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where:

- $u_p$  = The uptime of abatement system p (expressed as a decimal fraction).
- $t_p$  = The total time in which abatement system p is in an operational mode when fluorinated GHGs or N<sub>2</sub>O are flowing through production process tool(s) connected to abatement system p (hours).
- $T_p$  = Total time in which fluorinated GHGs or N<sub>2</sub>O are flowing through production

- process tool(s) connected to abatement system p (hours).
- p = Abatement system.

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

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

where:

- $EH_i$  = Emissions of fluorinated heat transfer fluid i, (metric tons/year).
- Density<sub>i</sub> = Density of fluorinated heat transfer fluid i (kg/l).
- $I_{iB}$  = Inventory of fluorinated heat transfer fluid i in containers other than equipment at the beginning of the reporting year (in stock or storage) (1). The inventory at the beginning of the reporting year must be the same as the inventory at the end of the previous reporting year.
- $P_i$  = Acquisitions of fluorinated heat transfer fluid i during the reporting year (1), including amounts purchased from chemical suppliers, amounts purchased from equipment suppliers with or inside of equipment, and amounts returned to the facility after off-site recycling.
- $N_i$  = Total nameplate capacity (full and proper charge) of equipment that uses fluorinated heat transfer fluid i and that is newly installed during the reporting year (1).
- $R_i$  = Total nameplate capacity (full and proper charge) of equipment that uses fluorinated heat transfer fluid i and that is removed from service during the reporting year (1).
- $I_{iE}$  = Inventory of fluorinated heat transfer fluid i in containers other than equipment at the end of the reporting year (in stock or storage)(1).
- $D_i$  = Disbursements of fluorinated heat transfer fluid i during the reporting year, including amounts returned to chemical suppliers, sold with or inside of equipment, and sent off-site for verifiable recycling or destruction (1). Disbursements should include only amounts that are properly stored and transported so as to prevent emissions in transit.
- 0.001 = Conversion factor from kg to metric tons.
- i = Fluorinated heat transfer fluid.

(1) If you use a fluorinated chemical both as a fluorinated heat transfer fluid and in other applications, you

may calculate and report either emissions from all applications or from only those specified in the definition of *fluorinated heat transfer fluids in § 98.98*.

(2) For the 2012 reporting year, you may calculate and report emissions of fluorinated heat transfer fluids whose vapor pressure falls below 1 mm Hg absolute at 25 °C either for the time period January 1, 2012 through December 31, 2012 or for the time period March 23, 2012 through December 31, 2012. The term “reporting year” in Equation I-16 shall be interpreted to be consistent with the time period selected. In addition, for the 2012 reporting year  $I_{iB}$  is not required to be the same as the inventory at the end of 2011 if the inventory at the end of 2011 excluded fluorinated heat transfer fluids whose vapor pressure falls below 1 mm Hg absolute at 25 °C. Starting in the reporting year 2013, you must calculate and report emissions of all fluorinated heat transfer fluids for the entirety of the reporting year.

[75 FR 74818, Dec. 1, 2010, as amended at 76 FR 59551, Sept. 27, 2011; 77 FR 10380, Feb. 22, 2012]

**§ 98.94 Monitoring and QA/QC requirements.**

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

(1) *Best available monitoring methods.* From January 1, 2011 through December 31, 2011, owners or operators may use best available monitoring methods for any parameter that cannot reasonably be measured according to the monitoring and QA/QC requirements of

this subpart. The owner or operator must use the calculation methodologies and equations in § 98.93, but may use the best available monitoring method for any parameter for which it is not reasonably feasible to acquire, install, or operate a required piece of monitoring equipment in a facility, or to procure necessary measurement services by January 1, 2011. Starting no later than January 1, 2012, the owner or operator must discontinue using best available monitoring methods and begin following all applicable monitoring and QA/QC requirements of this part, except as provided in paragraphs (a)(2), (a)(3), or (a)(4) of this section. Best available monitoring methods means any of the following methods specified in this paragraph:

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

(ii) Supplier data.

(iii) Engineering calculations.

(iv) Other company records.

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

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

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

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

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

(C) A description of the reasons why the needed equipment could not be obtained, installed, or operated or why

the needed measurement service could not be provided before July 1, 2011.

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

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

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

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

(iii) *Approval criteria.* To obtain approval, the owner or operator must demonstrate to the Administrator's satisfaction that by July 1, 2011, it is not reasonably feasible to acquire, install, or operate the required piece of monitoring equipment, or procure necessary measurement services to comply with the requirements of this subpart.

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

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product formation rates for the etching process type under § 98.93(a)(2)(ii)(A).

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

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

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

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

(iii) *Approval criteria.* To obtain approval, the owner or operator must demonstrate to the Administrator's satisfaction that by December 31, 2011 it is not reasonably feasible to acquire, install, or operate the required piece of monitoring equipment or procure necessary measurement services to comply with the requirements of this subpart.

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

(i) *Timing of request.* The extension request must be submitted to EPA no later than October 17, 2011.

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

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

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

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

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

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

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

(iii) *Approval criteria.* To obtain approval, the owner or operator must demonstrate to the Administrator's satisfaction that by December 31, 2011 (or in the case of facilities that are required to calculate and report emissions in accordance with § 98.93(a)(2)(ii)(A), December 31, 2012), it is not reasonably feasible to acquire, install, or operate the required piece of monitoring equipment according to the requirements of this subpart.

(b) For purposes of Equation I-12 of this subpart, you must estimate facility-wide gas-specific heel factors for each container type for each gas used, except for fluorinated GHGs or N<sub>2</sub>O which your facility uses in quantities less than 50 kg in one reporting year, according to the procedures in paragraphs (b)(1) through (b)(5) of this section.

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

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

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

where:

p = Absolute pressure of the gas (Pa).

V = Volume of the gas (m<sup>3</sup>).

Z = Compressibility factor.

n = Amount of substance of the gas (moles).

R = Gas constant (8.314 Joule/Kelvin mole).

T = Absolute temperature (K).

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

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

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

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

(1) You must demonstrate that the fluorinated GHG and N<sub>2</sub>O apportioning

factors are developed using calculations that are repeatable, as defined in § 98.98.

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

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

(ii) You must compare the actual gas consumed of input gas i to the modeled gas consumed of input gas i for one fluorinated GHG reported under this subpart under the plasma etching process type and the chamber cleaning process type. You must certify that the fluorinated GHGs selected for comparison correspond to the largest quantities, on a mass basis, of fluorinated GHGs used at your facility during the reporting year for the plasma etching process type and the chamber cleaning process type.

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

(d) If you use factors for fluorinated GHG process utilization and by-product formation rates other than the defaults provided in Tables I-3, I-4, I-5, I-6, and I-7 to this subpart, you must use utilization and by-product formation rates that are developed with measurements made using the International SEMATECH #06124825A-ENG (incorporated by reference, see § 98.7). You

may use recipe-specific utilization and by-product formation rates that were measured using the International SEMATECH #01104197A-XFR (incorporated by reference, see § 98.7) provided the measurements were made prior to January 1, 2007. You may use recipe-specific utilization and by-product formation rates measured by a third party, such as a manufacturing equipment supplier, if the conditions in paragraphs (d)(1) and (d)(2) of this section are met.

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

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

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

(1) The third party has measured N<sub>2</sub>O utilization factors using the International SEMATECH #06124825A-ENG (incorporated by reference, see § 98.7.) or the International SEMATECH #01104197A-XFR (incorporated by reference, see § 98.7) provided the measurements were made prior to January 1, 2007.

(2) The conditions under which the measurements were made are representative of your facility's N<sub>2</sub>O emitting production processes.

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

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

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

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

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

(3) To report emissions using the default destruction or removal efficiency of 60 percent, you must certify and document that the abatement systems at your facility are specifically designed for fluorinated GHG and N<sub>2</sub>O abatement.

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

(i) A properly measured destruction or removal efficiency value must be determined in accordance with EPA 430-R-10-003 (incorporated by reference, see § 98.7).

(ii) You must annually select and properly measure the destruction or removal efficiency for a random sample of abatement systems to include in a random sampling abatement system testing program (RSASTP) in accordance with procedures in paragraphs (f)(4)(ii)(A) and (f)(4)(ii)(B) of this section.

(A) Each reporting year for each abatement system class a random sample of three or 20 percent of installed abatement systems, whichever is greater, must be tested. If 20 percent of the total number of abatement systems in each class does not equate to a whole number, the number of systems to be tested must be determined by rounding up to the nearest integer.

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

(iii) If you have measured the destruction or removal efficiency of a particular abatement system during the previous 2-year period, you must calculate emissions from that system using the most recently measured destruction or removal efficiency for that particular system.

(iv) If the destruction or removal efficiency of an individual abatement system has not been properly measured during the previous 2-year period, you may use a simple average of the properly measured destruction or removal efficiencies for systems of that class, in accordance with the RSASTP. Your facility must maintain or exceed the RSASTP schedule if you wish to apply class average destruction or removal efficiency factors to abatement systems that have not yet been properly measured.

(v) If your facility uses redundant abatement systems, you may account for the total abatement system uptime calculated for a specific exhaust stream during the reporting year.

(g) You must adhere to the QA/QC procedures of this paragraph when calculating fluorinated GHG and N<sub>2</sub>O emissions from electronics manufacturing production processes:

(1) Follow the QA/QC procedures in the International SEMATECH

#06124825A-ENG (incorporated by reference, see § 98.7) when measuring and calculating facility-specific, recipe-specific fluorinated GHG and N<sub>2</sub>O utilization and by-product formation rates.

(2) Where you use facility-specific, recipe-specific fluorinated GHG and N<sub>2</sub>O utilization and by-product formation rates measured prior to January 1, 2007, verify that the QA/QC procedures in the International SEMATECH #01104197A-XFR (incorporated by reference, see § 98.7) were followed during measurement and calculation of the factors.

(3) Follow the QA/QC procedures in accordance with those in EPA 430-R-10-003 (incorporated by reference, see § 98.7) when calculating abatement systems destruction or removal efficiencies.

(4) Demonstrate that as part of normal facility operations the inventory of gas stored in containers at the beginning of the reporting year is the same as the inventory of gas stored in containers at the end of the previous reporting year.

(h) You must adhere to the QA/QC procedures of this paragraph (h) when calculating annual gas consumption for each fluorinated GHG and N<sub>2</sub>O used at your facility and emissions from the use of each fluorinated heat transfer fluid.

(1) Review all inputs to Equations I-11 and I-16 of this subpart to ensure that all inputs and outputs are accounted for.

(2) Do not enter negative inputs into the mass balance Equations I-11 and I-16 of this subpart and ensure that no negative emissions are calculated.

(3) Ensure that the inventory at the beginning of one reporting year is identical to the inventory reported at the end of the previous reporting year. This requirement does not apply to the end-of-the-year inventory of fluorinated heat transfer fluids in 2011 and the beginning-of-the-year inventory of the same in 2012.

(4) Ensure that the total quantity of gas *i* in containers in service at the end of a reporting year is accounted for as if the in-service containers were full for Equation I-11 of this subpart. Ensure also that the same quantity is accounted for in the inventory of input

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gas i stored in containers at the beginning of the subsequent reporting year.

(i) All flowmeters, weigh scales, pressure gauges, and thermometers used to measure quantities that are monitored under this section or used in calculations under § 98.93 must have an accuracy and precision of one percent of full scale or better.

[75 FR 74818, Dec. 1, 2010, as amended at 76 FR 36342, June 22, 2011; 76 FR 59551, Sept. 27, 2011; 77 FR 10380, Feb. 22, 2012; 77 FR 48089, Aug. 13, 2012]

### § 98.95 Procedures for estimating missing data.

(a) Except as provided in paragraph (b) of this section, a complete record of all measured parameters used in the fluorinated GHG and N<sub>2</sub>O emissions calculations in § 98.93 and § 98.94 is required.

(b) If you use fluorinated heat transfer fluids at your facility and are missing data for one or more of the parameters in Equation I-16 of this subpart, you must estimate fluorinated heat transfer fluid emissions using the arithmetic average of the emission rates for the reporting year immediately preceding the period of missing data and the months immediately following the period of missing data. Alternatively, you may estimate missing information using records from the fluorinated heat transfer fluid supplier. You must document the method used and values used for all missing data values.

[75 FR 74818, Dec. 1, 2010, as amended at 77 FR 10381, Feb. 22, 2012]

### § 98.96 Data reporting requirements.

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

(a) Annual manufacturing capacity of your facility as determined in Equation I-5 of this subpart.

(b) For facilities that manufacture semiconductors, the diameter of wafers manufactured at your facility (mm).

(c) Annual emissions of:

(1) Each fluorinated GHG emitted from each process type for which your facility is required to calculate emis-

sions as calculated in Equations I-6 and I-7 of this subpart.

(2) Each fluorinated GHG emitted from each individual recipe (including those in a set of similar recipes), or process sub-type as calculated in Equations I-8 and I-9 of this subpart, as applicable.

(3) N<sub>2</sub>O emitted from each chemical vapor deposition process and from other N<sub>2</sub>O-using manufacturing processes as calculated in Equation I-10 of this subpart.

(4) Each fluorinated heat transfer fluid emitted as calculated in Equation I-16 of this subpart.

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

(e) Annual production in terms of substrate surface area (e.g., silicon, PV-cell, glass).

(f) When you use factors for fluorinated GHG process utilization and by-product formation rates other than the defaults provided in Tables I-3, I-4, I-5, I-6, and I-7 to this subpart and/or N<sub>2</sub>O utilization factors other than the defaults provided in Table I-8 to this subpart, you must report the following, as applicable:

(1) The recipe-specific utilization and by-product formation rates for each individual recipe (or set of similar recipes) and/or facility-specific N<sub>2</sub>O utilization factors.

(2) For recipe-specific utilization and by-product formation rates, the film or substrate that was etched/cleaned and the feature type that was etched, as applicable.

(3) Certification that the recipes included in a set of similar recipes are similar, as defined in § 98.98.

(4) Certification that the measurements for all reported recipe-specific utilization and by-product formation rates and/or facility-specific N<sub>2</sub>O utilization factors were made using the International SEMATECH #06124825A-ENG (incorporated by reference, see § 98.7), or the International SEMATECH #01104197A-XFR (incorporated by reference, see § 98.7) if measurements were made prior to January 1, 2007.

(5) Source of the recipe-specific utilization and by-product formation rates and/or facility-specific-N<sub>2</sub>O utilization factors.