroyed.

(6) The mass and chemical formula of each by-product generated.

(7) The mass of each by-product destroyed at the facility.

(9) The mass of each by-product recaptured and sent off-site for destruction.

(10) The mass of each by-product recaptured for other purposes.

(c) *Reporting for emission factor and emission calculation factor approach.* For processes whose emissions are determined using the emission factor approach under § 98.123(b)(3) or the emission calculation factor under § 98.123(b)(4), you shall report the following for each process:

(1) 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 or emission calculation factor for each process vent.

(3) The mass of each fluorinated GHG emitted, including the mass of each fluorinated GHG emitted from equipment leaks.

(d) *Reporting for missing data.* Where missing data have been estimated pursuant to § 98.125, you shall 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 monitoring data.* A fluorinated GHG production facility that destroys fluorinated GHGs shall report the monitoring results for the destruction device that are deviations from the monitoring limit set (*e.g.,* parametric monitoring of incinerator temperature, outlet concentration checks, *etc.*) during the emissions test.

(f) *Reporting of destruction device testing.* A fluorinated GHG production facility that destroys fluorinated GHGs shall submit the emissions test report for the emission test conducted every 5 years. The emissions testing report must contain the following information:

(1) Destruction efficiency (DE) of each destruction unit for each fluorinated GHG, or if a surrogate was used, the DE of the surrogate.

(2) Test methods used to determine the destruction efficiency.

(3) Methods used to record the mass of fluorinated GHG destroyed.

(4) Chemical identity of the fluorinated GHG(s) used in the performance test conducted to determine DE, including surrogates, and information on why the surrogate is sufficient to demonstrate DE for all fluorinated GHG vented to the destruction unit.

(5) Name of all applicable Federal or State regulations that may apply to the destruction process.

(6) If process changes affect the destruction efficiency of the destruction device or the methods used to record mass of fluorinated GHG destroyed, then the revised emission testing report must be submitted to reflect the changes. The revised report must be submitted to EPA within 60 days of the change.

(g) *Reporting for destruction of previously produced fluorinated GHGs.* A fluorinated GHG production facility that destroys fluorinated GHGs shall report 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.

§ 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 (h) 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 of all analyses and calculations conducted, including all information reported as required under §§ 98.123 and 98.126.

(b) *Emission factor and emission calculation factor method.* Retain the following records for each process at the facility.

(1) Identify all process vents above and below the 10,000 metric tons CO_2e per year uncontrolled emission limit for fluorinated GHG.

(2) For vents above the 10,000 metric tons CO_2e per year uncontrolled emission limit, identify those that vent to a destruction device demonstrated to achieve a destruction efficiency of 99.9 percent for fluorinated GHGs, and for which the facility has equipment (*e.g.,* holding tank capacity; monitoring of bypass streams) or procedures (*e.g.,* compulsory process shutdowns) in place that ensure that uncontrolled emissions do not occur.

(3) For each vent, identify the method used to develop the factor (*i.e.,* emission factor by emissions test or emissions calculation factor).

(4) The emissions test data and reports and the calculations used to determine the process-vent-specific emissions factor, including the actual process-vent-specific emission factor, the average hourly fluorinated GHG emission rate from the process vent during the test or the average fluorinated GHG emissions per batch and the process feed rate, process production rate, or other process activity rate during the test.

(5) The calculations used to determine the process-vent-specific emissions calculation factor and the actual emissions calculation factor.

(6) The ongoing monthly, campaign, or batch process production quantity and 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.

(7) For continuous processes, identify whether the process was representative or whether it was another operating scenario. For batch processes, identify whether each batch operated was considered a typical batch or whether it was another operating scenario. For both continuous and batch processes, identify and provide the measurements during the test of the key process parameters that define the operating scenario (*e.g.,* process equipment, process vents, destruction device)).

(8) 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.

(9) The dates and time periods when the process vent emissions from a campaign or batch were vented to the destruction device.

(c) *Missing data records.* Where missing data have been estimated pursuant to § 98.125, you shall 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.

(d) *5-year process vent emission testing.* A fluorinated GHG production facility that conducts process vent emission testing to determine process-vent-specific emission factor for fluorinated GHGs shall retain the results of the emission testing, including data in § 98.124(c)(7) and:

(1) Test methods used to determine the flow rate and fluorinated GHG concentrations of the process vent stream.

(2) Flow rate of fluorinated GHG stream.

(3) Concentration (mass fraction) of each fluorinated GHG.

(4) Emission factor calculated from paragraph (b)(4) of this section in metric tons per activity.

(e) *5-year destruction efficiency testing.* A fluorinated GHG production facility that destroys fluorinated GHGs shall retain the emissions performance testing report containing the following information:

(1) Destruction efficiency (DE) of each destruction device.

(2) Test methods used to determine the destruction efficiency.

(3) Methods used to record the mass of fluorinated GHG destroyed.

(4) Chemical identity of the fluorinated GHG(s) used in the performance test conducted to determine DE.

(5) Name of all applicable Federal or State regulations that may apply to the destruction process.

(6) If process changes affect the destruction efficiency of the destruction device or the methods used to record mass of fluorinated GHG destroyed, then the revised emission testing report must be submitted to reflect the changes. The revised report must be submitted to EPA within 60 days of the change.

(7) Records of test reports and other information documenting the facility's five-year destruction efficiency report in § 98.126(e) and (g).

(f) *Equipment leak records.* If you are subject to § 98.123(c) 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; 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.

(g) *All facilities.* Dated records documenting the initial and periodic calibration of the gas chromatographs, GC/MS, GC/ECD, FTIR, and NMR devices, 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(c), (e), (f), (k) and (l).

§ 98.128 Definitions.

Except as provided below, 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.

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 process means a process used to destroy fluorinated GHG in a destruction device such as a thermal incinerator or catalytic oxidizer.

Equipment (for the purposes of 40 CFR part 98, subpart L 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, byproduct, or product that contains fluorinated GHG.

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.

Operating scenario means any specific operation of a process and includes for each process: (1) A description of the process and the specific process equipment used; (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); and (5) The applicable monitoring requirements and any parametric level that assures destruction or removal for all emissions routed to the control or destruction device. A change to any of these elements not previously reported, except for item (4) of this definition, shall constitute a different operating scenario.

Process means all equipment which collectively function 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 40 CFR part 98, subpart L 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. 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 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, 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.

5. 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 the following suppliers: any entity that is importing or exporting pre-charged equipment that contains a fluorinated GHG, and any entity that is importing or exporting 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 quantity of each fluorinated GHG contained in pre-charged equipment or closed-cell foams that you import or export during the calendar year.

§ 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 shall be estimated using Equation QQ–1 of this section:

$$I = \sum_{t} S_t * N_t * 0.001 \qquad \text{(Eq. QQ-1)}$$

Where:

I = Total mass of the fluorinated GHG imported or exported by the entity annually (metric tons)
t = Type of equipment/foam containing the fluorinated GHG
S_t = Mass of fluorinated GHG per unit of equipment or foam type t (charge per piece of equipment or kg/cubic foot of foam, kg)
N_t = Number of units of equipment 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)(3) for best available monitoring methods rather than follow the monitoring requirements of this section. For purposes of this subpart, any reference to the year 2010 in § 98.3(d)(1) through (3) shall mean 2011.

(b) The inputs to the annual submission shall 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 (cubic feet and kg/cubic foot).

§ 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 shall 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, 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, the quantity of fluorinated GHG contained in the foam in each appliance, and the number of appliances imported for each type of appliance.

(4) For imported closed cell-foams that are not imported inside of appliances, the identity of the fluorinated GHG, the density of the fluorinated GHG in the foam (kg fluorinated GHG/cubic foot), and the quantity of foam imported (cubic feet) for each type of closed-cell foam.

(5) Dates on which the pre-charged equipment or closed-cell foams were imported.

(6) Ports of entry through which the pre-charged equipment or closed-cell foams passed.

(7) Countries from which the pre-charged equipment or closed-cell foams were imported.

(b) Each exporter of fluorinated GHGs contained in pre-charged equipment or closed-cell foams shall 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, 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, the quantity of fluorinated GHG contained in the foam in each appliance, and the number of appliances exported for each type of appliance.

(4) For exported closed cell-foams that are not exported inside of appliances, the identity of the fluorinated GHG, the density of the fluorinated GHG in the foam (kg fluorinated GHG/cubic foot), and the quantity of foam exported (cubic feet) for each type of closed-cell foam.

(5) Dates on which the pre-charged equipment or closed-cell foams were exported.

(6) Ports of exit through which the pre-charged equipment or closed-cell foams passed.

(7) Countries to which the pre-charged equipment or closed-cell foams were exported.

§ 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 shall 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.

(b) In addition to the data required by § 98.3(g), exporters of fluorinated GHGs in pre-charged equipment and closed-cell foams shall 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.

(c) Persons who transship pre-charged equipment and closed cell foams containing fluorinated GHGs shall 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 below, 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.

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 constructed with a closed cell structure and a blowing agent containing a fluorinated GHG, including but 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.

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.

6. Add subpart SS to read as follows:

Subpart SS—Sulfur Hexafluoride and Perfluorocarbons From 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

Subpart SS—Sulfur Hexafluoride and Perfluorocarbons From Electrical Equipment Manufacture or Refurbishment

§ 98.450 Definition of the source category.

The electrical equipment manufacturing 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).

§ 98.451 Reporting threshold.

You must report GHG emissions under this subpart if your facility contains an electrical equipment manufacturing process and the facility meets the requirements of either § 98.2(a)(1) or (a)(2).

§ 98.452 GHGs to report.

(a) You must report annual SF_6 and PFC emissions (including emissions from equipment testing, manufacturing, decommissioning and disposal, refurbishing, and from storage cylinders and other containers) from any facility associated with the manufacture or refurbishment of closed-pressure and sealed-pressure equipment (including components of such equipment).

(b) You must report CO_2, N_2O and CH_4 combustion-related 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.

§ 98.453 Calculating GHG emissions.

(a) For each electrical equipment manufacturer, you must estimate the annual SF_6 and PFC emissions using the mass-balance approach in Equation SS–1 of this section:

$$\text{User Emissions} = (\text{Decrease in } SF_6 \text{ Inventory}) + (\text{Acquisitions of } SF_6) - (\text{Disbursements of } SF_6) \qquad \text{(Eq. SS-1)}$$

Where:

Decrease in SF_6 Inventory = (SF_6 stored in containers at the beginning of the year)—(SF_6 stored in containers at the end of the year).

Acquisitions of SF_6 = (SF_6 purchased from chemical producers or distributors in bulk) + (SF_6 returned by equipment users or distributors in equipment or containers) + (SF_6 returned to site after off-site recycling).

Disbursements of SF_6 = (SF_6 contained in new equipment delivered to customers) + (SF_6 delivered to equipment users in containers) + (SF_6 returned to suppliers) + (SF_6 sent off site for recycling) + (SF_6 sent to destruction facilities).

(b) The mass-balance method in paragraph (a) of this section shall be used 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.

(c) The disbursements of SF_6 or PFCs to customers in new equipment or cylinders shall be estimated using Equation SS–2 of this section:

$$D_{GHG} = \sum_{p=1}^{n} Q_p \qquad \text{(Eq. SS-2)}$$

Where:

D_{GHG} = The disbursement of SF_6 or PFCs over the period to customers in new equipment or cylinders.

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) The mass of SF_6 or PFCs disbursed to customers in new equipment or cylinders over the period p may be estimated by monitoring the mass flow of the SF_6 or PFCs into the new equipment or cylinders using a flow meter 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, this quantity shall be estimated by using Equation SS–3 of this section:

$$Q_p = M_B - M_E - E_L \qquad \text{(Eq. SS-3)}$$

Where:

Q_p = The mass of SF_6 or the PFC disbursed to customers over the period p.

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 (*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 flow meter, this quantity shall be estimated using Equation SS–4 of this section:

$$Q_p = M_{mr} - E_L \qquad \text{(Eq. SS-4)}$$

Where:

Q_p = The mass of SF_6 or the PFC disbursed to customers over the period p.
M_{mr} = The mass of the SF_6 or the PFC that has flowed through the flow meter during the period p.
E_L = The mass of SF_6 or the PFC emitted 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).

§ 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)(3) for best available monitoring methods rather than follow the monitoring requirements of this section. For purposes of subpart SS any reference to the year 2010 in § 98.3(d)(1) through (d)(3) shall mean 2011.

(b) Ensure that all the quantities required by the equations of this subpart have been measured using scales or flow meters that are certified with an accuracy and precision to within one percent of the true mass or weight or better, and is periodically recalibrated per the manufacturer's specifications. Account for the tare weights of the containers. Either measure new or residual gas (the amount of gas remaining in returned cylinders) or have the gas supplier measure them. If the gas supplier weighs the new or residual gas, obtain from the gas supplier a detailed monthly accounting, within 1 percent, of new or residual gas amounts in the cylinders returned to the gas supplier. You remain responsible for the accuracy of these masses and weights under this subpart.

(c) For purposes of Equations SS–3 and SS–4 of this subpart, the mass of SF_6 or the PFC emitted downstream of the container or flowmeter during the period p shall 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. The estimated mass of SF_6 or the PFC emitted downstream of the container or flowmeter during the period p shall include unexpected or accidental losses.

(d) Calibrate all flow meters, weigh scales, and combinations of volumetric and density measures that are used to measure or calculate quantities that are to be reported under this subpart prior to the first year for which GHG emissions are reported under this part. Calibrations performed prior to the effective date of this rule satisfy this requirement. Recalibrate all flow meters, weigh scales, and combinations of volumetric and density measures at the minimum frequency specified by the manufacturer. Use National Institute of Standards and Technology-traceable standards and suitable methods published by a consensus standards organization (*e.g.,* ASTM, ASME, ISO, or others).

(e) Ensure the following QA/QC methods are employed throughout the year:

(1) Ensure that procedures are in place and followed to track and weigh all cylinders or other containers at the beginning and end of the year.

(2) Ensure all domestic electrical equipment manufacturing locations have provided information to the manager compiling the emissions report (if it is not already handled through an electronic inventory system).

(f) 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 at each facility level, by chemical:

(a) SF_6 and PFC sales and purchases.

(b) SF_6 and PFCs sent off site for destruction.

(c) SF_6 and PFCs sent off site to be recycled.

(d) SF_6 and PFCs returned from off site after recycling.

(e) SF_6 and PFCs returned by equipment users with or inside equipment.

(f) SF_6 and PFCs stored in containers at the beginning and end of the year.

(g) SF_6 and PFCs inside equipment delivered to customers.

(h) SF_6 and PFCs returned to suppliers.

(i) The nameplate capacity of the equipment delivered to customers with SF_6 or PFCs inside, if different from the quantity in paragraph (g) of this section.

(j) 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.

(k) For any missing data, you must report the reason the data were missing, the length of time the data were missing, the method 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) Check-out and weigh-in sheets and procedures for cylinders.

(d) Residual gas amounts in cylinders sent back to suppliers.

(e) Invoices for gas purchases and sales.

§ 98.458 Definitions.

All terms used in this subpart have the same meaning given in the Clean Air Act and subpart A of this part.

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