DEPARTMENT OF
ECOLOGY
State of Washington

Concise Explanatory Statement

Chapter 173-441 WAC

Reporting of Emissions of Greenhouse Gases

Summary of rule making and response to comments

Appendix A: Copies of all written comments

December, 2010
Publication no. 10-02-038A

Appendix A: Copies of all written comments

Appendix A contains all of the comments received during the public comment period in their original form, including attachments.

V-1

Oral Comments Given at October 7, 2010 Public Hearing in Lacey by Rashad Morris of the Washington Environmental Council

Thank you. My name is Rashad Morris. I'm here to testify on behalf of the Washington Environmental Council. I'm gonna keep my statements rather brief right now because the environmental council will be submitting written statements later. But I just wanted to indicate that the environmental community in general and the Washington Environmental Council in particular is disappointed that the Department of Ecology is delaying this reporting when the initial statute was passed in 2008 that should have put everyone on notice that greenhouse gas emissions would be required to be reported. When the governor issued executive orders in both 2007 and 2009 and once again gave proper notice to emitters and others that they should start at least collecting the data and being prepared to deliver it.

It also should have given the Department of Ecology notice that they needed to start preparing to receive and deal with the data. And then in 2010 when the legislature passed engrossed second substitute Senate Bill 6373, it required that emissions reporting begin in 2010 for 2009 emissions. And it's disappointing that ecology and its submittal to the code reviser indicated that the soonest they can have an effective date for a rule was 2011.

So I strongly urge the Department of Ecology, and the environmental council strongly urges the Department of Ecology to make haste and do whatever is necessary to get their systems in place to deal with the data that needs to be received. Because it's very important that we start collecting data on emissions so that we can move forward with regulating emissions for the health of Washingtonians, especially the health of Washington's children, and for the development of the clean and efficient economy that we're constantly being promised. Ecology has a role in that and the environmental community and the Washington Environmental Council looks forward to working with ecology going forward. Thank you.

W-1

Weyerhaeuser

CH 2J26
PO Box 9777
Federal Way, WA 98477-9777
Telephone: (253) 924-3426
Fax: (253) 924-2013
E-Mail: ken.johnson@weyerhaeuser.com

October 8, 2010

Neil Caudill
Air Quality Program
Washington Dept of Ecology
P.O. Box 47600
Olympia, WA 98504-7600

Subject: Comments on Proposed WAC 173-441

Dear Mr. Caudill:

Weyerhaeuser NR Company comments on this proposed regulation are provided in the following paragraphs.

1. WAC 173-441-030(1)(b)(ii) -- The last clause directing inclusion of "all fugitive releases of GHG emissions from biomass" is a bit confusing. This could be read as an independent requirement, and not, as you explained in our October 3rd conversation, as applying only to the source categories specified in WAC 173-441-120. Making the point in a different way, it appears the agency intends that (b)(ii) is to elaborate on the regulatory direction presented in (b)(i). If so, these two sections could be restructured to confirm that intent.

   This ambiguity could be resolved by rewording subsections (i) and (ii) to read:

   (i) *Calculate the total annual emission of each GHG in metric tons from all applicable source categories that are listed and defined in WAC 173-441-120. The GHG emissions must be calculated using the calculation methodologies specified in WAC 173-441-120 (including, as directed, all fugitive releases of GHG emissions from biomass), and available company records.*
   (ii) *Include emissions of all GHG that are listed in Table A-1 of WAC 173-441-040, including all GHG emissions from the combustion of biomass.*

2. The separate reporting of greenhouse gases from combustion of biomass is not discretionary. Yet, proposed WAC 173-441-050(3)(d)(ii) and -050(3)(d)(iii)(A) offer that reporting biogenic CO2 emissions is optional. Note that RCW 70.94.151(5)(a)(i) requires separate reporting of combustion/biomass emissions. There is no exception in the Washington statute for emission units/sources regulated by 40 CFR Part 75.

1-W

(i) *Emissions of greenhouse gases resulting from the combustion of fossil fuels be reported separately from emission of greenhouse gases resulting from the combustion of biomass.*

It appears the language in WAC 173-441-050 needs to be adjusted.

The reporting of biogenic CO2 emissions is also the source of an EPA regulation modification and comment opportunity. Docket ID No. EPA-HQ-OGC-2010-0575: 75 FR 42085, July 20, 2010 provides notice of a "*Proposed Settlement Agreement, Clean Air Act Citizen Suit*" relating to the Greenhouse Gas Mandatory Reporting of Greenhouse Gases, 74 FR 56330 (Oct 30, 2009). Weyerhaeuser NR Company has submitted comments on this settlement proposal (see August 19, 2010 letter to EPA, enclosed). Weyerhaeuser cautions that the proposed EPA settlement (which proposes to aggregate all GHG reported emissions together) will create inconsistent, skewed and/or misleading data reporting of biogenic CO2 emissions. Several alternative approaches are suggested to EPA. EPA has not taken a final action on the Proposed Settlement.

3. WAC 173-441-090 *Compliance and enforcement* – As with other regulations authorized by the Washington Clean Air Act, it would be sufficient for -090 to simply state the first sentence.[1]

> *Any violations of any requirement of this chapter shall be a violation of chapter 70.94 RCW and subject to enforcement as provided in that chapter.*

The listing of seven examples of violation types is unnecessary and should be deleted.

The potential problem occurs if the language used in these examples is applied literally. For example, the proposed rule language says that "failure to report accurately" constitutes a violation. Note the proposed WAC 173-441 and EPA's reporting regulation at 40 CFR 98 do not require perfection in process data collection, application of calculation methods, retention of records, etc. Rather, the rules correctly recognize there will be some imperfection in metering, measuring, "missed data computations," incomplete or lost process data, calibration deviations, computation methods, etc., such that these deviations will result in a reasonable approximation of GHG emissions, but not an "accurate" value. Similar comments could be made about "failure to continuously monitor." It will not be reasonable to expect "continuous monitoring."

A concept drawn from the Title V permitting program (40 CFR Part 70) could be considered. Ecology could expect that "deviations" from literal monitoring record-

[1] Note, for example WAC 173-407 *Carbon Dioxide Mitigation Program for Fossil-Fueled Thermal Electric Generating Facilities*; WAC 173-400 *General Regulation for Air Pollution Sources*; WAC 173-460 *Controls for New Sources of Toxic Air Pollutants*

keeping, reporting obligations would be reported, but that these are not Clean Air Act "violations" subject to enforcement.

4. WAC 173-441-120(1) – The last sentence in this subsection starting with "Owners or operators are not required to report facility GHG emissions..." is confusing. Could that sentence be rewritten to more clearly define Ecology's intent?

5. WAC 173-441-120, Table 120-1 footnote reading "Unless otherwise noted, all calculation methods are from 40 CFR Part 98, as effective on August 1, 2010." Note that EPA proposed significant additions and modifications to the Greenhouse Gas Mandatory Reporting Rule on August 11, 2010.[2] These modifications have not been finalized. Ecology should be prepared to modify WAC 173-441 as needed to stay current with EPA's reporting rule. Unless the state regulation is synched with 40 CFR Part 98, Washington GHG reporters will be forced, by rule, to produce two versions of the emissions report.

6. WAC 173-441-150 *Confidentiality* – This section effectively says that EPA's confidentiality determination on data required to comply with 40 CFR 98 *Greenhouse Gas Reporting* is not relevant under Washington law. Rather, any claim for confidentiality of records and information must satisfy criteria in RCW 70.94.205. The actionable decision criteria in the statute can be paraphrased as:

   Whenever records or other information

   - *relate to processes or production unique to the owner or operator, or*
   - *is likely to affect adversely the competitive position of such owner or operator if released to the public or to a competitor, and*
   - *the owner or operator of such processes or production so certifies,*

   Such records of information shall be only for the confidential use of the department or board.

   This language creates a mandatory obligation to grant a confidentiality claim should an owner/operator assert/certify that a competitive position will be adversely affected. Weyerhaeuser will intend to claim the following categories of information as confidential:

   - Production/throughput data that are not inputs to emission equations,
   - Raw materials consumed that are not inputs to emission equations,
   - Process-specific and vendor data submitted in Best Available Monitoring Methods extension requests.

[2] Federal Register [FR 75 (154) 48744-48814], August 11, 2010

Weyerhaeuser has made this identical comment on EPA's proposed regulation addressing information confidentiality procedures[3],

Thank you for your considerations of these comments.

Sincerely,

Ken Johnson
Corporate Environmental Manager

[3] "Proposed Confidentiality Determinations for Data Required Under the Mandatory Greenhouse Gas Reporting Rule and Proposed Amendment to Special Rules Governing Certain Information Obtained Under the Clean Air Act; Proposed Rule," July 7, 2010; and "Supplemental Proposal," July 27, 2010. (Copy of Weyerhaeuser comment letter enclosed.)

EHS&S Regulatory Affairs

Weyerhaeuser

P.O. Box 9777
Federal Way, WA 98063-9777

September 7, 2010

Submitted electronically via regulations.gov:
EPA Docket Center (EPA/DC)
1200 Pennsylvania Ave., NW
Washington, DC 20460
ATTN: Docket ID No. EPA–HQ–OAR–2009–0924

cc: Carole Cook, Climate Change Division, Office of Atmospheric Programs (MC–6207J), U.S. EPA (by email to: GHGReportingRule@epa.gov)

re: Docket ID No. EPA-HQ-OAR-2009-0924: 75 FR 39094, July 7, 2010; and 75 FR 43889, July 27, 2010

Weyerhaeuser Company ("Weyerhaeuser") appreciates this opportunity to provide its comments on the notice of "Proposed Confidentiality Determinations for Data Required Under the Mandatory Greenhouse Gas Reporting Rule and Proposed Amendment to Special Rules Governing Certain Information Obtained Under the Clean Air Act; Proposed Rule," July 7, 2010; and "Supplemental Proposal," July 27, 2010.

Weyerhaeuser has a decade of experience conducting greenhouse gas (GHG) emissions inventories and reporting those emissions. In doing this we have worked extensively with the Greenhouse Gas Protocol, developed in a joint initiative by the World Resources Institute and the World Business Council for Sustainable Development, and including the incorporation of protocols advanced by the National Council for Air and Stream Improvement (NCASI) specifically for the forest products industry. We have made GHG reports to the Climate Disclosure Project, the Dow Jones Sustainability Index, and through an annual Weyerhaeuser sustainability report. We also commented extensively on the proposed Mandatory Reporting Rule (MRR) in 2009.[1] These activities have given us substantial insights on practical approaches to calculating and reporting GHGs that are relevant to the GHG MRR and we believe this experience provides a solid basis for our comments.

[1] Docket ID No. EPA-HQ-OAR-2008-0508-0451.1

Headquartered in Federal Way, Washington, Weyerhaeuser is an international forest products company that in the U.S. owns and operates bleach kraft pulp mills, lumber and wood products mills, and conducts extensive silviculture, home building, sales, distribution and transportation operations. All five of our U.S. pulp mills and some of our larger wood products mills are subject to the GHG MMR. In some cases we believe information these facilities are required to report should be treated as confidential business information, and therefore these interests make Weyerhaeuser a stakeholder that will be directly affected by how EPA treats such information under the Mandatory Reporting Rule.

We sincerely appreciate EPA's consideration of our comments and recommendations.

Please contact me at 252-633-7351 or steve.woock@weyerhaeuser.com with any questions you may have regarding these comments.

Sincerely,

Stephen E Woock

Stephen E. Woock
EHS&S Federal Regulatory Affairs Manager,
Weyerhaeuser

* * * * *

Contents

Comments

By March 31, 2011, Weyerhaeuser will be required to report GHG emissions and related data for facilities that directly emit GHGs to levels exceeding annual reporting thresholds from processes or stationary fuel combustion sources under the GHG MRR, 40 CFR Part 98. EPA's July 7 and July 27, 2010, proposed determinations affect which information presumptively will be CBI, and which emissions and emissions related information will be made directly available to the public. The latter categorically will not be confidential business information (CBI) even if it is not emissions data, in addition to the GHG emissions information that clearly is non-confidential information under 40 CFR Part 2, specifically 40 CFR §2.301. EPA is proposing to make these determinations because of the resources that may otherwise be necessary to respond to individual CBI claims given the volume of information that will be submitted to it beginning in spring 2011, and the Agency's belief the release of the information to the public is necessary for transparency to promote public confidence in the data and to meet certain Clean Air Act obligations.

In the preamble of the proposed rule at Table 2, EPA lists eleven proposed groupings or categories of the reportable data elements for direct GHG emitters. For each of those categories EPA also identifies its proposed decision regarding which of three types of data release determinations will be applicable. That is, EPA proposes to decide whether each category is emission data or not, and for the latter, whether or not each non-emissions data element category is CBI or not (Table 2 Summary of Proposed Determinations for Direct Emitter Data Categories; 75 FR 39097). For clarity in our comments these categories and determinations, and how EPA would release the information, are summarized:

Emissions data, which cannot be CBI (EPA would make publicly available)

- Facility and Unit Identifier Information
- Emissions
- Inputs to Emission Equations
- Calculation Methodology and Methodological Tier
- Data Elements Reported for Periods of Missing Data that are Not Inputs to Emission Equations

Data that are not emission data and not CBI (EPA would make publicly available)

- Unit/Process "Static" Characteristics that are Not Inputs to Emission Equations
- Unit/Process Operating Characteristics that are Not Inputs to Emission Equations
- Test and Calibration Methods

Data that are not emission data but are (presumptive) CBI (EPA would treat as CBI)

- Production/Throughput Data that are Not Inputs to Emission Equations
- Raw Materials Consumed that are Not Inputs to Emission Equations
- Process-specific and Vendor Data Submitted in BAMM Extension Requests

1. EPA's proposed CBI determination

The proposed CBI categories in Table 2 are straightforward --any production and raw materials information not included as inputs to the GHG emission calculations, and any process-specific and vendor data in the BAMM requests would be treated as CBI. We agree.

2. EPA's proposed emissions data determination

EPA also identifies the basic GHG emission data as not CBI, and we agree with the data element categories in that determination group, except for "Inputs to Emission Equations."

We do not agree to the public release of "Inputs to Emission Equations" information to the extent that certain production/throughput or raw materials data included in that data element category should be treated as CBI for the same reasons that those types of data elements are listed by EPA as CBI in their proposed CBI determination grouping. When EPA proposed the GHG MRR, we supported EPA's plan to require reporting of additional facility and unit information so that EPA could act as verifier of data accuracy and appropriateness for the self-certified reporting. We supported that approach rather than the alternative proposal that would have required reporters to submit their information to third party verification. We noted in our comment[2] that we did not support "…approaches requiring a special and substantially intrusive level of verification for GHG reporting that differs from the current well-established system for reporting other air program compliance information." We continue and expand that concern about "intrusiveness" here. It is one thing to have sensitive competitive information in EPA hands to facilitate and automate conducting their verification; it is another to open that information up to the public and therefore make it openly available to our competitors. EPA should not release to the public information that otherwise would be CBI except it is reported, as required, to support EPA's verification review of the simultaneously submitted GHG emissions estimates.

Weyerhaeuser is a member of the National Environmental Development Association's Clean Air Project (NEDA/CAP). We refer EPA to and support the comments submitted by NEDA/CAP on EPA's CBI proposals generally, and in particular, we refer EPA to the NEDA/CAP comments concerning EPA's proposed treatment of the inputs to the emissions equations category. We agree with a potential solution NEDA/CAP urges EPA to adopt: EPA would presume that such inputs are CBI, and subsequently the information could only be made available to the public under the current Part 2 procedures for sharing this information (i.e., requiring submission of FOIA requests, notification of the owner/operator of the facility, and owner/operator validation of the CBI nature of the information).

3. EPA's proposed determination for "not emission data and not CBI"

As part of the GHG MRR, facilities will be providing some types of information that are not emission data and which EPA believes are also not CBI. Therefore, in EPA's view this information would be made publicly available. We generally agree that the described data elements are not CBI, except for one item discussed below.

Static characteristics include descriptions of the general equipment, abatement devices, and other facility-specific characteristics. Most of this information can be obtained from a facility's Title V permit, therefore, we generally agree that this information is not CBI.

---

[2] See page 3 of our comment at Docket ID No. EPA-HQ-OAR-2008-0508-0451.1

Operation characteristics include non-GHG emission related information such as operating hours, surface area of the landfill, and the amount of GHG emissions from cogeneration units. EPA's argument to allow this information to be public is so stackeholders can track and assess GHG policy making to ultimately improve GHG reduction programs. EPA makes the argument that no production information can be derived from this data. However, we believe that the hours of operation is a direct measurement of production and should be CBI. Title V permits may have a maximum limit on hours of operation, but we do not know of any other public domain where we reveal this actual value. EPA should identify hours of operation as presumptively CBI.

Test and calibration methods include site-specific calibration methods, frequency of sampling and analysis, performance test methods, and material composition analytical methods. These are already spelled out in the GHG MRR regulation and we agree that this information is not CBI.

4. Aggregating Information at Facility Level for Public Release

In the preamble EPA asks, in the context of sensitive information in certain data element categories from multiple companies, if the data could be aggregated by the Agency and released in a manner that would not harm an individual company's business position. We refer EPA to the NEDA/CAP comments regarding the efficacy of such an approach under various conditions.

Here we comment on aggregation of the data more generally for public release. Because the GHG MRR is an emissions reporting rule only and there is no compliance limit to evaluate for specific units, facilities, or companies, we believe there is no compelling legal or policy reason that EPA has to reveal any of the emissions or emission related data at the unit level. We propose that EPA should aggregate the GHG emissions data for public availability at the facility level as the lowest identifiable level.

EHS&S Regulatory Affairs

Weyerhaeuser

P.O. Box 9777
Federal Way, WA 98063-9777

August 19, 2010

Submitted electronically via regulations.gov:
EPA Docket Center (EPA/DC)
1200 Pennsylvania Ave., NW
Washington, DC 20460
ATTN: Docket ID No. EPA-HQ-OGC-2010-0575

cc: Carol Holmes, Air and Radiation Law Office (2344A), Office of General Counsel, U.S. EPA (by email to: holmes.carol@epa.gov)

Carole Cook, Climate Change Division, Office of Atmospheric Programs (MC–6207J), U.S. EPA (by email to: GHGReportingRule@epa.gov)

re: Docket ID No. EPA-HQ-OGC-2010-0575: 75 FR 42085, July 20, 2010

Weyerhaeuser Company ("Weyerhaeuser") appreciates this opportunity to provide its comments on the notice of "Proposed Settlement Agreements, Clean Air Act Citizen Suit" published in the Federal Register at Volume 75, on July 20, 2010.

Our comments today focus solely on proposed changes to whether and how biogenic CO2 emissions will be calculated and reported under the Greenhouse Gas Mandatory Reporting Rule (MRR) promulgated by EPA last year ["Mandatory Reporting of Greenhouse Gases," 74 FR 56330 (Oct. 30, 2009)]. Those potential changes are contained in portions of the proposed settlement agreement[1] for the Utility Air Regulatory Group (hereafter, "UARG") case referenced in the July 20, 2010 Federal Register notice, namely case 09-1333 in the US Court of Appeals for the District of Columbia Circuit. We oppose the settlement solution proposed for biogenic CO2 reporting, but provide a possible solution in the detailed comments following this cover letter.

Weyerhaeuser has a decade of experience conducting greenhouse gas emissions inventories and reporting those emissions. In doing this we have worked extensively with the Greenhouse Gas Protocol, developed in a joint initiative by the World Resources Institute and the World Business Council for Sustainable Development, and including the incorporation of protocols advanced by

[1] Docket ID No. EPA-HQ-OGC-2010-0575-0007

the National Council for Air and Stream Improvement (NCASI) specifically for the forest products industry. We have made GHG reports to the Climate Disclosure Project, the Dow Jones Sustainability Index, and through an annual Weyerhaeuser sustainability report. We also commented extensively on the proposed MRR in 2009.[2] These activities have given us substantial insights on practical approaches to calculating and reporting GHGs that are relevant to the GHG mandatory reporting rule and we believe this experience provides a solid basis for our comments.

Headquartered in Federal Way, Washington, Weyerhaeuser is an international forest products company that in the U.S. owns and operates bleach kraft pulp mills, lumber and wood products mills, and conducts extensive silviculture, home building, sales, distribution and transportation operations. All five of our U.S. pulp mills and some of our larger wood products mills are subject to the GHG MMR, and as a major producer and consumer of timber resources and cellulosic biomass we are keenly interested in how EPA treats the reporting and regulation of biogenic greenhouse gas emissions. These interests make Weyerhaeuser a stakeholder that will be directly affected by any proposed changes to the Mandatory Reporting Rule.

We sincerely appreciate EPA's consideration of our comments and recommendations.

Please contact me at 252-633-7351 or steve.woock@weyerhaeuser.com with any questions you may have regarding these comments.

Sincerely,

Stephen E. Woock

Stephen E. Woock
EHS&S Federal Regulatory Affairs Manager,
Weyerhaeuser

* * * * *

Weyerhaeuser's Comments

As a first principle, we believe reporting of biogenic CO2 should be mandatory for all source categories subject to EPA's GHG MRR. It should not be optional, as suggested in the proposed Settlement Agreement with UARG (see details in Attachment A to that proposed settlement agreement). We believe separate reporting of biogenic CO2 is important because it is consistent with the approach taken in the IPCC and national and regional U.S. GHG inventory frameworks, and it correctly supports the concept that regulating biogenic CO2 in the U.S. --whether all or some of the biogenic CO2 as EPA currently is

[2] Docket ID No. EPA-HQ-OAR-2008-0508-0451.1

evaluating[3]-- in the global warming context is unnecessary. It is unnecessary, as EPA knows, because with respect to CO2 captured from the atmosphere in the photosynthetic process, the flux of biogenic CO2 released to the atmosphere during biomass combustion is a net neutral and the CO2 does not contribute to the overall global GHG inventory. Also, in Weyerhaeuser's view the separate reporting of biogenic CO2 as supporting information is appropriate for transparency and inventory balancing purposes since biogenic CO2 is accounted for in the land use portions of the EPA National Inventory.

Not surprisingly, EPA sets out its own reasons for deciding to retain separate reporting of biogenic CO2 for all facilities in its response to comments on the proposed Mandatory Reporting Rule. Specifically, in response to Weyerhaeuser and others' comments that supported the separate reporting of biogenic CO2 from other greenhouse gas emissions, EPA says:

> "...Upon review of the comments, we determined to retain the proposed approach in the final rule. Facilities are not required to count emissions associated with biomass combustion when determining whether they meet or exceed the threshold for reporting, but if the threshold is exceeded they are required to separately report emissions associated with the biomass combustion at the facility . This approach is consistent with IPCC Guidelines for National Greenhouse Gas Inventories, which require the separate reporting of CO2 emissions from biomass combustion and also the approach taken in the U.S. Inventory of Greenhouse Gas Emissions and Sinks. Separate reporting of emissions from biomass combustion is also consistent with some State and regional GHG programs, such as California's mandatory GHG reporting program, the Western Climate Initiative, and The Climate Registry, all of which require reporting of biogenic emissions from stationary fuel combustion sources. The final rule does not eliminate the requirement to report emissions from the combustion of biomass fuels because they can be used as alternatives to fossil fuels. While this reporting requirement does not imply whether emissions from combustion of biomass will or will not be regulated in the future, the data collected will improve EPA's understanding of the extent of biomass combustion and the sectors of the economy where biomass fuels are used. It will also allow EPA to improve methods for quantifying emissions through testing of biomass fuels."
>
> (Please see the full comments and EPA's response at Exhibit 1 at the end of this document)

We agree with this response-to-comment by EPA, and believed the matter settled. However, the proposed Settlement Agreement re-raises the issue in the context of trying to resolve concerns regarding the substantial and burdensome fossil fuel analyses and additional work beyond what Part 75 already requires. Specifically, the existing requirement to determine and report separately a small fraction of CO2 that is biogenic in origin amidst the predominant use of fossil fuel at an electric utility plant using CO2 CEMS and reporting using Part 75 methods appears unreasonable. However, instead of making the separate reporting of biogenic CO2 more manageable for UARG members, EPA provides a proposed settlement solution --an exemption from reporting biogenic CO2 and a change in the reporting focus-- that we believe is problematic. The following describes the basis for this comment.

The purpose of the Settlement Agreement is, in part, to relieve facilities using Part 75 CO2 CEMS methods from having to report biogenic CO2 emissions separate from their fossil fuel emissions. The changes are meant to apply to electric utilities subject to GHG reporting under EPA's GHG Mandatory Reporting Rule at 40 CFR 98 Subpart D (although as discussed later, the proposed rule language appears

[3] See EPA's "Call for Information" related to biomass published July 16, 2010 (75 FR 41173), as follow-up to the PSD Tailoring rule.

to exempt any user of Part 75 methods). The specific changes outlined in Attachment A to the Settlement Agreement aim to resolve UARG's challenge to EPA's requirements in Subpart A (General Provisions) at 40 CFR 98.3(c)(4) requiring separate reporting of biogenic CO2 emissions from all other GHG emissions (whether from fossil fuels or biogenic fuels). Currently, the final regulations issued in 2009 completely separate the reporting of biogenic CO2 quantities from all other GHG emissions, a practice that is in concert with international and other national and regional protocols and inventories for reporting "Scope 1" GHG emissions, as described earlier.

Although electric utility combustion units subject to Subpart D are expressly exempted from Subpart C of the MRR (see 40 CFR 98.30(b)(5)), the calculations and other methods for determining what portion of the CEMS total monitored CO2 emissions that are biogenic CO2 are provided in Subpart C at 40 CFR 98.33(e)(2). Subpart D units are also referred to Subpart C for methane (CH4) and nitrous oxide (N2O) calculations for any fuel used including biomass (see Subpart D 40 CFR 98.43(b), which refers to Subpart C at 40 CFR 98.33(c)). In 98.33(e)(2), <u>reporters actually are instructed first to determine the portion of the total CEMS CO2 monitored emissions that are of *fossil fuel*</u> origin; those fossil fuel CO2 emissions subsequently are subtracted from the CO2 CEMS monitor total to obtain and report the separate biogenic CO2 emissions estimate. This calculation requirement is embodied in equations C-13 and C-14 and the various subparagraphs of 40 CFR 98.33(e)(2).

The Settlement's proposed solution would allow Part 75 methods users to report biogenic CO2 separately on a voluntary basis, and, unlike the current regulation, all reporters would now first report total GHG emissions including biogenic CO2. Then, only the reporters *not* using Part 75 methods would still be required to report biogenic CO2 as a separate line item.

As proponents of acknowledging biogenic CO2 as a separately inventoried emission in keeping with international and other national protocols and precedent, we prefer to not change the reporting paradigm in the way EPA proposes. EPA's proposal carries with it, whether intended or not, a distinct policy change implication with respect to separate reporting of biomass emissions under greenhouse gas inventories and climate regulations. It also has the potential to cause a substantial under-representation of biogenic CO2 emissions in the separate biogenic CO2 line item while likewise making accurate estimates of the total fossil fuel emissions inventory incalculable. Fossil emissions would be incalculable since the total GHG emissions will contain an unknown quantity of biogenic CO2 un-reported because of the voluntary nature for some in the separate biogenic CO2 emissions reporting step. The following outline some examples of the problems:

- All electrical generating companies already report individual fuel usages; therefore, calculating and reporting biogenic CO2 could be very straightforward. All electrical generating companies report fuel usage (by fuel type) to the U.S. Energy Information Administration (EIA). Therefore, calculating the biogenic CO2 could simply be a matter of using this fuel information and the default biogenic CO2 emission factors provided in the MRR.

- Some Part 75 sources will over-report their total GHG emissions. For example, there are many pulp mills, primarily located in the East, that are subject to or use Part 75 methods. These pulp mills typically produce between 70% to 80% of their total energy from biomass fuels (e.g. spent pulping liquor, wood, bark and other wood residuals). Therefore, the total CO2 (including the biomass CO2) can be approximately four times larger than the fossil fuel CO2 emissions alone. As a consequence, if these sources decide not to report biogenic CO2 separately the total reported GHG emissions would gravely misrepresent the GHG emission impact from these facilities. These facilities would be allowed the option even though they are not classified as electric generating utilities subject to MRR

Subpart D because in the proposed Settlement Agreement at two places in Attachment A the modified rule language reads: "Units that use the methodologies in part 75 of this chapter to calculate CO2 mass emissions are not required to separately report biogenic CO2 emissions, but may do so as an option."

- There are electric generating utilities subject to the Acid Rain Program and using a CO2 CEMS subject to Part 75, thus making them subject to MRR Subpart D, that primarily burn biomass but would have the option to not separately report their biogenic CO2 emissions. These large biogenic CO2 emissions would be under-reported on the separate biogenic CO2 inventory but imply much large total fossil and other GHG emissions in the proposed new primary inventory category that includes biogenic CO2 emissions.

- Reporting the biogenic CO2 with the direct (Scope 1) GHG emissions is in conflict with the WRI GHG Protocol. The Protocol states that "Direct CO2 emissions from the combustion of biomass shall not be included in Scope 1 but reported separately". The WRI Protocol is an internationally accepted GHG accounting protocol, used by many organizations, companies and others to consistently account and report GHG emissions. Therefore, combining the biogenic CO2 with the Scope 1 GHG emissions is inconsistent with the WRI Protocol, and will cause unnecessary discrepancies between the different GHG reporting programs.

- The number of affected facilities is much larger than perceived. The perception is the vast majority of sources subject to 40 CFR Part 75 are electrical generating units (EGU). However, as previously mentioned there are many other Part 75 facilities, including pulp mills. Many pulp mills burn coal not only because of its relatively lower cost, but also because of operational necessity. Coal is a source of dry fuel when burning other wetter biomass materials, e.g. wet tree bark (hogged fuel). Therefore, many other Part 75 sources besides EGU's will be affected by this proposed change.

- Including biogenic CO2 with the anthropogenic GHG is in conflict with EPA's Green Power Partnership (GPP). Weyerhaeuser is among many companies considering investments in additional green electrical power capacity. EPA defines green power as electricity produced from solar, wind, geothermal, biogas, biomass, and low-impact small hydroelectric sources. EPA goes on to state "Green power sources produce electricity with an environmental profile superior to conventional power technologies and produce no anthropogenic (human caused) greenhouse gas emissions." Therefore, EPA provides a clear distinction between biogenic CO2 and anthropogenic GHG emissions. Combining the biogenic CO2 with anthropogenic GHG defeats the GPP's objectives.

A Proposed Solution

In overview, sources would still report biogenic CO2 completely separate from other GHG emissions as in the current rule, but CO2 CEMS users would have the option as to which fuel type fossil fuel or biomass fuel- to use to determine the portion of their CO2 emissions to subtract from their CEMS total to get the balance of CO2 for the other fuel type. Part 75 CO2 CEMS users subject to Subpart D would also be allowed to use a default higher heating value (HHV) for their biomass fuel when their biomass fuel use is less than 50% of their total heat input. These changes should allow the UARG members who are not predominantly burning biomass to report biogenic CO2 separately with minimal additional effort to their Part 75 CO2 CEMS reporting obligations under the Mandatory Reporting Rule.

Current Rule
Under current rule provisions, sources that combust both biomass and fossil fuel and use a CO2 CEMS are required to calculate the fossil CO2 and determine the biomass fuel CO2 by difference (i.e., CEM CO2 minus fossil CO2).

Alternate Approach
Under this alternate approach, sources would be allowed to choose either their biomass or the fossil fuel use to determine the calculated CO2 emissions using the same methodology as the current Equation C-13. This approach is reasonable since the amount of biomass fuel used has to be quantified for CH4 and N2O calculations anyway and a fuel specific default F-factor for Bark and Wood residue is available from Table 1 in section 3.3.5 of Appendix F to 40 CFR Part 75. Alternatively, a facility would have the option to determine a site-specific value as outlined under section 3.5.6 of Appendix F to 40 CFR Part 75. In addition, since Subpart D Part 75 method users are expected to select the biomass fuel calculation option when they are firing only relatively small amounts of biomass, the rule language could be modified to allow those Subpart D reporters to use default higher heating values for biomass in their Equation C-13 calculation without any appreciable loss of accuracy. These default values are provided by EPA in Table C-1 of Subpart C. EPA could set the threshold for this HHV default selection to when biomass comprises less than 50% of the annual heat input. Also note that fuels not listed in Table C-1 are exempt if they provide less than 10% of the total heat input.

To allow the use of either calculating the fossil fuel CO2 or biomass CO2, a small change to the current Equation C-13 can be made. The current Equation C-13 is as follows:

$$V_{ff} = [Fuel*Fc*HHV] / 10^6 \quad \text{(Eq. C-13)}$$

Where:

V_{ff} = Annual volume of CO2
Fuel = Total quantity of the fossil fuel combusted
Fc = Fuel-specific carbon based F-factor
HHV = High heat value of the fossil fuel
10^6 = Conversion factor, Btu per mmBtu

Equation C-13 calculates the annual CO2 volume from the fossil fuels. To allow the calculation of CO2 for any fuel, the reference to "fossil fuels" should be changed to "fuels combusted." Therefore, Equation C-13 stays the same, but the definitions are now:

$\cancel{V_{ff}}$ V_{fc} = Annual volume of CO2 (Note V_{fc} = volume of CO2 for fuels combusted (fc))
Fuel = Total quantity of the ~~fossil fuel~~ <u>fuels</u> combusted
Fc = Fuel-specific carbon based F-factor
HHV = High heat value of the ~~fossil fuel~~ <u>fuels combusted</u>
10^6 = Conversion factor, Btu per mmBtu

Corresponding rule language text changes to calculate the correct CO2 fraction would need to be made in 40 CFR 98.33(e)(2)(iii) and (iv). For example, at 98.33(e)(2)(iii) at the two places where the words "fossil fuel" currently exist they could be replaced with the phrase "either fossil fuel or biomass."

In summary, allowing the source to select the fuel type to calculate the CO2 will still achieve the accuracy standards in the GHG MRR while lessening the unnecessary monitoring and reporting burden for Subpart D sources that use CO2 CEMS and predominantly burn fossil fuels.

EXHIBIT 1

EPA Response to Weyerhaeuser and other's comments on the proposed MRR

Commenter Name: Stephen E. Woock
Commenter Affiliation: Weyerhaeuser Company
Document Control Number: EPA-HQ-OAR-2008-0508-0451.1
Comment Excerpt Number: 10

Comment: Weyerhaeuser agrees with and supports EPA's proposal to report biogenic CO2 separately. This is consistent with the approach taken in the IPCC and national US GHG inventory frameworks, and correctly supports the concept that regulating biogenic CO2 in the global warming context is unnecessary because biogenic CO2 emissions are recycled to bound carbon in the photosynthetic process and thus do not contribute to new global GHG inventory.

Response: See the response to comment EPA-HQ-OAR-2008-0508-0690.1, excerpt 1.

[the following is from EPA's R-T-C Vol 1/pg 51, and is the referenced xxxxx-0690.1, excerpt 1]

Commenter Name: Ronald H. Strube
Commenter Affiliation: Veolia ES Solid Waste
Document Control Number: EPA-HQ-OAR-2008-0508-0690.1
Comment Excerpt Number: 1

Comment: The proposed GHG Mandatory Reporting Rule (the Rule) applies to facilities generating 25,000 tons per year of GHGs in carbon dioxide (CO2) equivalents (CO2e). Veolia strongly believes that EPA should only require the reporting of anthropogenic emissions and not require the reporting of any biogenic emissions. Anthropogenic sources emit climate forcing greenhouse gases. Biogenic sources are part of the natural near-term carbon cycle and not considered by international protocols as a climate forcing form of a greenhouse gas nor can they be attributed to a single facility. International greenhouse gas inventory reporting, such as that established by the Intergovernmental Panel on Climate Change (IPCC) and EPA's yearly estimates of greenhouse gas sinks and emissions, focus on anthropogenic, not biogenic, emissions.

Response: EPA received several comments on the treatment of the biogenic emissions associated with biomass combustion under this rule. Some stated, as in this comment, that EPA should focus only on anthropogenic emissions and not require the reporting of any biogenic sources. Some reporters urged us to require the accounting of the emissions associated with the combustion of biomass in determining whether facilities exceeded the reporting threshold because of the potential for increased net GHG emissions into the atmosphere when evaluating the project on a life cycle basis. Finally, several commenters supported our proposed approach of not counting emissions associated with biomass combustion toward the threshold but requiring the separate reporting of these emissions by facilities that are required to report under the rule.

Upon review of the comments, we determined to retain the proposed approach in the final rule. Facilities are not required to count emissions associated with biomass combustion when determining whether they meet or exceed the threshold for reporting, but if the threshold is exceeded they are required to separately report emissions associated with the biomass combustion at the facility . This approach is consistent with IPCC Guidelines for National Greenhouse Gas Inventories, which require the separate reporting of CO2 emissions from biomass combustion and also the approach taken in the U.S. Inventory of Greenhouse Gas Emissions and Sinks. Separate reporting of emissions from biomass combustion is also consistent with some State and regional GHG programs, such as California's mandatory GHG reporting program, the Western Climate Initiative, and The Climate Registry, all of which require reporting of biogenic emissions from stationary fuel combustion sources. The final rule does not eliminate the requirement to report emissions from the combustion of biomass fuels because they can be used as alternatives to fossil fuels. While this reporting requirement does not imply whether emissions from combustion of biomass will or will not be regulated in the future, the data collected will improve EPA's understanding of the extent of biomass combustion and the sectors of the economy where biomass fuels are used . It will also allow EPA to improve methods for quantifying emissions through testing of biomass fuels.

We disagree with those commenters who argued that the "anthropogenic" emissions do not include emissions from biogenic source categories. In the lexicon of greenhouse gas emissions accounting, the opposite of "anthropogenic" is "natural", and the word "biogenic" is not synonomous with the word "natural". While "natural" sources of emissions are traditionally excluded from GHG inventories, many biogenic emission are the direct result of human actions and practices. Examples include the cultivation of livestock and rice and land use changes such as deforestation.

We also disagree with commenters who encouraged us to require facilities to include emissions from biomass combustion when determining applicability with the rule. As we noted in the proposed rule, the CO2 emissions that result from the burning of biomass are considered to be part of the Earth's natural carbon cycle. We agree with several commenters, however, that not all of this biomass combustion is "carbon-neutral" if lifecycle emissions are considered. Requiring facility-level reporting from all the source categories required to prepare a complete lifecycle analysis is beyond the scope of this rule because many of the relevant source categories for this type of analysis are not included in this rule . The response to comment EPA-HQ-OAR-2008-0508-0525.1, excerpt 25 in this volume provides our rationale the coverage of agriculture and forestry emissions sources in the final rule, and the preamble section on source categories to report provides the response to comments on the coverage of carbon sequestration in the final rule. Thus, while recognize that life cycle analyses can be useful for many purposes, such as determining a facility's or product's overall carbon footprint, we are not requiring this reporting at this time. This rule is only one of many Federal, State, and regional programs related to GHG emissions and climate change.

The approach in the final rule provides EPA with complete information on combustion emissions from the facilities that exceed the emissions threshold based on their fossil fuel emissions, and avoids requiring reporting from facilities that would exceed the threshold only if their emissions from biomass fuels are counted. Thus, facilities that rely primarily on biomass fuels will not be required to report under the rule. We do not agree with the commenters that have argued that requiring the separate reporting of emissions from biomass combustion in units that co-fire biomass fuels will create a disincentive for these types of projects. Our analysis shows that the cost savings by co-firing biomass fuels can far exceed the minimal burden associated with this reporting requirement .

W-2

Caudill, Neil (ECY)

From: Marion Huxtable [mhuxtable@olympus.net]
Sent: Monday, October 11, 2010 8:55 AM
To: Caudill, Neil (ECY)
Subject: Public comment on Washington's Greenhouse Gas Reporting Rule
Attachments: Greenhouse Gas Emissions from PTPC Cogeneration.pdf; ATT2155804.htm

Dear Mr. Caudill:

I am sending public comment on the Washington's Greenhouse Gas Reporting Rule, Chapter 173-441 WAC - Reporting of Emission of Greenhouse Gases.

I have no criticisms of the proposed rule. However I have a question and some comments.

1. Questions about reporting by suppliers of liquid fuel

Are suppliers who must file tax reports the only ones who must report greenhouse gas emissions from liquid fuel? I believe that tax reports are only filed at the terminal rack. This makes it possible for the State to obtain accurate greenhouse gas emissions from liquid fuel sold in the State, but not the counties. There seems to be no method of accurately counting greenhouse gas emissions from liquid fuel sold at the county level. Many counties (including Jefferson County where I live) do count greenhouse gas emissions, but have no direct way of counting emissions from liquid fuel, because no tax reports are filed at the county level. Alternative methods (such as estimates based on vehicle miles traveled) are used to estimate greenhouse gases from transportation (the main use of liquid fuels) at the county level. This is not such an accurate method as a calculation based on what is sold. I do not know if there is a solution to this. So my question is whether it is possible for the State to provide data to each county about the amount of liquid fuel sold in the county.

2. Comments about greenhouse gases from biomass incineration

Although the reporting rule is only intended for the reporting of greenhouse gases, I wish to also comment on including the carbon dioxide from biomass incineration in the States greenhouse gas inventory, since I believe that the Department of Ecology will be involved in advising about this.

The National Commission on Energy Policy called for reductions in Greenhouse gases of 2 to 3% per year. We are also told that the only safe level for carbon dioxide in the atmosphere is 350 ppm. We already have 390 ppm of carbon dioxide and it is rising rapidly. Although climate experts continue to warn about the danger of increasing the carbon dioxide in the atmosphere, and in particular about the dangers of climate change to Washington State, efforts in Washington State are inadequate.

It appears that we have a short window in which to slow global climate change. The next few years are crucial for avoiding runaway change. Although carbon dioxide released from burning wood is part of a cycle of carbon dioxide converting back to biomass and oxygen, it does not happen immediately. The EPA has warned about the length of the cycle. Although the cycle for wood is shorter than for peat or coal, it seems not to be short enough to sequester the carbon dioxide in a safe time span. The harvest cycle of Douglas firs in Washington State is 60 years, I believe. Wood remaining from construction can continue to sequester carbon for decades if re-used rather than by being burned.

Accounting for carbon dioxide through wood burning is apparently to be accounted for by inventorying land use change and forestry (LUCF). Although recognizing that accounting for changes in carbon dioxide in the atmosphere through burning wood is a very complex question, it seems to me that it is more direct to use the data for carbon dioxide from biomass burning that the Department of Ecology will be collecting through the new reporting rule. There can still be separate rules for maintaining carbon sinks in forestry, and rules can be worked out so that debits and credits are only counted once.

My concern is that the new biomass incinerators that are planned for Washington State will release enormous amounts of carbon dioxide that over the short term will accelerate the increase in atmospheric carbon dioxide. As an example I am attaching here a calculation of the amount of carbon dioxide that will be released from the new project planned for Port Townsend Paper Corporation. I used one of the EPAs methods[1] to calculate the carbon dioxide. As you can see, the amount released will dwarf the emissions from the rest of Jefferson County. Under current Washington State rules, the carbon dioxide from PTPCs project will be discounted in the States inventory. However, it will add to the carbon dioxide in the atmosphere and contribute to climate change over the next few years, regardless of Washington States laws on the subject.

1. http://www.epa.gov/climatechange/emissions/downloads09/GHG-MRR-FinalRule.pdf

Carbon dioxide (a greenhouse gas) emissions expected from the Port Townsend Paper Corporation's cogeneration project

Background information:

In 2007, Jefferson County and the city of Port Townsend adopted a joint resolution (Number 44-7) to address energy use and climate change, triggering a baseline inventory.[1] Jefferson County's 2005 Emissions Inventory showed that PTPC accounted for 29% of the county's greenhouse gas emissions. This included the reprocessed fuel oil, electricity and propane, but did not include the wood that was being used as fuel. The total carbon dioxide equivalent for the entire county, including stationary (municipal, residential, industrial and commercial) and transportation amounted to 536,714 tons of carbon dioxide equivalent.

PTPC's cogeneration project

It is reported that PTPC will operate a 25-MW to 30-MW steam turbine generator in its new biomass project.[2] A 25 MW biomass power plant is expected to use an estimated 430,000 green tons of biomass per year, according to the Eastern Oregon Biomass Assessment[3]

How much carbon dioxide will be emitted?

The US Energy Information Agency's emission factor is 3814 pounds (1.9 tons) of CO2 per ton of wood burned.[4] This seems reasonable assuming about 50% of wood is carbon. Green wood is recently harvested and could be conservatively estimated to have 30% moisture. Assuming that the emission factor is for dry wood (70% of the green wood estimate) the wood required by the project will emit 571,900 tons of carbon dioxide per year.

Assuming 47 diesel trucks per day, each carrying 25 tons of wood, making a round trip of 80 miles at 6 mpg and 22.2 pounds of CO2 per gallon burned, transportation of fuel wood adds an additional 2,539 tons of CO2 per year.

How does this affect Jefferson County's resolution to address energy use and climate change?

Carbon dioxide from burning wood adds to the total greenhouse gases in the atmosphere, just as from CO_2 from other fuels. Replanted trees sequester CO_2, so wood is considered to be a renewable fuel. It appears that the new 25 MW generator will emit about the same amount of carbon dioxide per year as the entire county emitted in 2005. This will make it increasingly difficult to meet the city/county joint resolution to reduce greenhouse gas emissions by 80% by 2050. It will take many years for the carbon dioxide to be sequestered in replanted trees.

What Government regulations affect use of biomass?

County:

The city/county joint resolution to reduce greenhouse gases could affect the county's attitude towards construction.

State:

1. GHG Targets

Washington State previously set a number of GHG emission reduction targets through Executive Order 07-02, issued by Governor Gregoire on February 7, 2007. That order established the following targets for reducing Washington's GHG emissions:

- By January 1, 2020, reduce GHG emissions to 1990 levels,
- By January 1, 2035, reduce emissions to 25 percent below 1990 levels, and
- By January 1, 2050, reduce emissions to the lesser of 50 percent below 1990 levels or 70 percent below the projected annual emissions level for 2050.

SSB 6001 adopts these goals into law.

2. Biomass supply

HB 2481 Authorizing the department of natural resources to enter into forest biomass supply agreements

Sec. 13. The department of natural resources must conduct a survey of scientific literature regarding the carbon neutrality of forest biomass. The department must submit the survey results with any findings and recommendations to the appropriate committees of the legislature by December 15, 2010. This section expires January 1, 2011.[5]

Federal:

Beginning next January, facilities that must already obtain New Source Review permits for other pollutants will be required to include greenhouse gases in their permits if they increase their emissions of the gases by at least 75,000 tons of carbon dioxide equivalent per year.

On July 1, 2011, EPA will extend the requirements to new construction projects that emit at least 100,000 tons of greenhouse gases and existing facilities that increase their emissions by at least 75,000 tons per year, even if they do not exceed thresholds for other pollutants. Sources that emit at least 100,000 tons of greenhouse gases per year will also be required to account for greenhouse gas emissions in their Title V operating permits starting next July.

Does this include CO2 from biomass?

On 6.3.2010, EPA published the final Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule (known hence forth as the Tailoring Rule) (75 FR 31514). In that Rule, EPA did not take action on a request from commenters to exclude CO_2 emissions from biogenic fuels. The Agency did not have sufficient information to address the issue of the carbon neutrality of biogenic energy.[6]

Call for Information

EPA has issued a Call for Information[7] to solicit information about whether emissions from biogenic sources should be counted as greenhouse gases.

References

1. http://www.co.jefferson.wa.us/commdevelopment/climatechange.htm
2. http://www.industrialinfo.com/showAbstract.jsp?newsitemID=155571
3. http://www.oregon.gov/ENERGY/RENEW/Biomass/assessment.shtm
4.http://docs.google.com/viewer?a=v&q=cache:j-mZBpsFOT4J:www.mwcog.org/uploads/committee-documents/vlZeWV420070820112319.pdf+carbon+dioxide+emission+factor+for+wood&hl=en&gl=us&pid=bl&srcid=ADGEEShM_b6qZYC1HawMr0ZacBCEOVwg29EHOyUY0yqb2huJXlsDd3ry3M1rEWkYcB-_hgK-DyJCqhgYYeM_ApbNvcseBLk1JviR1NizoccNIwTSyc2NHEul54vBG7F5gbGZUrY1OMvh&sig=AHIEtbS75d2-ndPcmnZS3L47cEdO4UzA7g
5. Second substitute house Bill 2481, Forest Biomass on State Lands, section 13
6. The Tailoring Rule http://www.epa.gov/apti/video/pdfs/tailoring.pdf
7. http://www.epa.gov/climate/climatechange/emissions/pdf/Biomass_fact-sheet.pdf

Marion Huxtable, August 29, 2010

W-3

Neil Caudill
Air Quality Program□Washington
Department of Ecology□
P.O. Box 47600□Olympia, WA 98504-7600□
neil.caudill@ecy.wa.gov□
FAX (360) 407-7534

From:
Elaine Bailey
925 Rose St
Port Townsend, WA 98368

Thank you for including this in your considerations.
The regulation of GHG with the exclusion of Biomass incineration is a huge mistake. The science is still out on "carbon neutral" and is actually a misinterpretation of the IPCC accounting for CO2. Burning was never in the accounting. There have been many studies to show that increased CO2 in the atmosphere will continue to speed up the acidification of our oceans and the Puget Sound area. We are all faced with difficult decisions regarding this issue. It should be noted that a large part of the industries that have pushed for biomass exclusion are those that would profit from this.
Studies have been done that show Forest recovery cannot resequester suffiecint carbon from multiple sources operating 24/7 year round. That it will take 100's of years for forests to actually create a net O accounting.

The following is taken from
http://treephys.oxfordjournals.org/cgi/reprint/22/2-3/77.pdf
Management implications and conclusions
Publications considering forests as a means of atmospheric CO2 mitigation have reached contradictory conclusions (Harmon et al. 1990, Marland and Marland 1992) depending on whether calculations consider CWD loads (Harmon et al. 1990, Fischlin 1996), substitution of wood for fossil fuels (Matthews 1992, 1994), afforestation, or conversion of oldgrowth forest to secondary forest (Schlamadinger and Marland 1996). There is also evidence that longer rotations, underplanting and other silvicultural manipulations of existing stands do little to improve CO2 mitigation and are less effective than afforestation (Kuersten and Burschel 1993). The latter conclusions are supported by the low storage and high fluxes associated with conversion to short-rotation forests relative to intact old-growth forest indicated here. Conversely, afforestation on a scale to achieve appreciable CO2 mitigation is limited by available land area (Shroeder and Ladd 1991). Given these limits, optimizing forest C storage appears to mean preserving old-growth forests and stopping deforestation

or moving forest products into decomposition-free permanent storage.

Mass-based methods of estimating NEP also deserve more attention, particularly if the results of these methods run contrary to flux-based estimates. Although the legitimacy of flux tower and chamber-based measurement of NEP (e.g., Arneth et al. 1998, Schmid et al. 2000) are not disputed here, key events in a stand's history, such as stand-destroying wildfire, may rapidly release high percentages of stored stand C. Because these events may span only days or weeks, a short period of time relative to potential stand life spans of several centuries or longer, there is a high probability that short-duration monitoring, regardless of method, will miss these rapid changes in C stores. Thus, estimates of NEPw, and consequently conclusions about C sources, C sinks and C accumulation drawn from short-term flux measurements, should be interpreted cautiously.

Finally, descriptions of forest CWD C stores across a range of forest types have improved (Grier and Logan 1977, Harmon et al. 1995), but assessment of the sources and fates of these stores is still needed. Our results indicate that the more CWD is left on site, the more negative NEPw becomes, the longer before NEPw switches from negative to positive, and the lower the maximum NEPw. When off-site and burned CWD stores are accounted for and C accumulation is summed over time, logging old-growth *Pseudotsuga–Tsuga* forests creates a CO_2 debt that may persist for more than 150 years, even when oldgrowth forests are replaced with vigorously growing secondary forest. If stand history is not considered, NEP-based determinations of whether stands function as CO_2 sources or sinks can be misleading. This is because C stores in old-growth stands may differ vastly from C stores in second-growth stands that replace them, because woody biomass exported from a site may not be reflected in NEP, and because substantial fractions of stand C stores may be lost in rapid pulses easily missed by short-term monitoring.

Acknowledgments

This researchwas sponsored by the U.S. Department of Energy (DOE), National Institute for Global Environmental Change (NIGEC),Western Regional Center for Global Environmental Change (WESGEC), University of California, Davis, under Grant DE-FC03-90ER61010. Other support was provided by the H.J. Andrews LTER Program (DEB 9632921). We thank Kermit Cromack for field assistance and comments, and Gody Spycher for processing data used in this article. Suggestions from Steve Acker, Christian Wirth and Rod Keenan greatly improved the paper.We thank Jay Sexton, Becky Fasth, Jenna

Boyle, Julia Hyatt, theWind River Canopy Crane staff, and many others
for their contributions.

References

Aber, J.D. and J.M. Melillo. 1991. Terrestrial ecosystems. Saunders College Publishing, Philadelphia, 429 p.

Acker, S.A., P.A. Harcombe, M.E. Harmon and S.E. Greene. 2000. Biomass accumulation over the first 150 years in coastal Oregon *Picea–Tsuga* forest. J. Veg. Sci. 11:725–738.

Anonymous. 1999. Wood handbook: Wood as an engineering material. USDA Forest Service, Forest Products Laboratory. Madison, WI, Gen. Tech. Rep. FPL-GTR-1134, 63 p.

Arneth, A., F.M. Kelliher, T.M. McSeveny and J.N. Byers. 1998. Net ecosystem productivity, net primary productivity and ecosystem C sequestration in a *Pinus radiata* plantation subject to soilwater deficit. Tree Physiol. 18:785–793.

Bible, K. 2001. Long-term patterns of Douglas-fir and western hemlock mortality in the western Cascades ofWashington and Oregon. Ph.D. Diss., Univ. Washington, Seattle, WA, 85 p.

Boone, R.D., P. Sollins and K. Cromack, Jr. 1988. Stand and soil changes along a mountain hemlock death and regrowth sequence. Ecology 69:714–722.

Bormann, F.J. and G.E. Likens. 1979. Pattern and process in a forested ecosystem: Disturbance, development, and the steady state based on the Hubbard Brook ecosystem study. Springer-Verlag, Berlin, 253 p.

Chen, J. and J.F. Franklin. 1992. Vegetation responses to edge environments in old-growth Douglas-fir forests. Ecol. Appl. 2: 387–396.

Constantin, J., A. Grelle, A. Ibrom and K. Morgenstern. 1999. Flux partitioning between understorey and overstorey in a boreal spruce/pine forest determined by the eddy covariance method. Agric. For. Meteorol. 98/99:629–643.

Conway, S. 1982. Logging practices: principles of timber harvesting systems. Miller Freeman Publications, San Francisco, 432 p.

Davis, M.B. 1986. Climatic instability, time lags, and community disequilibrium. *In* Community Ecology. Eds. J. Diamond and T.J. Case. Harper and Row, New York, pp 269–284.

DeBell, D.S. and J.F. Franklin. 1987. Old-growth Douglas-fir and western hemlock: A 36-year record of growth and mortality.West. J. Appl. For. 2:111–114.

Eberhart, K.E. and P.M.Woodard. 1987. Distribution of residual vegetation

“Climate change represents one of the most significant challenges to public health in the 21st century,” Christopher Portier, the director of the C.D.C.’s National Center for Environmental Health, said in a statement announcing the program. “These projects will lead the way in anticipating and preparing for those extreme weather events and their impact and reducing the burden on the health of our communities."

There are also many studies indicating the adverse effects on soil structure and it's ability to sustain healthy forests with excessive slash removal. Even the argument that this will mitigate forest fire has science that questions this assumption.

Too much is at stake for the environments of Washington State to create a blanket statement excluding Biomass from GHG accounting.

BIOMASS COMBUSTION IS NOT CARBON NEUTRAL

To be considered carbon neutral in the context of being a solution for climate change, any type of electrical power generation cannot emit more than minimal amounts of carbon dioxide.

For years biomass combustion has been "***assumed***" to be carbon neutral[1] by EPA and IPCC. In a FOIA request by EcoLaw for all documents, e-mail, papers, meeting transcripts and data to substantiate this assumption, in 1.5 GB of material EPA only provided documents which repeatedly used the words assumed or assumption without appropriate scientific documentation, e.g.

> "combustion of biomass emits greenhouse gases....[but] the CO2 emissions from these activities are not included in the national emissions totals. It is assumed that the C released during the consumption of biomass ...causes no net addition of CO2 to the atmosphere."[2]

Current science provides evidence that the assumption is not valid:
Searchinger, et. al.[3] write the following:

> "However, exempting emissions from bio-energy use is improper for greenhouse gas regulations. Replacing fossil fuels with bio- energy does not by itself reduce carbon emissions, because the CO_2 released by tail- pipes and smokestacks is roughly the same per unit of energy regardless of the source "

> "Thus, maintaining the exemption for CO_2 emitted by bioenergy use under the protocol (IPCC) wrongly treats bioenergy from all biomass sources as carbon neutral. For example, the clearing of long-established forests to burn wood or to grow energy crops is counted as a 100% reduction in energy emissions despite causing large releases of carbon."

> "However, harvesting existing forests for electricity adds net carbon to the air. That remains true even if limited harvest rates leave the carbon stocks of regrowing forests unchanged, because those stocks would otherwise increase and contribute to the terrestrial carbon sink."

"The potential consequences were downplayed in the carbon-neutrality hypothesis."

Lussayert, et. al.[4] note:

---

[1] Odum, E.P.: "The Strategy of Ecosystem Development", Science 164:262, 1969
[2] http://epa.gov/climatechange/emissions/downloads09/Energy.pdf
[3] Science, 325:529, October 23, 2009
[4] Nature, 455:213, 2008

I urge you to reconsider Biomass in the accounting for GHG.

W-4

Caudill, Neil (ECY)

From:	Moody, Doug [DMoody@wafertech.com]
Sent:	Thursday, October 14, 2010 6:10 AM
To:	Caudill, Neil (ECY)
Cc:	Inloes, Scott; Moody, Doug; Short, Jim; Leese, Spencer; Newman, Alan (ECY); Adair, Janice (ECY)
Subject:	WaferTech Comments on WAC 173-441
Attachments:	WA State GHG Reporting Comments - WaferTech 10-13-10.doc; Attachment A--SIA Comments on ReProposed GHG MRR Rule.pdf
Importance:	High

****

Security C: WaferTech - TSMC Fab 11 Secret

****

Neil,

We appreciate the opportunity to comment as the semiconductor industry representative in Washington State. Please see the attached comment letter and referenced attachment. We look forward to meeting with you and discussing further. A hardcopy will follow this communication shortly.

Regards,

Doug Moody, CIH

EH&S Manager

WaferTech LLC

5509 NW Parker St.

Camas, WA 98607-9299

P: 360-817-3308

F: 360-817-3049

E: HYPERLINK "mailto:dmoody@wafertech.com" dmoody@wafertech.com

4-C

WaferTech - TSMC Fab 11 PROPERTY

<<WA State GHG Reporting Comments - WaferTech 10-13-10.doc>> <<Attachment A--SIA Comments on ReProposed GHG MRR Rule.pdf>>

October 13, 2010

Neil Caudill
Air Quality Program
Washington Department of Ecology
PO Box 47600
Olympia, WA 98504-7600

Subject: WaferTech's Comment on the Proposed Greenhouse Gas Reporting Rule (WAC 173-441)

Dear Neil:

Thank you for the opportunity to provide comments on the proposed Greenhouse Gases Reporting rule (Chapter 173-441 WAC). WaferTech is opposed to the Department of Ecology's proposal to require semiconductor manufacturers in Washington to comply with a proposed federal rule which is still being debated within the federal rulemaking process for the following reasons:

1) We estimate the proposed federal rule would cost WaferTech over $100,000 per year to comply with, and compliance would put us at a significant competitive disadvantage to other US, not to mention international, semiconductor manufacturers.
2) The additional cost would result in minimal improvement in the accuracy of the data provided.
3) WaferTech should be allowed to use our proposed GHG monitoring plan until any Federal rule for the electronic industry is finalized.

I. Background:

As you know, WaferTech is a committed environmental leader in Washington State. We are ISO14001 certified, members of the US EPA Climate Leaders program, and a past member of the former US EPA Performance Track organization. We are the largest semiconductor manufacturer in Washington State, providing over one thousand high tech jobs in Clark County. WaferTech is the only semiconductor company in Washington State participating in the rule development process.

Nationally, the semiconductor industry emits 0.07% of the total US greenhouse gas emissions. In Washington State, WaferTech calculates emissions to be about 0.1% of the State totals. WaferTech has two projects to reduce GHG emissions: one project is to reduce PFC emissions and the second is a partnership with Bonneville Power Administration and Clark PUD to reduce our electricity usage.

II. Concerns

A. Semiconductor Industry of America (SIA) Comments:

Attached is SIA's June 11, 2010 comment to EPA's proposed rule which has been attached for your review (see **Attachment A**). The major points of the SIA's comments are summarized below:

1) The proposed "refined method" grows out of a deeply flawed uncertainty analysis.
2) The proposed "refined method" would result in significant capital expenditures and ongoing compliance costs.
3) An alternative refined method (endorsed by the SIA) would achieve greater data accuracy as compared with EPA's proposed refined method, and should also avoid undue burden.

B. Technical issues

The following are technical issues associated with adopting the proposed federal GHG reporting rule for the electronic industry:

1) The scales we use to estimate our gas usage are not designed to do a two point calibration. We set a baseline periodically (zero) and use the gas production weight each time to set the upper span. The scale automatically subtracts the empty cylinder weight from our online measurement. This is not a classical two point scale calibration.
2) The pressure transducers we use to estimate our usage are directly measuring our gas pressure. We confirm vacuum conditions when we change each cylinder. To perform the proposed two-point calibration would require us to break the high purity lines, calibrate using a secondary gas and purge our lines for a long period of time to confirm below ppb level of contamination. This will result in an increase in our GHG emissions to meet that calibration requirement.
3) WaferTech has 600-900 heat exchangers that require material balance to confirm compliance with this rule. A majority of the heat transfer fluids have low vapor pressure and thus low emissions, and measuring the GHG gases these fluids will be challenging for most third party testing facilities. Measuring the trace amounts of fluorinated compound in our waste stream will be very expensive.
4) EPA is proposing developing new emissions factors for equipment that is normally not tested. The emissions from these new processes are less than 10% of our emissions. We assert that it is reasonable to limit the development of emissions factors for processes that are a significant amount of our emissions.
5) WaferTech uses over 90% of our GHG gas brought on site. Less than 10% of the gas is returned to our suppliers, 1-150 lbs per cylinder. This rule requires a large amount of effort for a small quantity of emissions.

C. Cost concerns

We estimate that using the proposed federal rule as a state rule would cost WaferTech over $12,000 in capital cost and an annual cost of over $60,000 (non-man-hours), with over 3,000 man-hours per year to maintain totaling around $100,000 per year. Just the reporting obligation would be about $1 per MT CO2 emissions per year. This amount of money could better be spent on emissions reductions and not reporting requirements. The State should account for this cost as part of the rule package until the federal rule is final.

D. Confidential Business Information

The rule requires WaferTech to publicly identify each tool and the amount of each type of gas used would give our competitors information on how we make our product.

WaferTech is a foundry which means that we manufacture semiconductors to our customers' designs and specifications. The way we manufacture our products for our customers is a critical competitive advantage for us and our parent company. The release of this information related to the tools, recipes, detailed process-specific gas consumption and emissions, and abatement equipment used is considered confidential information because inferences can be made by a knowledgeable person as to our production processes. Presently we are working with EPA to identify what information will be reported to EPA in their reporting rule and expect the State to respect these critical business needs.

WaferTech, as part of the EPA's Climate Leaders program, has reported greenhouse gas emissions as total PFCs, SF_6, NF_3, N_2O, Methane, and CO_2. During the onsite visit by the Climate Leader program contactor, we reviewed all the data and procedures used to determine emissions using Semiconductor Tier 2b methods. Confidential business information was not taken off site during the visit or included in any written reports

III. Comments on WAC 173-441

During the July 6, 2010 GHG meeting with Ecology we were informed that some parts of the rule would likely be suppressed if the federal rule conflicted with the state definitions. We would like to discuss the specifics of WAC 173-441 we raise below.

a. WAC 173-441-030(1)(iv): Include in the emissions calculation any CO2 that is captured for transfer off site. WaferTech has two offsite transfers, fist the returning of PFC gases to suppliers and the recycling/disposal of heat transfer fluids that have minimal vapor pressure. **Clarifications:**

   i. **Does this only apply to CO2 and not fluorinated green house gases?**

   ii. **Based on EPA's GHG reporting rule our suppliers are responsible for the PFC gases returned to them. WaferTech should not have to report the amount of PFC gas returned to our supplier.**

   iii. **The disposal of the heat exchanger fluid may be a low amount of emissions but require a large amount of time and money to estimate these emissions. WaferTech may want to assume all the heat transfer fluid is emitted if the amount is small.**

b. WAC 173-441-050 (6) (a): A list of all units, operations, processes, and activities for which GHG emission was calculated: **Recommendations: WaferTech would identify the general type or classification of equipment but not the make and model**

number for all of our equipment. This information is considered confidential because this would identify how we make our products.

c. WAC 173-441-050 (8) (c): … Calibrate each transmitter at a zero point and at least one upscale point. **Recommendations: WaferTech does not do a two point calibration for our pressure transmitters. We confirm that the system vacuum is achieved but we do not do a high pressure confirmation. To do this would require that we compromise our high purity system and purge our GHG until ppb levels are achieved. WaferTech should only be required to perform a vacuum check and not a two point calibration.**

d. WAC 173-441-120: Calculation methods incorporated by reference from 40 CFR Part 998 for facilities: **Neil indicated to Scott Inloes in a telephone call on 9/29/10 that if the Semiconductor rule is not final they would meet with WaferTech in the end of October to come up with an option that works for both parties. Recommendations: Drop the requirement for WaferTech to compile with EPA's proposed rule (Subpart I – 40 CFR Part 98) because the rule is not final. WaferTech would propose that we could report to Ecology as in our GHG monitoring plan until a time when EPA has a final rule.**

e. WAC 173-441-150: Confidentiality. **Recommendations: WaferTech will work with Ecology regarding confidential information once the rule is final.**

IV. Conclusions

Thank you for giving WaferTech the opportunity to comment on a very complex and potentially costly program that will affect everyone in the State. We are committed to greenhouse gas reduction, but believe the above changes will make for a better rule and minimize unproductive future expense and compliance issues. WaferTech will meet with you in October to come up with a compliance option for WaferTech. This option should include the following:

- Allow WaferTech to use our proposed GHG monitoring plan until any federal GHG report rule is final.
- Let WaferTech continue with our current method for operations confirmation of our scales and pressure transmitters.
- Eliminate the requirement to identify all specific equipment GHG discharging points. We will identify the general type of equipment we have on site.

This will reduce our compliance costs while not compromising the accuracy of our data. Please contact me with any questions or to set up a time when we can get together to discuss further.

Regards,

Doug Moody, CIH
Environmental Health and Safety Manager

CC: Janice Adair, Ecology
Al Newman, Ecology

Attachment A: SIA's comment to EPA's proposed rule 40 CFR Part 98, subpart I, June 11, 2010.

SIA | SEMICONDUCTOR INDUSTRY ASSOCIATION

June 11, 2010

SUBMITTED ELECTRONICALLY

Environmental Protection Agency
EPA Docket Center (EPA/DC)
Mailcode 6102T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: EPA Docket ID No. EPA-HQ-OAR-2009-0927

Dear Sir or Madam:

Attached please find the comments of the Semiconductor Industry Association (SIA) on the U.S. Environmental Protection Agency's Mandatory Reporting of Greenhouse Gases: Additional Sources of Fluorinated GHGs; Proposed Rule, 75 Fed. Reg. 18651 (Apr. 12, 2010). SIA greatly appreciates the opportunity to comment on this Proposed Rule.

Sincerely,

Thomas P. Diamond CIH
Director, Environmental, Health & Safety
Semiconductor Industry Association

cc: Julie Hatcher, Latham & Watkins
Carole Cook, U.S. EPA

COMMENTS OF THE SEMICONDUCTOR INDUSTRY ASSOCIATION ON U.S. EPA'S MANDATORY REPORTING OF GREENHOUSE GASES; ADDITIONAL SOURCES OF FLUORINATED GHGs; PROPOSED RULE, 75 FED. REG. 18,652 (APR. 12, 2010) EPA DOCKET ID NO. EPA-HQ-OAR-2009-0927

Semiconductor Industry Association
181 Metro Drive
Suite 450
San Jose, CA 95110
(408) 573-6609

Of Counsel
Julie Hatcher
Matt Brewer
Latham & Watkins
555 11th Street, N. W.
Washington, D. C. 20004

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Semiconductor Industry Association (SIA) appreciates this opportunity to submit comments on U.S. EPA's Mandatory Reporting of Greenhouse Gases; Additional Sources of Fluorinated GHGs; Proposed Rule, 75 Fed. Reg. 18,652 (Apr. 12, 2010) [hereinafter "GHG Reporting Re-Proposal" or "Re-Proposed Rule"]. SIA is a trade association representing the U.S. semiconductor industry, uniting companies responsible for more than 85 percent of semiconductor production in the U.S. More information about the SIA can be found at www.sia-online.org.

SIA greatly appreciates U.S. EPA's responsiveness to our comments on the original Proposed Rule[1] and its decision to defer a GHG reporting regime for our industry pending this new rulemaking. We believe that the Re-Proposed Rule reflects some solid improvement from the original. In particular, SIA appreciates that the Re-Proposal – in contrast to the original proposal – would allow semiconductor manufacturers to calculate emissions instead of requiring individual tool measurement or continuous emissions monitors (CEMS), neither of which are technically or economically feasible at this time.

Unfortunately, the Re-Proposal's process-based reporting scheme under the so-called "Refined Method" is not viable. The "Refined Method" stems from a technically flawed uncertainty analysis and apparent misunderstandings of current process realities. It would not achieve EPA's stated objective to obtain "information . . . relevant to implementing the existing CAA" that "produces a more representative and accurate emissions estimate." 75 Fed. Reg. 18655, 18663.

To achieve its stated objective, EPA should adopt an Alternative Refined Method that moves well beyond the *status quo* to enhance the current Intergovernmental Panel on Climate Change (IPCC) methodologies through the following 4 key components:

1. ***Gas-Specific Consumption Factors:*** *Require, unless infeasible, that a facility develop a heel factor specific to each type of cylinder and for each gas type based on the point established as the trigger for changing out the cylinder.*

2. ***Facility-Wide Apportioning Protocol***: *Require apportioning of gas usage based on an alternative to the Proposed Refined Method that apportions across the following five process categories: (1) CVD Chamber Cleaning – in-situ Plasma; (2) CVD Chamber Cleaning – Remote Plasma; (3) CVD Chamber Cleaning – in-situ Thermal; (4)*

---

[1] Comments By The Semiconductor Industry Association On U.S. EPA's Mandatory Reporting Of Greenhouse Gases; Proposed Rule, 74 Fed. Reg. 16448 (Apr. 10, 2009) EPA Docket ID NO. EPA-HQ-OAR-2008-0508-0498.1.

Etch; and (5) Wafer Cleans. These five process categories, as explained in our comments, would move beyond the two IPCC Tier 2b categories to achieve greater accuracy, but would avoid the uncertainly issues created by the Refined Method's 9 categories. To assure a sufficient degree of accuracy, this apportionment among the 5 categories should occur based on a combination of at least one quantifiable indicator and engineering judgment.

3. ***Tier 2b For All, Except Tier 3 Where Available**: Require use of Tier 2b emissions factors by all facilities, except require use of Tier 3 measurement data where in possession of a facility, for the etch and CVD categories. Require use of the emissions factors in EPA's Notice of Data Availability (NODA)[2] for 2 additional categories (CVD Chamber Cleaning – in-situ Thermal and Wafer Cleans). For heat transfer fluids, require a mass balance method keyed to purchase and offsite shipment.*

4. ***Abatement Default Factors**: Allow for default factors based on abatement installed capabilities, but otherwise allow for a reasonable DRE test sample size and timeframe.*

In Part One below, SIA provides a robust Introduction and Summary of our comments. In Part Two below, we review pertinent background on semiconductor manufacturing processes and our history of proactive and cooperative involvement on GHGs with U.S. EPA. Finally, in Part Three below, we detail our issues and concerns – particularly as to the Re-Proposal's Refined Method but also as to other aspects, including confidentiality – and offer proposed solutions.

---

2 Mandatory Reporting of Greenhouse Gases: Notice of Data Availability; Default Emission Factors for Semiconductor Manufacturing Refined Process Categories, 75 Fed. Reg. 26904 (May 13, 2010).

PART ONE:
INTRODUCTION AND SUMMARY

The Semiconductor Industry Association (SIA) appreciates this opportunity to submit comments on U.S. EPA's Mandatory Reporting of Greenhouse Gases; Additional Sources of Fluorinated GHGs; Proposed Rule, 75 Fed. Reg. 18,652 (Apr. 12, 2010) [hereinafter "GHG Reporting Re-Proposal" or "Re-Proposed Rule"]. SIA is a trade association representing the U.S. semiconductor industry, uniting companies responsible for more than 85 percent of semiconductor production in the U.S. SIA is dedicated to maintaining our Nation's world leadership in semiconductor technology while at the same time helping its members to provide safe working conditions in production facilities and to protect the environment. Collectively, the semiconductor industry employs a domestic workforce of approximately 200,000 people, and is our Nation's second-largest exporting industry. More information about the SIA can be found at www.sia-online.org.

SIA greatly appreciates U.S. EPA's responsiveness to our comments on the original Proposed Rule[3] and its decision to defer a GHG reporting regime for our industry pending this new rulemaking. We believe that the Re-Proposed Rule reflects some solid improvement from the original. In particular, SIA appreciates that the Re-Proposal – in contrast to the original proposal – would allow semiconductor manufacturers to calculate emissions instead of requiring individual tool measurement or continuous emissions monitors (CEMS), neither of which are technical or economically viable at this time.

Unfortunately, the Re-Proposal's process-based reporting scheme under the so-called "Refined Method" is not viable. The "Refined Method" stems from a technically flawed uncertainty analysis and apparent misunderstandings of current process realities. It would not achieve EPA's stated objective to obtain "information . . . relevant to implementing the existing CAA" that "produces a more representative and accurate emissions estimate." 75 Fed. Reg. 18655, 18663. SIA also continues to have significant concerns regarding confidential business information.

I. THE PROPOSED REFINED METHOD IS NOT VIABLE

A. The Proposed Refined Method Grows Out Of A Deeply Flawed Uncertainty Analysis

The Refined Method in the Re-Proposed Rule's Section 98.93 sets out 9 semiconductor manufacturing process categories and sub-categories as well as a 10th "N_2O other" category. The Re-Proposal would require apportionment of gas usage to each category and subcategory based on quantifiable indicators. With the Refined Method, EPA aims to reduce uncertainty and relative error

---

3 Mandatory Reporting of Greenhouse Gases; Proposed Rule, 74 Fed. Reg. (Apr. 10, 2009).

based on the following theory: Apportioning gas usage among the 9 process categories based on quantifiable indicators and then applying emissions factors will result in less uncertainty and more precision as compared with the IPCC Tier 2b methodology, which has two process categories – CVD and Etch – and which allows a facility to apportion gas usage based on engineering judgment.

⇒ ***As with the original Proposed Rule, the independent entity – International Sematech Manufacturing Initiative (ISMI) – with whom U.S. EPA itself has partnered on emissions reporting method development – performed supplemental surveys at SIA' request during the Re-Proposed Rule comment period. The ISMI Supplemental Survey Reports, appended to our comments today, demonstrate that the theory behind the Refined Method falls apart – and that the Refined Method would introduce even greater uncertainty as compared with the IPCC Tier 2b Method – for several reasons:***

- **The Technical Support Document (TSD) presenting EPA's uncertainty analysis fails to account for the potential magnifying impact on uncertainty that can occur when the method establishes more categories for apportionment, due to the hundreds of process recipes a facility would need to account for during aggregated apportionment across hundreds of process tools.**

    - **Process "recipes" indicate which gas to use when, but do not specify a precise amount of gas that must be applied at each step in the recipe. Instead, a recipe achieves precision through strict control of other parameters, such as pressure, flow rate, temperature, etc.**

    - **The variation in gas usage amount – and therefore in the level of uncertainty – for any single recipe is minute. That minute level of uncertainty undergoes a magnification effect, however, when hundreds of process recipes must be taken together and apportioned across hundreds of process tools. That magnification effect becomes more pronounced the more process categories and subcategories across which a facility must apportion each recipe.**

    - **The TSD fails to recognize, let alone account for, this magnification effect. Indeed, the Proposed Refined Method, by requiring apportionment across five times as many process categories as the IPCC Tier 2b method, would end up increasing – and not reducing – the level of uncertainty as compared with IPCC Tier 2b by introducing new sources of error.**

⇒ These new sources of error are potentially compounded by variations in gas usage across differing generations of technology and individual facility configurations. EPA has based the Proposed Refined Method on gas usage distribution of a single large manufacturer. As the ISMI Supplemental Surveys indicate, however, this manufacturer is not reflective of the industry as a whole. Moreover, the ISMI Supplemental Surveys demonstrate that across all respondents, the wafer cleaning subcategories account for one percent or less of total gas usage, as do several of the etch subcategories. As a result, these multiple categories and subcategories create another potential source of error without any corresponding benefits given their small overall size.

⇒ In addition to the foregoing, SIA has moved beyond the ISMI Survey reports and performed additional analysis. Through its additional analysis, SIA identified other evidence that multiple flaws exist in the TSD's uncertainty analysis. SIA provided this evidence to EPA on 10 June 2010, but also is appending it to our comments today.

B. <u>The Proposed Refined Method Would Result in Significant Capital and Ongoing Compliance Costs</u>

The costs to the semiconductor industry of complying with the Re-Porposed Rule are significant and substantially higher than those estimated by EPA. The ISMI supplemental survey results found that the estimated cost burden for the semiconductor industry to comply with just the Re-Proposed Rule's gas usage consumption tracking requirements (excluding the gas apportioning costs) would exceed $3 million per year in labor and operational/maintenance costs alone – already exceeding EPA's estimate of $2.9 million for the entire industry. In addition, the industry expects to incur more than $3 million in capital expenditures to meet Re-Proposed. This cost is reflective of facilities migrating from using a default heel factor and meeting specific tracking requirements.

C. <u>An "Alternative Refined Method" Would Achieve Greater Data Accuracy As Compared With EPA's Proposed Refined Method, And In Doing So, Would Avoid Undue Burden</u>

As the ISMI Survey Report for the original Proposed Rule indicated that 81% of respondents currently estimate gas purchases, typically by relying on the Intergovernmental Panel on Climate Change (IPCC) default gas usage 10% heel factor. The Report also demonstrates that only one large company uses IPCC Tier 3; the remainder of Survey participants estimate emissions via IPCC Tier 2a, 2b, or some combination of tiers, with the majority of companies using Tier 2a.

However, SIA has never asserted that EPA should accept this *status quo*. Instead, we have been urging the Agency to adopt an enhanced version of the

IPCC methodology. Through our recent dialogue with EPA between its original Proposed Rule and during the Re-Proposal comment period, SIA has identified an "Alternative Refined Method" that is far superior to the Proposed Refined Method in terms of both accuracy and cost. This Alternative Refined Method would consist of the four key components:

1. **Gas-Specific Consumption Factors**: Require, unless infeasible, that a facility develop a heel factor specific to each type of cylinder and for each gas type based on the point established as the trigger for changing out the cylinder.

As explained in our comments on the original Proposed Rule – and reiterated in our comments today – gas-specific consumption factors reduce the uncertainty associated with the default heel factor currently being used under the IPCC method. We are pleased that EPA has included gas-specific consumption factors as a requirement in the Re-Proposed Rule. As explained in our comments today, however, the proposed § 98.123's cylinder tracking and 1% accuracy measurement devices calibration requirements do not accord with current industry practices and would entail significant costs without a commensurate gain in accuracy.

2 **Facility-Wide Apportioning Protocol**: Facility-Wide Apportioning Protocol: Require apportioning of gas usage based on an alternative to the Proposed Refined Method that apportions across the following five process categories: (1) CVD Chamber Cleaning – in-situ Plasma; (2) CVD Chamber Cleaning – Remote Plasma; (3) CVD Chamber Cleaning – in-situ Thermal; (4) Etch; and (5) Wafer Cleans. These five process categories, as explained in our comments, would move beyond the two IPCC Tier 2b categories to achieve greater accuracy, but would avoid the uncertainly issues created by the Refined Method's 9 categories. To assure a sufficient degree of accuracy, this apportionment among the five categories should occur based on a combination of at least one quantifiable indicator and engineering judgment.

Facility-specific engineering models that are based on some quantifiable indicator(s) related to the facility's tool and infrastructure configuration are more appropriate for apportioning gas consumption to individual process categories at a higher level (CVD vs. Etch but not sub-categories for etch). Most facilities will need to incorporate one or more indicators in a model to accurately apportion gases. Among these indicators are: measuring gas usage to a specific tool that may run a single process category or multiple (albeit related) process categories; tool monitoring data; process monitoring data; tool utilization data; and engineering specifications.

3. **Tier 2b For All, Except Tier 3 Where Available**: Require use of Tier 2b emissions factors by all facilities, except require use of Tier 3

measurement data where in possession of a facility, for the etch and CVD categories. Require use of the emissions factors in EPA's Notice of Data Availability (NODA)[4] for 2 additional categories (CVD Chamber Cleaning – in-situ Thermal and Wafer Cleans). For heat transfer fluids, require a mass balance method keyed to purchase and offsite shipment.

4. **Abatement Default Factors**: Allow for default factors based on abatement installed capabilities, but otherwise allow for a reasonable DRE test sample size and timeframe.

Section 98.96 of the Re-Proposal would prohibit semiconductor manufacturers from obtaining full credit for the emissions reductions provided by their GHG abatement devices unless the source undertakes the following measures on an annual basis:

(1) a certification that each abatement system has been installed and is maintained, and operated in accordance with manufacturers' specifications;

(2) an accounting of each system's uptime;

(3) a random sampling of 3 units or 20% of installed units (whichever is greater), following EPA's DRE protocol.

SIA is concerned that the foregoing measures would require semiconductor manufacturers to generate a large amount of information on an annual basis for the hundreds of point of use (POU) abatement devices used for GHG control on individual process tools. Doing so would prove quite costly and burdensome. Indeed, the ISMI Supplemental Survey Reports indicate that EPA's cost assumptions on POU abatement compliance would run an estimated $242,000 per fab – not the $70,000 per fab estimated by EPA – and would be incurred by 29 instead of the 23 facilities assumed by EPA. As a result, annual compliance costs would run $7 million for this element alone – not including lost production time – instead of the $1.61 million estimated by EPA.

We acknowledge that the Re-Proposal would allow the use of a default DRE value in lieu of the foregoing, and appreciate U.S. EPA's willingness to provide this option in contrast to the original proposal, which would not have provided any such option. The Re-Proposal's 60% default DRE value, however, falls well short of the GHG control offered by POU devices, and therefore, penalizes semiconductor manufacturers who have operated voluntarily and in

---

4 Mandatory Reporting of Greenhouse Gases: Notice of Data Availability; Default Emission Factors for Semiconductor Manufacturing Refined Process Categories, 75 Fed. Reg. 26904 (May 13, 2010).

good faith under the MOU and other GHG reduction programs to install and maintain control devices.

SIA recognizes the importance of using test data, where available, but would submit that where a device has been designed for GHG reductions, default factors reflect test data with sufficient accuracy and that testing should be required only for new models of abatement systems that are not simply a variant of an existing system. Moreover, periodic testing is not necessary as long as a facility operates equipment properly.

D. The "Alternative Refined Method" Is Superior To The Proposed Refined Method, But Nevertheless, Could Be Upgraded Over Time Through An Emissions Factors Inventory Process Similar To That Used For Conventional Pollutants

As detailed in Part Three of our comments, the above Alternative Refined Method would provide data that is far superior to the Re-Proposed Rule's Refined Method in terms of accuracy and uncertainty. It also would build on the longstanding partnership between our industry and EPA to achieve two key objectives:

(1) upgrade reporting methodologies across the industry to produce data of sufficient quality to support EPA's GHG regulatory programs; and

(2) allow GHG reporting to begin in a timely manner for the 2011 reporting year.

Notably, with the Alternative Refined Method, EPA still would be imposing significant reporting burdens on the many companies which, as demonstrated by the original ISMI surveys, do not currently use measured heel factors and rely on Tier 2a solely and/or a Tier 1/Tier 2 combination. Moreover, SIA believes that EPA should institute a process for upgrading the Alternative Refined Method over time to reduce uncertainty and increase accuracy. The collaborative, extra-rulemaking process used to develop and revise the AP-42 emissions factors for VOCs would seem to provide a sensible and practical model.

II. SIA CONTINUES TO HAVE SERIOUS CONFIDENTIALITY CONCERNS

Section 98.93 sets out 9 semiconductor manufacturing process categories and sub-categories. The Re-Proposal would require annual reporting of both usage and mass emissions information for each of these categories and sub-categories on an individual gas-by-gas basis, as well as for a 10th "N_2O other" category.

Information about which gases a facility uses in which processes and in what amounts would reveal competitively valuable, trade secret information.

Indeed, such details of GHG usage and emissions by process would provide those familiar with our industry specific knowledge of proprietary device designs and manufacturing processes, and also effectively may reveal customer sensitive product information based on manufacturing loadings. Annual production levels and/or facility capacities also could be used by competitors to characterize manufacturing efficiencies and to influence prospective customer decisions.

Under the circumstances, our members likely would have no choice but to claim much of the information that would be required under the Re-Proposal as confidential, including the mass emissions information broken down by gas and by process. We understand that U.S. EPA may wish to receive some of this kind of information from our members to verify their compliance. We question, however, the need for the Agency to receive it routinely, especially in view of the trade secret nature of the information.

As we detail in Part Three below, we believe that the information in question qualifies as a legal matter for trade secret protections. Yet, EPA has not spoken at all in the Re-Proposal or in other contexts on this issue.

We strongly urge EPA to proceed with the rulemaking that it has announced on trade secret protections under the GHG reporting and other regimes.[5] Indeed, it is not legally appropriate for EPA to take the position that it can make "no promises" at this time and to remain silent. The issue of trade secret protections goes to the heart of our business, and without any understanding whatsoever of EPA's position on this issue, SIA does not have an adequate opportunity for comment on this aspect of the Re-Proposal.

---

[5] **See 74 Fed. Reg. 56287.**

PART TWO:
SEMICONDUCTOR INDUSTRY BACKGROUND

I. <u>OVERVIEW OF SEMICONDUCTOR MANUFACTURING</u>

A. <u>Process and Finishing Steps</u>

In general, semiconductor manufacturing consists of a series of processing and finishing steps:

⇒ **<u>Crystal Growth:</u>** Crystal growth operations involve the growing and processing of silicon "crystals" to create wafers. The crystal growth area generally includes the following process operations:

- ✓ Crystal Pulling
- ✓ Wafer Slicing
- ✓ Wafer Polishing
- ✓ Wafer Cleaning
- ✓ Epitaxy
- ✓ Equipment/Parts Cleaning

Few semiconductor manufacturing operations include crystal growth. Rather, most of the fabs in the U.S., purchase wafers from separate crystal growing facilities.

⇒ **<u>Wafer Fabrication</u>**: Semiconductor manufacturing centers around wafer fabrication – a series of integrated processes to etch the intricate circuit "imagery" onto the wafers through encoding and other steps that impart essential conductive properties. Wafer fabrication generally includes the following process operations:

- ✓ Epitaxy
- ✓ Diffusion

  – Pre-Diffusion Cleaning
  – Quartz Tube Cleaning

- ✓ Thin Film Processes
- ✓ Lithography

– Positive Photoresist
– Negative Photoresist
– Photoresist Stripper

✓ Wet Etch

✓ Dry Etch (plasma)

✓ Ion Implant

✓ Chemical Vapor Deposition

✓ Metallization

✓ Equipment/Parts Cleaning

⇒ **<u>Assembly/Test Operation</u>: After the wafers have been fabricated, the next stage involves cutting each wafer into individual semiconductor "chips" and assembling those chips according to specifications, such as, for example, circuit board assembly. Assembly/test operations generally involve the following process operations:**

✓ Wafer Cleaning

✓ Wafer Dicing

✓ Die Attach

✓ Wire Bonding

✓ Plating

✓ Encapsulation

✓ Final Test

✓ Equipment/Parts Cleaning

⇒ **<u>General Facility Services</u>: In addition to the foregoing semiconductor manufacturing activities, each facility also has general operations. These operations include boilers, waste treatment, cooling towers, chemical storage and ultra-pure water preparation.**

Of the foregoing process and finishing steps, wafer fabrication constitutes the most significant semiconductor manufacturing operation in terms of the global business demands for production upgrades, advancement and innovations. Thus, the remaining text focuses on wafer fabrication.

B. <u>Chemical Use</u>

1. <u>Conventional Pollutants</u>

The structural details involved in many electronics products are unique as compared with other more traditional manufacturing sectors. For example, the structural details on a semiconductor chip are microscopic. Indeed, current leading-edge chip manufacturing technology creates details of less than 100 nanometers (one tenth of a micron). These extremely small scales generate exceptionally demanding process tolerances. Most manufacturing processes must occur in "clean rooms" with atmospheric particle contents at least several orders of magnitude lower than typical room air. To achieve this environment requires continuous circulation of fresh, filtered air. N_2O

Process chemicals used in semiconductor manufacturing must meet rigorous purity specifications due to the precise nature of the manufacturing process. Fabrication plants typically employ a variety of chemicals in dozens or even hundreds of different pieces of equipment. The majority of the chemicals used are relatively non-volatile, and therefore, an individual piece of equipment typically will have a small volume of emissions. The result is an air emissions stream that is typically high in volume with very dilute pollution concentrations.

Volatile organic compounds ("VOCs") represent the largest class of chemicals employed by the semiconductor industry. Historically, the industry also has had significant usage of ozone depleting substances ("ODSs"), but semiconductor manufacturers phased out ODSs, largely through substitutions with organic solvents and with other fluorinated compounds.

2. <u>Global Warming Compounds</u>

a. Nature of PFC Use

The semiconductor industry uses perfluorocarbons and hydrofluorocarbons (collectively referred to as "PFCs" by the industry and often referred to in the Re-Proposed Rule as "F-gases") in the fabrication of semiconductor silicon wafers. PFCs are used in two processes essential to semiconductor production: 1) cleaning of chemical vapor deposition (CVD) tool chambers, which are used to lay down thin films of chemicals onto the surface of silicon wafers; and 2) dry etching of integrated circuits into those thin films.

The PFCs used in semiconductor fabrication include:

- ✓ hexafluoroethane (C_2F_6);
- ✓ octofluoropropane (C_3F_8);
- ✓ nitrogen trifluoride (NF_3);

- ✓ tetrafluoromethane (CF_4);
- ✓ sulfur hexafluoride (SF_6);
- ✓ trifluoromethane (CHF_3);
- ✓ octofluorocyclobutane (C_4F_8); and others.

Generally, C_2F_6, C_3F_8 and NF_3 are used for chamber cleaning, and account for about 75 percent of PFC usage at a semiconductor wafer fabrication site (or "FAB"). The remaining PFCs – CF_4, SF_6, CHF_3 and C_4F_8 – are used primarily in etching.

b. The Criticality of PFCs to Semiconductor Manufacturing

PFCs possess characteristics that cannot be d uplicated by currently available alternative chemicals. These compounds, therefore, are critical to the manufacturing of semiconductors and to the semiconductor industry. The fluoride atom in PFCs is highly effective in etching silicon, silicon oxide, and other thin films on the surface of silicon wafers and the stable nature of PFCs allows unmatched precision in etching – a requirement for modern semiconductor manufacturing, which is dependent on the ability to produce ever smaller, and therefore faster, circuits.

In addition to their high etching performance, PFCs also clean (CVD) tool chambers quickly and exceptionally well, which allows the deposition of high-purity thin films onto silicon wafers required for manufacture of semiconductors. PFCs also are non-toxic, and therefore, pose minimal health risk to workers. Because of these properties, PFCs are of unmatched performance in the fabrication of semiconductors. Indeed, without these gases, it simply would not be possible to etch circuits to the extreme limits required in the manufacture of leading edge integrated circuits. Furthermore, unless and until suitable substitutes are found, PFCs undoubtedly will play a critical role in the manufacture of the next generation of nano-devices.

Our industry's PFC uses are critical, but small on a relative basis. Indeed, based on U.S. EPA's most recent greenhouse gas emissions inventory, semiconductor emissions of PFCs (defined as perfluorocarbons within the GHG Inventory), SF_6 and HFCs comprise only 0.07% of the total U.S. inventory of greenhouse gases.

II. SIA'S HISTORY OF PROACTIVE AND COOPERATIVE ENGAGEMENT WITH U.S. EPA ON GHGS

In the early 1990's scientific studies indicated that PFC gases had high Global Warming Potentials (GWPs). As a result, SIA member companies began to consider approaches for stewardship, recognizing world concern that PFCs have global warming potential. After engaging in dialogue with EPA over a

number of months, SIA member companies joined with EPA to form the "PFC Emission Reduction Partnership for the Semiconductor Industry." This Partnership was formalized in a 1996 Memorandum of Understanding (MOU) under which the participating companies agreed to:

(1) endeavor to reduce the absolute and normalized rate of PFC emissions from U.S. semiconductor manufacturing operations;

(2) share non-confidential information about technologies for reducing PFC emissions;

(3) implement a comprehensive system for reporting their PFC emissions to EPA; and

(4) undertake a research and development effort to determine whether it would be appropriate for the industry to set specific goals for PFC reduction.

The semiconductor industry has consistently applied its reduction efforts to a "basket" of gases relevant to our operations. This basket includes not only perfluorocarbons (CF_4, C_2F_6), SF_6, and HFCs (*e.g.* CHF_3), but also NF_3.

As the 1996 MOU was being finalized with U.S. EPA, U.S. semiconductor manufacturers also entered into discussions with manufacturers worldwide, which led to the formation of the World Semiconductor Council (WSC) in 1996.[6] Initially, the WSC included the semiconductor industry associations of the United States (SIA) and Japan (JSIA), Europe (ESIA) and Korea (KSIA), with Taiwan (TSIA) joining soon afterwards and China (CSIA) joining in 2007. The WSC's member associations currently represent about 85% of the world's semiconductor manufacturing capacity.

One of the first cooperative projects undertaken by the WSC was the adoption, in 1999, of a voluntary global PFC emission reduction program with a goal of reducing absolute emissions to 10% below each association's baseline emission level by the year 2010. The WSC voluntary agreement represented the first time that an international industry sector had joined together in a cooperative effort to address the issue of global climate change. The WSC itself, and several SIA member companies, have received EPA Climate Protection Awards for their work within this collaborative industry-wide effort.

With no controls, global semiconductor PFC emissions were projected to increase by a factor of more than seven between 1995 and 2010, due to worldwide increases in semiconductor manufacturing to meet the demands of today's technology-driven economy. However, as a result of the global emission reduction program, current worldwide emissions are instead only slightly above

---

[6] The WSC's website is available at: http://www.semiconductorcouncil.org.

baseline levels, and the WSC expects the 10% reduction goal to be achieved by 2010. Furthermore, it is anticipated that new programs will be developed within the WSC to continue this effort into the next decade.

Semiconductor manufacturers have been able to reduce PFC emissions by taking a number of actions including:

- ⇒ **Process optimization, to minimize the amount of PFCs needed to make semiconductors;**
- ⇒ **Where possible, replacing higher GWP PFCs with alternative compounds;**
- ⇒ **Employing alternative manufacturing processes, to minimize PFC emissions; and**
- ⇒ **Improving PFC abatement systems.**

Since our baseline year of 1995, the SIA MOU participants have already reduced their absolute PFC emissions by more than 25%. In the 2009 reporting year, the participating companies reported PFC emissions totaling 0.63 MMTCE (million metric tons of carbon equivalents).

Beyond the MOUs, SIA and its member companies have been supportive of our Nation's efforts to develop a sound policy for control of PFCs and other greenhouse gases (GHGs). We have been engaged in dialogue with U.S. EPA and Congressional staff on legislative approaches. Most recently and most pertinent to our comments today, we also have been working with U.S. EPA on viable approaches for GHG emissions reporting by semiconductor manufacturers – one of the deferred sectors in U.S. EPA's final GHG reporting rule and the subject of the GHG Reporting Re-Proposal.

PART THREE:
ISSUES, CONCERNS AND PROPOSED SOLUTIONS

I. ISSUES RAISED BY THE RE-PROPOSED RULE'S REPORTING APPROACH AND SIA'S RECOMMENDED ALTERNATIVE APPROACH FOR OBTAINING RELIABLE EMISSIONS DATA IN A TECHNICALLY SOUND, LEGALLY VALID AND COST EFFECTIVE MANNER

The Re-Proposed Rule's "Refined Method" is not viable. It stems from a technically flawed uncertainty analysis and erroneous assumptions about semiconductor industry tools and practices. SIA believes that an Alternative Refined Method that builds on existing emissions estimating methods being used under the Partnership with EPA can meet EPA's data needs. SIA also has additional concerns about the Re-Proposed Rule reporting requirements and the impacts on both the protection of sensitive business information and competitiveness of the U.S. industry given the intense global pressures of semiconductor markets.

To provide the EPA with evidence to support these claims, SIA collaborated once again with the International SEMATECH Manufacturing Initiative (ISMI) to conduct two supplemental surveys across a representative sampling of the industry. The ISMI Supplemental Survey Reports are provided with these comments. We also incorporate by reference the Survey Reports submitted with out comments on the original Proposed Rule.

SIA presented testimony outlining our concerns at the public hearing, and then provided further details at a meeting with EPA representatives at a May 19, 2010 and a June 10, 2010 webinar. During both the meeting and the webinar, SIA reviewed some data from the ISMI surveys and sought to gain a fuller understanding EPA's assumptions of industry practices and to identify specific questions to address in our comments.

SIA's comments below key off of our discussions at the meeting and webinar. We present a more fulsome summary of the ISMI Supplemental Surveys (and append the Survey Reports to our comments); provide responses to specific EPA requests and questions; present an Alternative Refined Method; and address other areas of concern raised by the Re-Proposed Rule.

A. Gas Consumption Determination

1. Issues Raised by Re-Proposed Rule

B. Gas Consumption Determination

The Re-proposed Rule provides an alternative method from the 2009 Proposed Rule to determine annual GHG gas consumption. In the alternative

method, gas consumption (C) is calculated based on acquisitions (A) and disbursements (D) from purchase records, the inventory of input gas (I) at the beginning and end of the year, along with facility-wide gas-specific heel factors (h) to be developed for each cylinder/container type for each gas used. *See* proposed § 98.93, Equation I-10 and proposed § 98.94. EPA requests comments on this alternative method, stating in the Re-Proposed Rule's Preamble: "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)." 75 Fed. Reg. 18661.

SIA recognizes that the requirement to develop facility-wide gas-specific heel factors and apply them to purchase records in this manner is less onerous than the method proposed in the 2009 Proposed Rule, which would have required the use of flow meters to determine gas usage. SIA also recognizes that facility-wide gas-specific heel factors will greatly improve the accuracy of the gas usage determination over using the 2006 IPCC 10% default value. We note, however, that, according to the 2009 ISMI survey, 81% of the responding facilities will have to institute practices not currently in place to determine all of their facility-wide gas-specific heel factors to meet the Rule requirements.

SIA questions the significance of accounting for the "inventory" of gases at the end of the reporting period and raises concerns over the burden of determining this inventory. In the survey conducted in 2009 by ISMI1, 81% of the survey respondents estimated F-GHG consumption by tracking purchases and assuming a default heel factor, typically the 2006 IPCC specified 10%. These respondents were not tracking individual cylinders/containers in their facilities or measuring gas usage by any other means. A typical facility can have hundreds of individual cylinders/containers in service. Determining the quantity in each cylinder at the end of the reporting period would create a tremendous burden for these facilities. It would also create additional burden to facilities that may be tracking individual cylinders/containers at their facilities but at the point of cylinder changeout; end of reporting period inventory may not be comprehended, only the usage by cylinder changeouts during that reporting period. It is expected that year-on-year, the total inventory of each F-GHG and N_2O would not vary widely. Furthermore, if usage for a previous reporting rule was "under-reported" or "over-reported" due to relying only on purchase records, not accounting for the inventory, the usage for the following reporting rule would account for the deficit or excess amount.

The Re-Proposed Rule states "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 the calculate the previous gas-specific heel factor." 75 Fed. Reg. 18700. It also states "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 determine values, you shall weigh that cylinder or measure the pressure of that cylinder with a pressure gauge, in place of using a heel factor.'' 75 Fed. Reg. 18700. EPA has requested comment on the frequency of these exceptional circumstances and also the proposed percentage difference (i.e. 20 percent). 75 Fed. Reg. 18661.

In the course of minor operational modifications, a facility may adjust a certain trigger point for a single cylinder or a small amount of cylinders by a small amount to determine the effect on the process. This may be a temporary or permanent adjustment – and may only be for a small number of cylinders of that gas type. In some of these instances, the percentage change from the original trigger point may exceed the 1% requirement to recalculate, but may not result in any significant change in the amount of residual gas in the cylinder due to the amount of gas contained in the cylinder. A facility-wide gas-specific heel factor recalculation requirement of 5% of trigger point may be more reasonable and practical and would likely be representative of any significant change. It would also reduce the burden of tracking multiple facility-wide gas-specific changes (and the intervals during which the change applied) that may only be temporary.

1. <u>ISMI Supplemental Survey Results</u>

The original ISMI GHG Facility Survey results indicate that 80% of the respondents estimate gas consumption based on purchases and an assumed heel factor. No respondent uses mass flow controllers with +/- 1% accuracy for tracking gas consumption. The estimated minimum average cost to install infrastructure to comply with the gas consumption tracking requirements of the rule as proposed is $0.72 million per fab with an estimated annual operating cost of $0.22 million per fab. Based on an estimated 91 semiconductor facilities that would be subject to the Re-Proposed Rule, the total estimated minimum cost for the industry to comply with the gas consumption data requirements is $65 million for infrastructure installation and $20 million for annual operating costs.

The 2010 Supplemental ISMI Survey asked about exceptional circumstances for cylinder changes differing from the trigger point. Of the 13 respondents, only one facility reported that because they currently track all cylanders, they could track these exceptional cylinder changes. According to this company, however, exceptional cylinder changes occur very infrequently (facility reported 6% or less). The typical reasons for changing out a cylinder at a different point are customer request and engineering development activities. Given the sensitive nature of semiconductor processes, cylinders would rarely – if ever – be changed 20% past the trigger point by any facility; they would only be changed prematurely – or before the trigger point had been reached. A facility

can changeout 1000 or more cylinders of F-GHG and N_2O per year. Each cylinder changed out > 20% prematurely would have to be specifically removed from the purchase record accounting and the calculation of Eq. I-10, measured, and tracked manually. The burden of this independent tracking is not warranted given that under-reporting of gas usage is highly unlikely.

The Re-Proposed Rule states: "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." 75 Fed. Reg. 18702. The Re-Proposed Rule did not include specific requirements for instrument calibration, however the Final Mandatory Greenhouse Gas Reporting Rule, Subpart A-General Provisions 40 C.F.R. §98.3: "All measurement devices must be calibrated according to the manufacturer's recommended procedures, an appropriate industry consensus standard, or a method specified in a relevant subpart of this part. All measurement devices shall be calibrated to an accuracy of 5 percent… Subsequent calibrations shall be performed at the frequency specified in each applicable subpart." The general provisions appear to require an initial calibration to an accuracy of 5% and then some subsequent calibrations specific to industry or instrument types. Many older fabricators measurement equipment do not have instrumentation that can meet the 1% accuracy requirements, but the majority of those facilities have accuracies of 2 to 4%. The 5% accuracy requirement provided in the general provisions enables those fabricators to utilize their existing equipment. The majority of new fabricators and new equipment will be able to meet the 1% requirement as discussed in the analysis of the survey data below.

According to the 2010 Supplemental ISMI Survey, 74% of the respondents have measurement devices that meet the 1% accuracy/precision requirement while 26% may not. Of this 26%, the measurement devices used at many of the facilities that do not meet the 1% requirement likely do have an accuracy/precision in the 2-4% range. This 26% of facilities can be expected to incur additional capital costs to meet this instrumentation requirement.

As indicated in SIA's comments to the original Proposed Rule, the scales and pressure monitoring devices are not calibrated per ISO 9000 Quality Standards for calibration and are not calibrated using NIST traceable standards or other methods that would be considered true calibration. In many cases, calibration of a measurement device would involve removing it from service and possibly even disconnecting it from a tool, rendering it inoperable. This is not acceptable because semiconductor fabs operate continuously and are subject to rigorous contamination control for replaced equipment (where a device had to be removed for external calibration) to prevent system contamination.

As with other process sensitive parameters in our industry, performance verification is conducted for these scales and pressure measurement devices as needed since the trigger point for change-out is a highly critical measurement to

ensure that the integrity of the gas delivery to the tools is not compromised (change-out indication too late) and that costly gas is not unused (change-out indication too soon). SIA believes that performance verification, such as a 2 point, zero and span process for scales or a comparable in-line method for mass flow controller or pressure transducers - or similar method- would satisfy the intent of instrument calibration required in the Final Rule – and it is often done more frequently than annually. Performance verification would be consistent with the requirement of an appropriate industry consensus standard.

Overall, the 2010 Supplemental ISMI survey estimated that the cost burden for the semiconductor industry to comply with just the Re-Proposed Rule's gas usage consumption tracking requirements would exceed $3 million per year in labor and operational/maintenance costs alone. In addition, the industry expects to incur more than $3 million in capital expenditures to meet the requirements as Re-Proposed. This cost is reflective of facilities migrating from using a default heel factor and meeting specific tracking requirements.

In the meeting with USEPA on May 19, 2010, EPA requested comment on placing the requirement of cylinder measuring and tracking on the gas supplier. While this may be practical at some facilities at additional cost, SIA believes this would not be practical in most cases. Specific "used" cylinders may not be uniquely identified once they are removed from service such that their correlation of their incoming weight to their outgoing weight may not be possible. Furthermore, suppliers often pick up used cylinders from customers in multi-facility trips, also known as "milk runs." This would convolute the requirement to weigh specific cylinders for specific customers when they return to the supplier location. In any case, this would require the establishment of an "on and off" facility tracking system for which facilities and supplier protocols are not currently equipped or staffed. Most certainly all costs for this tracking would be incurred ultimately by the facility, thus avoiding no part of the cost and burden associated with gas usage tracking as proposed.

2. <u>SIA's Proposed Alternative Approach</u>

SIA appreciates EPA's willingness in the Re-Proposal to adopt much of SIA's alternative for calculation of a gas-specific heel factor offered in our comments on the original Proposed Rule. As illustrated in Table 1 of those comments (re-proposed again below), this methodology offers significant accuracy improvement in gas consumption estimates compared to use of a default heel factor by accounting for what can be substantial relative differences in change-out trigger points from gas to gas and from one facility to another, due to differences in tool and process sensitivity.

Use of facility determined gas specific heel factors is sufficiently reliable relative to direct measurement of all gas usage because container change-out based on established trigger points is consistently executed in semiconductor fabs as a result of simultaneous requirements to protect processes from

excursions and to make maximum cost-effective use of raw materials. Furthermore, costly installation of gas distribution and measurement infrastructure is not required

Table 1 – Calculation of Gas-Specific Heel Factors

Gas	Pressure (psig)	weight (lb)	Change trigger (psig or lb)	Heel Factor %
C2F6		95	7 lb	7%
C4F8		16	1 lb	6%
C4F8		88	5 lb	6%
CHF3		70	17.6 lb	25%
CF4	1800		180 psig	10%
NF3 etch	1450		85/60 psig	6% / 4%
NF3 CVD	1450		40 psig	3%
SF6		50	12 lb	24%
N_2O		60	12 lb	20%

FLUORINATED GHG USAGE DETERMINATION
SIA PROPOSED ALTERNATIVE

Semiconductor facilities shall use annual purchase records showing acquisitions and disbursements of gas containers along with facility-wide gas specific heel factors to determine annual gas consumption for each gas. If a cylinder/container change-out trigger point is modified by more than 5% of the value used to determine that facility-wide gas specific heel factor (weight or pressure), the facility shall re-calculate the facility-wide gas specific heel factor for that gas/container type and apply at the point during the year that the change occurs. Alternatively, if a facility tracks gas consumption by individual cylinders/containers, that method may be used in lieu of the heel factors applied to purchase records since the usage is still determined by the changeout trigger. Facilities are not required to account for the inventory of F-GHG and N_2O gas in every cylinder/container at the beginning and end of the reporting period; only the usage according to purchase records during that reporting year. Cylinders changed out prematurely (i.e., before the trigger point is reached) need not be accounted for independent of the annual purchase records.

All instrumentation used in association with gas consumption determination (e.g., scales, pressure transducers, thermometers) shall have an accuracy and precision of 5% of full scale or better. Such instrumentation shall undergo a performance verification appropriate for the range of gas usage measurement (e.g., weight or pressure) and nature of the instrument consistent with an industry accepted practice at least annually.

C. **Apportioning Gas Usage**

1. Issues Raised by Re-Proposed Rule

a. Wafer Passes Will Not Be A Suitable Quantifiable Indictor of Gas Usage For All Facilities

The Re-Proposed Rule states that "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." 75 Fed. Reg. 18700) In summary, these categories are defined as 4 etch processes (oxide, nitride, silicon, and metal), 3 CVD chamber clean processes (in-situ plasma, remote plasma, and thermal), and 2 wafer cleaning processes (bevel cleaning and ashing) for a total of nine (9) process categories, which are also referred to as the "refined process categories" 75 Fed. Reg. 18662). The preamble further states that "…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.." 75 Fed. Reg. 18661) and that "…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…" 75 Fed. Reg. 18662).

The results of the supplemental 2010 ISMI survey clearly indicate that using wafer pass as the required metric to apportion gas usage is not appropriate for a variety of reasons. Although facilities may track wafer passes through a given tool, fab tracking systems and tool recipe data is either not easily available or this data does not necessarily provide the data required for gas usage apportioning. In etch, for example, a given tool may have hundreds of individual recipes with multiple gases used, flows, and times. . The recipe mixes are very complex and dynamic, with different types and ranges of recipes varying literally on a daily basis due to changes in production mix.

Furthermore, these recipes are often designed to etch through a film stack which consists of two or more of the "refined process categories" for etch – and the gases used for each portion of the film stack may be the same. The tool itself does not track how much of each gas was used for what portion of the film stack was etched, nor is that feasible. Wafer pass, therefore, may not be viable as a required quantifiable indicator for all facilities.

The ISMI assessment of semiconductor facilities in the United States have indicated that each facility is unique in terms of its wafer size, process technologies and product mix, gas distribution systems, and production management systems. As such, there is no "one size fits all" approach to apportion gas use and estimate PFC process emissions

b. EPA's Uncertainty Analysis To Support Apportionment Across The 10 Process Categories Is Flawed

ISMI performed a detailed analysis of the uncertainty model the EPA presented in the TSD and the usage data provided through the 2010 ISMI Supplemental Survey. Many of the assumptions and conclusions from the EPA analysis raised serious questions regarding the validity of the analysis. The ISMI analysis was provided by SIA to EPA on June 10, 2010. Some of the issues identified include:

1. The uncertainties applied to the emissions factors used in the uncertainty analysis comparing the 9 category analysis to the tier 2b categories analysis overstated the accuracy of the etch emissions factors. Specifically, the use of 10% uncertainty for emissions factors with only a single data point and no specified uncertainty overstates the certainty of the emissions factor value.
2. The gamma distribution truncated the distribution for emissions factors less than zero but an infinite distribution tail for emissions factors greater than 1 resulted in 2 to 3% of the runs emitting more gas than was used in the process. This distribution reflects a major problem in the analysis.
3. The gamma distribution did not fit well with some of the data where the value of Uij was high. A beta distribution provides a better fit to the available data and improves the Monte Carlo model output.
4. There is a wide distribution of the etch utilization factors within each of the 4 etch categories. For most companies a significant number of etch processes do not have available etch factors. This necessitates using the Tier 2b etch factor for those factors which do not have data thus converging the model.

In summary, the limited available data for the etch emissions factor does not justify the extension of the etch category from 1 to 4 categories as detailed in the re-proposal. In addition, the industry does not have the systems in place to cost-effectively apportion PFC use and etch emissions factors across the fabrication process. This combination of factors suggests that the best approach is to use a 5 category apportioning model with a single etch category at this time.

2. ISMI Supplemental Survey Results

The 2010 supplemental ISMI Survey estimates that semiconductor industry would incur an estimated $2.6 million in capital expenditures along with an estimated annual labor and operational/maintenance cost of $22 million to

apportion gas usage according to the proposed "refined process categories." Please see the Survey Report appended to our comments for further details.

3. <u>SIA's Proposed Alternative Approach</u>

To achieve its objectives, EPA should adopt an Alternative Refined Method that includes a Facility-Wide Apportioning Protocol. This Protocol would apportion across five process categories, instead of just the two IPCC Tier 2b categories, based on a combination of at least one quantifiable indicator and engineering judgment, with flexibility to determine the most appropriate indicator based on facility configuration and processes.

FLUORINATED GHG USAGE APPORTIONMENT SIA PROPOSED ALTERNATIVE

Semiconductor facilities shall apply a Facility-Wide Apportioning Protocol for the following five process categories:

1. **CVD Chamber Cleaning – in-situ Plasma**
2. **CVD Chamber Cleaning – Remote Plasma**
3. **CVD Chamber Cleaning – in-situ Thermal**
4. **Etch**
5. **Wafer Cleans**

Apportionment must occur based on at least one quantifiable indicator and engineering judgment. A facility may determine the most appropriate indicator based on its configuration and processes.

Facility-specific engineering models that are based on some quantifiable indicator(s) related to the facility's tool and infrastructure configuration are more appropriate for apportioning gas consumption to individual process categories at a higher level (CVD vs. Etch but not sub-categories for etch). Most facilities will need to incorporate one or more indicators in a model to accurately apportion gases. Among these are measuring gas usage to a specific tool that may run a single process category or multiple (albeit related) process categories, tool monitoring data, process monitoring data, tool utilization data, and engineering specifications.

Some facilities may also have an overall facility management software system that collects certain process and tool parameters that, combined with engineering judgment and/or specifications, could be used to provide the necessary data for a facility-specific model to apportion gas usage among certain process categories. Flexibility to choose indicators facility-by-facility by process category will provide more accurate estimates now and the option to

implement improved methods later when new technologies develop. However, even these complex, facility-specific engineering models will have severe limitations to apportion gas usage to the proposed etch sub-categories when multiple etch processes are used within a single tool.

As stated above, apportionment of gas use should be done based on a facility specific plan, developed by each facility, based on the technologies run at the system, the ability to assign gas use to specific tools, the tool and process control systems used in the facility and the extent of the tool and process control data which is available for manipulation, and available engineering data on tool and process gas use. Examples of specific options which could be employed include:

a. Matching of gas use from distinct distribution systems to specific process types. Some facilities may have distribution systems segregated by process type or specific to tools which will enable direct matching of use to process type and calculation of emissions using process emissions factors.

b. Development of an apportionment model based on the analysis of the primary process recipes for the manufacturing technologies employed at the facility. This analysis would develop use estimates by total gas consumption per wafer start per primary technology recipe type, which could then be multiplied by wafer starts over a time period to calculate gas use for the process type. These calculations could be performed for each primary technology recipe and the results manipulated against the known gas use and process emissions factors using statistical methods to generate total emissions by gas. A more detailed discussion of this proposal is provided in Appendix A.

c. Develop a facility specific methodology for apportioning using a combination of methodologies dictated by the specific fabricator systems. Options include using or combining information from:

    a. matching gas use from distinct, measured distribution systems to specific process types;

    b. process monitoring data and engineering knowledge;

    c. tool monitoring data and engineering knowledge;

    d. engineering and wafer start or wafer pass data;

    e. destruction efficiencies for abatement systems applied to gas use;

    f. other facility specific data.

    g. Where a fabricator has some or all processes covered by abatement systems, the facility should be able to perform emissions calculations based on gas use and abatement system destruction efficiencies. Destruction efficiencies should be measured in accordance with the SIA proposed alternative presented in Section III D

d. If a facility has a software-based facility management system properly configured to be capable of providing the necessary data to apportion gas usage to specific process categories, the facility can rely on their system output for the usage.

In all cases, the facility develops a location-specific F-GHG gas use monitoring and calculation plan detailing the specific data collection processes, apportionment methodologies, and calculation and modeling processes used to determine actual facility gas use and emissions. The specific quantifiable indicators used should not be prescribed by this Rule.

D. Applying Emissions Factors

1. Issues Raised by Re-Proposed Rule

The emission factor coverage on the multiple etch categories as provided in the NODA is inadequate and the data quality is not sufficient to support the differentiation of etch processes into multiple categories. SIA has provided further detail is provide in the uncertainty analysis given to EPA on June 10, 2010, and included as Attachment B1 to these comments.

The overarching issue is that the both the number and accuracy of the available etch emissions factors is not adequate to support refinement of the etch category for this rule. The SIA refined model proposal, which closely follows the EPA refined model proposal, provides significant improvements in method accuracy through better calculation of gas use through the use of measured, facility specific heel factors and improved differentiation in the chamber clean processes.

2. SIA's Proposed Alternative Approach

To achieve its objectives, EPA should adopt an Alternative Refined Method under which a facility will rely on Tier 3 measured data if available, and if not, then rely on the Tier 2b emissions factors for the etch and CVD categories and on the factors proposed by EPA in the NODA.

METHOD FOR APPLYING EMISSION FACTORS SIA PROPOSED ALTERNATIVE

Facilities will use process-specific Tier 3 factors for their gas utilization and by-product formation provided that:

⇒ they already have physical possession of those factors either from tool suppliers or through their own measurement methodologies consistent with the ISMI 2006 Guideline; and

⇒ they conclude – based on their professional judgment – that those factors are representative of their particular process.

For facilities that do not have process-specific Tier 3 factors in their physical possession, the 2006 IPCC Tier 2b default emission factors will be an approved alternative for process platforms and toolsets for 300mm wafers or smaller. The amount of each gas used by each process will be determined using the Facility-Wide Apportioning Protocol discussed above.

The 2006 IPCC Tier 2b methodology is a globally accepted method for estimating GHG emissions for a semiconductor manufacturing facility. The Tier 2b factors were developed using 190 distinct measured emission factors for CVD chamber cleaning and etch processes and are accurate for developing an inventory of GHG emissions. [Draft Report - Emission Factors for Semiconductor Manufacturing: Sources, Methods and Results, February 2006] Given that a typical facility has many tools using these gases in hundreds of different process recipes, a facility is, in effect, an inventory.

In this context, SIA emphasizes that given most facilities do not currently use Tier 3 methodology, limited data representative of manufacturing conditions exist upon which to base an estimate of the improved accuracy of Tier 3 emissions calculations. The only actual comparisons known to SIA were presented in our comments on the original Proposed Rule and demonstrate only a modest difference in the results of the methods. Since then, EPA has engaged in an effort to develop emissions factors based on more recent data. Although these data have not been made available to SIA – and therefore we are not able to comment fully – the emissions factors in EPA's recent Notice of Data Availability (NODA) do not differ materially from the Tier 2b factors – thereby underscoring the appropriateness of using the Tier 2b factors at this time.

3. Additional Reliability and Accuracy Considerations Supporting SIA's Proposed Alternative Method for Applying Emissions Factors

a. Original ISMI Survey Results

As part of the GHG Facility Survey participation, one respondent provided additional data from an analysis completed to compare results of 2006 IPCC Tier 2a, 2b, and 3 methods for three 200 mm fabs over 3 years and three 300 mm fabs (one for 1 year and two for 3 years each). These 16 data sets show that Tier 2a and Tier 2b produce a very similar result with Tier 2a averaging +2% higher (standard deviation 9%). When comparing Tier 3 to Tier 2a and 2b, Tier 3 yielded an estimated 10 % and 11% lower, respectively (standard deviation 3%

and 8%). The IPCC methods for the electronics industry require use of 100-year time horizon global warming potentials (GWP100) to calculate CO2 equivalent emissions. As noted in the IPCC Fourth Assessment Report, uncertainties of GWP100 are ±35% (IPCC 4th ARWG1, Ch.2, p.214). The largest difference between methods is less than one-third of the uncertainties of GWP100.

b. Proven Reliability and Accuracy of Tier 2b Factors

As stated above, the IPCC Tier 2b factors are widely recognized as a reliable basis for estimating emissions. The Chicago Climate Exchange (CCX), a voluntary market-based emission reduction and trading system that requires participants to establish emissions baselines and track their progress towards emission reductions goals, recognizes the reliability of Tier 2b factors.

Using reliable gas usage by process estimations along with Tier 2b default factors should satisfy the intent of the Re-Proposed Rule, particularly considering the inherent uncertainty (+/-35% or greater) in the modeled global warming potentials themselves, which continue to change over time and are used in the emissions estimations. In addition, assuming that governments are moving towards market-based approaches to GHG management, the relatively small uncertainties that may remain should be left to the markets to resolve. It should be noted that other sources of GHG emissions that may become part of future market-based approach will also have some inherent, but nonetheless acceptable, small levels of uncertainty.

Transitions to new wafer sizes represent the best opportunity to consistently introduce new equipment requirements. The industry is currently in the process of developing tools for the next wafer size - 450 mm. According to ISMI, "IC makers wish to work with suppliers of wafer fab equipment to achieve capability for pilot lines in 2012 and prepare for manufacturing their products on 450 mm wafers", while initial new facility ramp-up may occur in the 2014-2015 timeframe. Note that detailed technology goals will be defined by individual companies' business requirements. The introduction of production-ready 450 mm tools represents the most appropriate transition point for consistent application of Tier 3 factors. As with current emissions estimation processes used by the industry, data for a supplier's baseline process should be considered representative of company-specific processes.

4. Possibility of A Future Emissions Factors Initiative

If EPA desires to increase the number of etch, it will be necessary to undertake an effort to establish emissions factors for an appropriately defined set of etch processes. However, it is not appropriate to include such emission factors in the text of the Re-Proposed Rule itself, since modifying or adding new emission factors as new tools and processes are adopted, or as emission factors for existing tools are refined, would be hampered by the formal rulemaking that would be required to modify the text of the Rule. Moreover, the

short period of time between the Rule proposal and finalization simply does not provide a sufficient opportunity to develop appropriate emission factors. For these reasons, in dealing with conventional pollutants, EPA has a long-history dating back to the 1960s of developing and upgrading emissions factors through a collaborative technical process open to interested stakeholders that is outside the confines of a formal rulemaking. The AP-42 emissions factors for volatile organic compounds (VOCs), originally developed in 1968 and upgraded through EPA's Technology Transfer Network, Clearinghouse for Inventories & Emissions Factors, provides an appropriate model. See http://www.epa.gov/ttnchie1/ap42/.

The Clean Air Act's New Source Performance Standards (NSPS), codified at 40 C.F.R. Part 60, explicitly require existing facilities, upon modification, to calculate their increase in emission rate by applying "Emission factors as specified in the latest issue of 'compilation of air pollutant emission factors,' EPA Publication No. AP-42 . . . ." 40 C.F.R. § 60.14(b)(1). AP-42, then, is a compilation of emission factors developed and periodically updated by the Emission Factor And Inventory Group (EFIG), in EPA's Office Of Air Quality Planning And Standards (OAQPS), with opportunity for public review and stakeholder input. Incorporating these external emission standards by reference in the regulations, rather than including them in the CAA regulations themselves, would allow the emission factors to be updated without having to undergo the full rulemaking needed to modify the text of the Rule and would provide EPA and stakeholders the time needed to develop appropriate emission factors. If such a model were adopted in the Re-Proposed Rule, SIA would be willing to work with EPA to develop such appropriate emission factors that could be maintained in an analogous, extra-rule, database could be updated periodically as needed.

Another possibility for a future initiative would entail an MOU between our industry and EPA to develop and execute a voluntary, cooperative plan with the industry to develop a full set of etch emissions factors, with defined uncertainties, to model and determine the degree of refinement that can be achieved in order to reduce the uncertainty of the emissions calculations. As set forth above, SIA has a history of successful MOU development and execution with EPA, and would consider adopting this model for the development of emission factors.

5. Potential Additional Alternative

SIA also believes the Re-Proposed rule should provide flexibility to allow alternative measurement methods for F-GHG and N_2O. These methods should be included in the Final Rule as alternatives to the requirements in the Re-Proposed Rule. While these options may not be fully implementable today, they could provide viable options in the near future. These option are:

1. Facility Wide Emission Factor

Development of an accurate facility wide emission factor using statistical parameters. A facility wide emission factor would eliminate the compounding uncertainty that is realized when using multiple variables (i.e., apportionment of gas usage, process emission factors, abatement destruction removal efficiency) to calculate emissions. Such a facility wide emission factor could be established by:

a) Characterization of the facilities final exhaust using an approved protocol (e.g. 2006 ISMI, 2010 EPA protocol)
    a. Sampling would include sufficient final exhaust data to understand the variability and develop an average factor and uncertainty range
    b. The method could contain a requirement to retest and establish new emission factors if gas use increased by 20%.
b) Develop an average emission factor with uncertainties comparable to other acceptable methods utilizing the final exhaust data
    a. Use mass balance to quantify constituents below method detection limits
c) Calculate emissions over time by applying this average emission factor to actual gas consumption (i.e. emissions = gas consumption x EF)

2. Factory Modeling

Factory modeling may be possible for new factories if the appropriate software is integrated into new systems. With the appropriate capability built into new tools, it may become possible to track tool level gas consumption and develop emission factors for a representative sample of process steps. Total emissions could then be expressed as a function of chemical use multiplied by the average emission factors.

As measurement technologies are likely to improve over time, we believe it is important that the final rule contain flexibility that would allow for the use of alternative methods without a future rule change.

E. Accounting for N_2O Emissions

1. Issues Raised by Re-Proposed Rule

The Re-Proposed Rule in Equation I-9 requires the use of a process utilization factor (U) for N_2O and states “(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." 75 Fed. Reg. 18699.

The preamble further states "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." 75 Fed. Reg. 18665)

The Re-Proposed Rule defines two distinct categories for N_2O usage in semiconductor manufacturing: CVD processes and "other" processes (processes other than CVD processes). The Re-Proposed Rule only allows for a default utilization factor for N_2O used in CVD processes of 20% if a facility-specific N_2O utilization factor is not developed. As indicated in our comments to the Proposed Rule (as acknowledged in the preamble), SIA has provided data to support a 40% default factor. The Re-Proposed Rule does not allow for any default utilization factor (0%) for N_2O used in processes other than CVD. SIA believes the same 40% is a conservative default factor for this "other" process category as well as N_2O is primarily a reactant gas in processes such as furnace deposition and would be expected to be consumed to some extent.

METHOD FOR APPLYING N_2O EMISSION FACTOR
SIA PROPOSED ALTERNATIVE

Where facility-specific N_2O utilization factor is not developed, a facility shall use a default utilization factor of 40% for N_2O used in both CVD processes and other processes.

It should be noted that the inclusion of N_2O in GHG emissions estimation is an overall improvement in emissions reporting accuracy over the IPCC Tier 2b or Tier 3 methods as it was not included in either. The "other" process category for N_2O also adds and additional process category not currently recognized in the gas usage apportioning aspect of the Re-Proposed Rule (9 process categories) Refined Method.

F. POU Abatement - Verification of DRE

1. Issues Raised by Re-Proposed Rule

Section 98.96 of the Re-Proposal would prohibit semiconductor manufacturers from obtaining full credit for the emissions reductions provided by their GHG abatement devices unless the source undertakes the following measures on an annual basis:

(1) a certification that each abatement system has been installed and is maintained, and operated in accordance with manufacturers' specifications;

(2) an accounting of each system's uptime;

(3) a random sampling of 3 units or 20% of installed units (whichever is greater), following EPA's DRE protocol.

SIA is concerned that the foregoing measures would require semiconductor manufacturers to generate a large amount of information on an annual basis for the hundreds of point of use (POU) abatement devices used for GHG control on individual process tools. Doing so would prove quite costly and burdensome.

We acknowledge that the Re-Proposal would allow the use of a default DRE value in lieu of the foregoing, and appreciate U.S. EPA's willingness to provide this option in contrast to the original proposal, which would not have provided any such option. The Re-Proposal's 60% default DRE value, however, falls well short of the GHG control offered by POU devices, and therefore, penalizes semiconductor manufacturers who have operated voluntarily and in good faith under the MOU and other GHG reduction programs to install and maintain control devices.

2. Results of the ISMI Survey Regarding Abatement

The results of the original ISMI GHG Facility Survey indicate that 50% of the respondents with abatement have not characterized abatement DRE. These respondents use either defaults or DRE measurements provided by suppliers. Only one respondent has characterized the majority of their installed POU abatement units. Based on the prescriptive testing methods required by the rule, the estimated average cost for a fab to comply is $0.24 million over 7 weeks. This cost is greater for a fab with >100 units. Based on an estimated 66 fabs having POU abatement, the minimum total industry cost to comply with abatement testing is $17 million over 450 weeks of testing.

The 2010 Supplemental ISMI Survey indicates similarly staggering costs, which a facility can avoid only through a significant penalty of a default DRE of 60%. The ISMI Supplemental Survey Reports indicate that EPA's cost

assumptions on POU abatement compliance would run $242,000 per fab – not the $70,000 per fab estimated by EPA – and would be incurred by 29 instead of the 23 facilities assumed by EPA. As a result, compliance costs would run $7 million – not including lost production time – instead of the $1.61 million estimated by EPA.

3. SIA's Proposed Alternative Approach

The SIA offers this proposed alternative for DRE measurement of abatement devices that will provide sufficiently accurate and representative DRE factors for companies to be able to apply the factors to their emissions (where applicable) to reflect emissions reductions due to these devices. This alternative also meets the objectives of the Re-Proposed Rule as part of an Alternative Refined Method.

VERIFICATION OF DRE
SIA PROPOSED ALTERNATIVE

EPA requested comment (75 Fed. Reg. 18668) on the proposed default DRE value and additional data and supporting documentation of DREs from studies that have been conducted on properly installed, operated, and maintained abatement systems and consistent with EPA's DRE Protocol. SIA agrees with the approach to establish and provide default DRE values for abatement systems as SIA requested in the June 9, 2009 comments. However, the proposed 60% default factor is based on the destruction of CF4, and should not be applied to other F-GHGs. CF4 is the most stable compound and difficult to destruct F-GHG and should be addressed separately. SIA facilities recognize that CF4 is difficult to abate and have installed systems based on the capability to abate the other F-GHGs (C2F6, C3F8, NF3, SF6, CHF3, etc.) SIA facilities using the proposed 60% DRE default factor for abatement of F-GHGs other than CF4 will significantly overstate emissions. Also, the preamble (p.18659) states that the C2F6 DRE may be overstated by a factor of up to 10 as compared to an overstated factor of 40 to 50 for CF4 when dilution is not taken into consideration. SIA understands that the EPA has data to establish more appropriate DREs for F-GHGs other than CF4 which would prevent the overstatement of F-GHG emissions.

SIA proposes that the EPA consider including the following DRE requirements in the rule. Provide additional default factors for C2F6 and the other F-1GHGs that are easier to abate. Allow the use of manufacturer's certified DREs discounted by 10% to account for differences between field and lab certification conditions. Discounted manufacturer's DREs would account for both the installed equipment's capability and the slight reductions in DREs resulting from use under field conditions. Note, EPA's 2009 proposal allowed the use of manufacturer's DRE data generated using the EPA abatement systems testing protocol. Systems processing CF4 emissions would

continue to use the 60% default DRE. Allow facilities to calculate emissions using the average DRE for a gas or gas type determined by testing a representative sample of abatement units. These methods will result in the application of more accurate DREs.

EPA requested comments (75 Fed. Reg. 18669) on the required frequency of abatement system performance measurement. SIA disagrees with the requirement, to test the greater of 3 or 20% of all F-GHG abatement systems at a facility annually indefinitely in lieu of using the 60% default DRE. The annual cost burden (as indicated in the 2009 and 2010 survey results) of these tests is excessive and the EPA has not provided data to establish the need for annual testing beyond what is currently required in other EPA regulations.

Because EPA's DRE Protocol was recently published and not available for testing DRE of existing abatement systems prior to its publication, we may not have characterized the DREs of installed abatement systems. We believe that the units are performing as expected based on manufacturer's performance criteria. We propose that a facility should be able to use the average DRE based on the data from performance testing. SIA proposes a facility can provide test data for an abatement system class to certify annual emissions. Upon completion of two (2) years of random testing of at least two (2) abatement systems by class at a facility, the DRE by class should be able to be certified in subsequent years. In addition, the facility would be expected to perform the required system maintenance.

EPA has requested comment (75 Fed. Reg. 18668) on whether to require an independent quality assurance audit/inspection for abatement system installation operation, and maintenance. SIA does not find it necessary for a third party quality assurance audit/inspection for abatement system installation, operation, and maintenance. Certification by a company responsible official is consistent with other programs and SIA believes this is appropriate for F-GHG reporting. Furthermore, restricting the facility to only the manufacturer's maintenance specifications provide upon purchase of new equipment would not allow for future improvements in operational and maintenance procedures. Another concern is that this provision's restrictions may not allow for competition of maintenance contracts.

EPA (75 Fed. Reg. 18668) has requested comment on the proposal to account for and report the uptime of abatement systems and detailed information on how uptime may be monitored and calculated. Semiconductor facilities may monitor abatement operation with existing manufacturing systems. As indicated in the ISMI surveys additionally labor and cost will be required to install and maintain these monitoring systems. SIA proposes that EPA allow for a facility specific monitoring systems and to calculate uptime as the percent of the total abatement operation and included in the fraction of input gas in Eqs. I-7 and I-8 and multiplied by the DRE in the equation.

EPA (75 Fed. Reg. 18669) requested comment on the method proposed for proper measurement of DRE at a facility and the proposed RSASTP for abatement systems by class. ISMI has provided SIA comments for the EPA DRE protocol and is provided in Attachment B.3. SIA requests the EPA accept these comments including that FTIR is already an acceptable approved EPA method (*i.e.*, Method 320, Method 301 validation, etc.) to characterize other air emissions without the need for additional analytic equipment (i.e. Quadrapole Mass Spectroscopy).

G. Emissions of Heat Transfer Fluids

1. Section 98.92: GHGs to Report

Section 98.92(a)(5) requires reporting "Fluorinated GHG's from Heat transfer fluids." 75 Fed. Reg. 18698.

The premise of this requirement is that all Fluorinated Heat Transfer Fluids are used only for the purpose the name implies. We are aware of uses of these molecules for purposes other than to transfer heat. These uses are expected to generate insignificant emissions and the use of the mass balance equation maybe unwarranted. In other cases the use may not be accurately measured using Eq. I-12. 75 Fed. Reg. 18700. For these small uses and emissions a "*de minimis*" quantity for use and reporting should be established. This is consistent with the refrigerant management requirements found in 40 CFR part 82 which apply the most detailed tracking requirements only to refrigerant units containing more than 50 lbs. of refrigerant. Once a use and reporting "*de minimis*" quantity is established, our uses above this limit for purposes other than to transfer heat should be accounted for using any of the other accepted methods in this Subpart.

The original ISMI F-HTF Survey results indicate that companies use at least 17 different F-HTFs with ambient vapor pressures ranging from 6 – 30,000 + Pascals. Four of the fluids reported have exceptionally low (<400 Pa) vapor pressure so are not considered volatile and should not be assumed to be emitted to the atmosphere if not accounted for by material tracking. Some F-HTFs do not have a documented IPCC 4th Assessment GWP (so CO2e estimation is not possible).

2. § 98.93 Calculating GHG emissions (Eq. I-12).

Upon close review the calculations proposed will identify amounts that cannot otherwise be accounted for and would therefore be assumed to be fugitive emissions. However, the identifiers continue to be somewhat confusing. We suggest that some of these terms be clarified and use language that is more normally used to describe some of the variables in the accounting equation.

The following is a summary of the definitions provided in the Re-Proposed Rule 75 Fed. Reg. 18700 and an SIA proposed alternative language or clarification for the terms:

Re-Proposed Rule:	"I_{io} = Inventory of heat transfer fluid i at the end of previous reporting period"
SIA Alternative:	I_{io} ="Inventory in containers other than equipment at the beginning of the reporting year" (in stock or storage).
Re-Proposed Rule:	"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."
SIA Alternative:	P_{it} = "Fluorinated heat transfer fluids acquired for the reporting year contained purchased equipment, from recyclers or from suppliers."
Re-Proposed Rule:	"N_{it} = Total nameplate capacity [charge] of equipment that contains heat transfer fluid i and that is newly installed during the reporting period"
SIA Alternative:	N_{it} = Inventory [charge] contained in new equipment installed during the reporting period."
Re-Proposed Rule:	"R_{it} = Total nameplate capacity [charge] of equipment that contains heat transfer fluid i and that is retired during the current reporting period"
SIA Alternative:	R_{it} = "Inventory contained in equipment retired during the reporting period."
Re-Proposed Rule:	"I_{it} = Inventory of heat transfer fluid i at the end of current reporting period"
SIA Alternative:	I_{it} = "Inventory in containers other than equipment at the end of the reporting year" (in stock or storage).

We agree with the definition for D_{it} in the Re-Proposed Rule.

It should be noted that all terms used in Equation I-12 should be expressed in liters (l) since the overall emissions calculation (E) includes multiplying by the density of the F-HTF in kg/l. All of the term definitions in the Re-Proposed Rule include both liters (l) and kilograms (kg) as units. This should be clarified to be (l) for all.

3. SIA's Proposed Alternative Approach

SIA proposes clarification of the terms used in Equation I-12 as stated above.

EMISSIONS OF HEAT TRANSFER FLUIDS SIA PROPOSED ALTERNATIVE

Semiconductor facilities shall report usage of fluorinated heat transfer fluids with vapor pressures that exceed 400 Pa and that have a documented IPCC 4^{th} Assessment Global Warming Potential. For application of these compounds other than heat transfer, where the usage exceeds a "de minimis" quantity of 20 kg, the usage shall be reported using any of the other accepted methods in this Subpart.

H. Reporting Threshold and *De minimis* Emissions

Small electronics manufacturing processes with wafer production capacities of less than 1,080 m^2 emit less than 5% of the 25,000 metric ton CO2e reporting threshold for this rule. However, some of these small processes are located at large integrated manufacturing facilities that have on-site power generating utilities (e.g. Boilers for generating heat and electricity). GHG emissions from combustion operations at these facilities typically exceed the 25,000 tons CO2e threshold and, therefore, bring the entire facility into the reporting rule, including the small electronics manufacturing process.

To reduce the regulatory burden for insignificant sources of GHG emissions, SIA proposes to modify the reporting threshold section for electronics manufacturing (Subpart I, Section 98.91) to exclude these small processes from the reporting rule as highlighted below:

EXCLUSION FOR SMALL ELECTRONICS MANUFACTURING PROCESSES
SIA PROPOSED ALTERNATIVE

Sec. 98.91 Reporting threshold.

You must report GHG emissions under this subpart if your facility contains an electronics manufacturing process with a production capacity >1,080 m^2 and the facility meets the requirements of either Sec. 98.2(a)(1) or (a)(2). To calculate GHG emissions for comparison to the 25,000 metric ton CO2e per year emission threshold in paragraph Sec. 98.2(a)(2), calculate ~~process~~ emissions from electronics manufactur~~e~~ing processes with a production capacity >1,080 m^2 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.

The Re-Proposed Rule does not allow for any *de minimis* reporting level. *A company could use a certain F-GHG in a very small amount* that would be difficult and burdensome to track. Reporting requirements of GHG emissions should establish a *de minimis* threshold of CO2e per chemical that does not require tracking in the total facility inventory.

DE MINIMIS EMISSIONS
SIA PROPOSED ALTERNATIVE

A company may exclude from emissions calculations any F-GHG that comprises less than five percent of the total usage of F-GHGs where:

a) The de minimis amount of the F-GHG used in etch comprises less than 5% of the total usage of all F-GHG compounds in etch.

b) The de minimis amount of the F-GHG used in CVD chamber cleaning comprises less than 5% of the total usage of all F-GHG compounds in CVD chamber cleaning.

c) The de minimis amount of the F-GHG used in wafer cleaning comprises less than 5% of the total usage of all F-GHG compounds in wafer cleaning.

d) The de minimis amount of the F-HTF used comprises less than 5% of the total usage of all F-HTF compounds.

I. SIA Alternative Refined Method

The preamble of the Re-Proposed Rule presents " Review of Existing Reporting Programs and Methodologies and Consideration of Alternative Methods." This Section states "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…" 75 Fed. Reg. 18664)

SIA's Proposed Refined Method mirrors EPA's modified Tier 2b method ("Refined Method) with some alternatives to the components of this modified Tier 2b method as described in Section III (A-D)

SIA's Alternative Refined Method

SIA proposes to improve the accuracy of overall emission reporting information by improving several of the data elements and continuing to use Tier 2b factors. The improvement in data will be derived from the combination of methods detailed below.

1) **Proposed Gas Consumption Determination as presented in these comments**
2) **Proposed Facility-Wide Apportioning Methodology as presented in these comments**
3) **Existing Tier 2b Emission Factors (possibly add one or two categories from latest EPA factors) as presented in these comments**
4) **Proposed Abatement Requirements as presented in these comments**
5) **Proposed N_2O Emission Factors as presented in these comments**

Based on the information included and provide in our meeting with EPA on June 10, 2010, SIA requests that EPA recalculate the uncertainty of using the Tier 2b method using the improved uncertainty values for existing factorsidentified in the TSD and NODA.

J. Consideration of Alternative Methods

1. IPCC Tier 3 Methodology

The preamble of the Re-Proposed Rule states "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…. 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.." 75 Fed. Reg. 18664. This same concept is stated elsewhere as such in the preamble: "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." 75 Fed. Reg. 18663.

As indicated in our comments to the 2009 Proposed Rule, SIA does not support requiring the use of IPCC Tier 3 methodology

2. CEMS

The Re-Proposed Rule preamble states "Another option we are considering is to evaluate emissions from electronics manufacturing using continuous emissions monitoring system(s) (CEMS). Under this approach, facilities would be required to install and operate CEMS to measure process emissions." 75 Fed. Reg. 18665. SIA does not believe that CEMS is a viable option for emissions estimation.

CEMS are not employed in, nor are they appropriate for, quantifying mass emissions of PFCs from semiconductor manufacturing facilities for several reasons: A typical semiconductor manufacturing facility (a "fab") has a large number (in the hundreds for a large fab) of individual tools using and potentially emitting PFCs . Clearly, installing CEMS on such a large number of points is not feasible. Therefore, the only option would be to install CEMS at final exhaust stacks where the combined tool emissions exit the facility. Even this could require many monitoring devices as a large fab site can contain 20-30 stacks (sometimes separated by large distances) that the emissions would be dispersed among. Furthermore, a typical fab would have 8-10 different fluorinated gases in the exhaust stream. Historically, CEMS have predominantly been used for monitoring single pollutant exhaust streams. The types of instruments most widely used in existing CEM applications would also not be applicable to monitoring PFCs. The most frequently used technology for discrete short term measurements of the mix of fluorinated gases used in semiconductor manufacturing is Fourier Transform Infrared Spectroscopy, or "FTIR." This has not been widely used as a CEMS technology in this industry and

there would be many difficulties inherent in adapting this method for long term, continuous measurement of mass emissions from exhaust stacks.

FTIR technology has been widely used in the industry for periodic testing of concentrated emissions in the exhaust of individual fab tools, and is very effective at quantifying emissions of a wide range of pollutants in that situation. It has also been used to monitor workspace areas to provide notice of leaks of potentially hazardous materials. However, both of these applications have considerable differences from attempting to quantify facility wide mass emissions on a continuous basis.

Monitoring of workspace areas for hazardous gas releases, commonly known as toxic gas monitoring, is achieved through a variety of instrument types, FTIR being a rather accurate (albeit expensive) technique. Toxic gas monitoring is intended to alert the facility of a potential point-source release of a hazardous gas at a level potentially harmful to human health. However, these systems are not designed for accurate, long-term quantitative determination of emissions; they are designed to alert the facility if a gas level nears or reaches a level of concern at any time. Since such releases are not common and are certainly not a course of business, the appropriateness of FTIR for this application does not translate to the appropriateness for use as a continuous quantitative measure for F-GHG emissions.

End of stack fab exhaust points, where CEMS would need to be located, typically have very dilute pollutant concentrations (typically in the parts per billion range). In fact, for significant periods of time concentrations of the individual pollutants that make up the PFC category are near or even below instrument detection levels. One SIA member, Intel Corporation, has attempted to perform periodic (not continuous) measurement of PFC emissions from the final exhaust points at one of its manufacturing sites that contained 30 exhaust stacks and several hundred thousand cubic feet per minute of combined exhaust. In one 8 hour test period, emissions of seven different PFCs were monitored using FTIR. The amount of time the PFCs were below the detection limit varied by individual compound but ranged from 40-90% of the total test time. In other words, for a majority of the monitoring period, the only thing known about emissions was that they were somewhere between zero and the detection level. For a system with such a large air flow, this results in a large measurement error when trying to quantify total mass emissions. The error would be further compounded by any periods of downtime the CEMS experienced. Existing regulations dealing with CEMS used under the acid rain program (40CFR part 75) typically allow device downtime of up to 10%. Semiconductor facility emissions, while dilute, are also highly variable due to the fact that there are a large number of individual points and it is impossible to predict which combination of them might be emitting at any given time. Presumably, a source would assume some average emissions value during the CEM downtime periods. For a highly variable exhaust stream, this would introduce another substantial error for as much as 10% of the reporting period

assuming the existing standard were applied and could be achieved. Downtime problems may be more pronounced in a semiconductor operation, due to the type of environment the CEM device would be operating in. Exhaust systems that contain fluorinated compounds may also contain ammonium salt particulates, or corrosive materials such as acids. This environment could result in additional maintenance requirements that would impact CEMS instrument uptime.

Analytical instrumentation capable of detecting F-GHG compounds, such as FTIR, are highly sophisticated devices that require specific expertise to operate and interpret spectral results. The expertise would also be required to determine if the instrument(s) are operating properly, if calibration is required, and to perform the necessary calibrations in accordance with proper protocols. This expertise is not widely available for ready deployment in the number of facilities that would be required to employ CEMS. In addition to the expertise required to interpret and understand results, the systems would require substantial maintenance by personnel who are familiar with the operation of these devices. This would present a challenge initially as the industry has not previously utilized CEMS and therefore generally does not have personnel on staff with this training. Even if such resources were to be developed over time, this would clearly add operating cost.

Even if these limitations could someday be addressed, CEMS would still not be able to monitor all of the emissions covered by the reporting rule. Fluorinated heat transfer fluids are generally used in support operations and not connected to exhaust systems. Hence, emissions are likely to be "fugitive", meaning they will not pass through the monitored exhaust stacks which essentially makes them invisible to a CEM. That being the case, CEMS would still provide an incomplete solution even in the unlikely event that the above mentioned shortcomings of stack monitoring could be addressed.

In short, there is no existing, proven CEM methodology for our industry that has been used in this manner. Even if the tools that are used for short-term measurements could somehow be adapted for CEM, the results yielded would be extremely inaccurate. In fact, it is highly questionable whether they would result in any improvement in accuracy over existing methods. Requiring the use of CEMS would require the semiconductor manufacturing industry to invest significant resources to develop and demonstrate some type of continuous monitoring technology that would ultimately still yield inaccurate results in place of the currently established conservative approaches, like IPCC Tier 2b, or the SIA Refined Method proposed in these comments.

II. OTHER ISSUES AND CONCERNS RAISED BY THE PROPOSED RULE

A. Potential For Significant U.S. Competitiveness Impacts

U.S. semiconductor manufacturing operations face tremendous competition from non-U.S.-based operations, including overseas foundry operations. No other "Country or Region" regulations require such detailed GHG emissions reporting as would the Re-Proposed Rule:

⇒ No requirement to report usage and/or emissions by gas/process

⇒ No requirement for company-specific emissions characterization or such rigorous gas usage measurements

⇒ No abatement testing requirements

⇒ No expense to comply with U.S rule and no risk of revealing confidential or competitive information

Clearly, "leakage" could potentially result as U.S. companies migrate their manufacturing operations to other countries/regions which is not the intent of the Re-Proposed Rule. As noted above, SIA's member companies have worked proactively within the WSC to ensure a consistent and proactive approach to reducing PFC emissions across the global semiconductor industry. This has also served to "level the playing field" with regards to investments in PFC reduction. The industry has traditionally considered such matters "pre-competitive" which has resulted in extensive international sharing and collaboration. SIA believes it would be unfortunate to see US companies placed at a disadvantage as a result of a unilaterally stringent regime imposed in the US alone.

B. <u>Importance of Confidentiality Protections for Competitively Sensitive Business Information</u>

As described in our comments on the original proposed Rule, GHG gas usage and emissions by process is considered highly sensitive by the semiconductor industry. This information can provide specific knowledge of proprietary device design and manufacturing processes. Furthermore, facility production data and specific GHG usage and apportionment among processes can be used to inappropriately "characterize" manufacturing operations:

⇒ Provides customers and competitors an incomplete picture of manufacturing efficiencies

⇒ Influences prospective customer decisions based on perceived efficiencies and pricing

⇒ Reveals customer or supplier sensitive product information

The Re-Proposed Rule would require reporting not only of F-GHG "emission data," but also of highly proprietary information that does not constitute "emission data" in any legal, technical or practical sense of the term.

The Re-Proposed Rule also would seek various types of highly-proprietary information on gas usage apportioned across process categories and subcategories. Yet, this information likewise does not constitute "emission data," as it is not "necessary" for determining emissions, given the availability of other, less intrusive means to do so.

Information about which gases a facility uses in which processes and in what amounts would reveal competitively valuable, trade secret information. Indeed, such details of GHG usage and emissions by process would provide those familiar with our industry specific knowledge of proprietary device designs and manufacturing processes, and also effectively may reveal customer sensitive product information based on manufacturing loadings. Annual production levels and/or facility capacities also could be used by competitors to characterize manufacturing efficiencies and to influence prospective customer decisions.

SIA understands that EPA intends to engage in a separate rulemaking on how the Clean Air Act's confidential business information (CBI) protections would apply to GHGs. That rulemaking has not yet occurred, however, and in the meantime, EPA has indicated to SIA that it can "make no promises" regarding CBI. Under the circumstances, SIA reiterates below the points made in our comments on the original Proposed Rule regarding CBI.

This section first explains EPA's rules for determining whether data submitted under the Clean Air Act are "emission data" subject to public disclosure or, conversely, confidential business information ("CBI") that is not "emission data" and is therefore protected from public disclosure. This section then addresses each of the proposed data elements that the Re-Proposed Rule would require to be submitted, and explains whether each element is "emission data" or CBI that should not be disclosed to the public.

1. No Definition of "Emission Data"

The Re-Proposed Rule, like the original Proposed Rule, provides no definition of "emission data" and no discussion of what, if any, information required to be submitted under the Rule would properly be considered non-emission data. Rather, the Re-Proposed Rule contains only a few sentences in the Preamble that cite to the Clean Air Act and EPA's confidentiality regulations. The Preamble states:

> 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.

75 Fed. Reg. 18694[7] This statement recites the general rule under the Clean Air Act that "emission data" is not considered CBI and is therefore subject to public disclosure. However, the remainder of Re-Proposed Rule provides no indication as to whether all the information requirements of § 98.96 are considered by EPA to be "emission data." As explained below, much of the information the Re-Proposed Rule would require to be submitted is not "emission data" under EPA regulations.

2. <u>Emission Data Are Only Those "Necessary for Determining Emissions"</u>

EPA regulations define "emission data" as, in relevant part:

> **(A) Information *necessary to determine* the identity, amount, frequency, concentration or other characteristics . . . of any emission . . .;**
>
> **(B) Information *necessary to determine* the identity, amount, frequency, concentration, or other characteristics . . . of the emissions . . .; and**
>
> **(C) A general description of the location and/or nature of the source to the extent *necessary to identify* the source and distinguish it from other sources . . . .**

40 C.F.R. Section 2.301(a)(2)(i) (emphasis added). As explained below, this definition has been interpreted narrowly by the federal courts to mean that, where information is not strictly "necessary" to determine emissions – *i.e.*, where emissions can be determined using alternative means not relying on confidential information – that information does not qualify as "emission data" under EPA regulations.

In *RSR Corp. v. Environmental Protection Agency*, 588 F. Supp. 1251 (N.D. Tex. 1984), to meet Clean Air Act reporting requirements, RSR submitted certain documents to EPA – including an air emissions inventory data form, a federal Air Pollutant Emissions Report, and an EPA inspection/monitoring report – under a claim of confidentiality. *Id.* at 1253. After reviewing these documents, EPA determined that they were the only means of calculating emissions through a material balance calculation and therefore constituted "emission data" not protected from disclosure. *Id.* at 1254. RSR challenged the EPA determination

---

[7] A footnote to this paragraph in the Preamble references EPA's 1991 guidance document "Disclosure of Emission Data Claimed as Confidential Under Sections 110 and 114(c) of the Clean Air Act." 56 Fed. Reg. 7042 (Feb. 14, 1991). This document provides examples of information EPA considers "emission data," but it does not address information of the sort included in the Proposed Rule and is therefore of limited use for determining which information might be considered non-emission data. This paragraph also references EPA's initiation of a separate rulemaking process to address CBI issues, which SIA wholly supports.

on the basis that, in the explanation of its decision, EPA indicated that other data could potentially have been used to calculate emissions, and therefore the information at issue was not strictly "necessary" to calculate emissions. *Id.* at 1256.

The Court agreed with RSR, finding that EPA's decision was arbitrary and capricious, and thus improper, because EPA had not "considered and examined all relevant factors and alternatives" so that "release of information claimed to be proprietary could be avoided unless required by statute." *Id.* In reaching this conclusion, the court focused on the word "necessary" in the definition of emission data at 40 C.F.R. § 2.301(a)(2)(i), holding that, in order for the information claimed as CBI to be truly "necessary" to determine emissions, EPA was required to show that no alternative methods for determining emissions existed that would avoid publication of confidential information. *Id.* Thus, where alternative means existed that would have allowed EPA to determine emissions without revealing CBI, the information considered CBI by the company was not "necessary" to determine emissions, and was not "emission data." *See also NRDC v. Leavitt*, 2006 U.S. Dist. LEXIS 13326 (D.D.C. Mar. 14, 2006) (citing *RSR* and adopting a similarly strict interpretation of the "necessary to determine" requirement).[8]

Accordingly, the only two federal cases to have squarely addressed the meaning of "emission data" under the Clean Air Act have held that the term "necessary to determine" emissions is to be defined narrowly to include only data actually required to determine emissions. Data are not necessary to determine emissions, and therefore are not "emission data," if other methods of determining emissions that do not require the disclosure of CBI are available.

3. <u>EPA's Regulatory Definition of Confidential Business Information</u>

Under EPA regulations at 40 C.F.R. part 2, subpart B, in determining whether particular business information is entitled to confidential treatment, EPA must assess whether:

> (a) The business has asserted a business confidentiality claim which has not expired by its terms, nor been waived nor withdrawn;
>
> (b) The business has satisfactorily shown that it has taken reasonable measures to protect the confidentiality of the information, and that it intends to continue to take such measures;

---

8 Note also that EPA's 1991 guidance document "Disclosure of Emission Data Claimed as Confidential Under Sections 110 and 114(c) of the Clean Air Act" provides a list of information EPA considers "emission data" that does not include information of the sort included in the Proposed Rule. 56 Fed. Reg. 7042.

(c) The information is not, and has not been, reasonably obtainable without the business's consent by other persons (other than governmental bodies) by use of legitimate means (other than discovery based on a showing of special need in a judicial or quasi-judicial proceeding);

(d) No statute specifically requires disclosure of the information; and

(e) Either–

(1) The business has satisfactorily shown that disclosure of the information is likely to cause substantial harm to the business's competitive position; or

(2) The information is voluntarily submitted information (see Sec. 2.201(i)), and its disclosure would be likely to impair the Government's ability to obtain necessary information in the future.

40 C.F.R. § 2.208.

Much of the information that would require reporting by the Re-Proposed Rule is: 1) highly-guarded within the industry; 2) would not qualify as "emission data" subject to disclosure requirements; and 3) would harm the companies' competitive position if disclosed, and thus falls squarely within the realm of information to be treated as CBI under EPA's regulations. The confidentiality of each of the data elements that would be required by the Re-Proposed Rule is discussed below.

4. Analysis of Data Elements that Would Be Required by the Re-Proposed Rule

Under § 98.96, the Re-Proposed Rule would require the reporting of a variety of information, some of which is properly considered "emission data," but some of which is instead highly-proprietary information that may be relevant to the calculating or verifying emissions, but does not itself constitute "emission data." Each of the data elements for which reporting would be required under § 98.96 of the Re-Proposed Rule is discussed below.

a. § 98.96(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.

Although reporting of F-GHG on a facility-wide basis would clearly be "emission data" appropriate for public disclosure under EPA's regulations and federal case law, the Re-Proposed Rule calls for reporting of emission data on a process-specific basis. It is unclear from the repeated use of the term "processes" in this section whether the Re-Proposed Rule may require semiconductor manufacturers to submit information that could be used to identify closely-guarded process "recipe" parameters. Competition within the semiconductor industry is based heavily on innovation and the development of new and faster products. Accordingly, semiconductor manufacturers invest considerable time and money in research and development perfecting the combination of gases (a "recipe" parameter) used in each production process for each product. As such, the combination of gases used in a particular process is a highly-guarded secret within the industry and always treated as CBI. The publication of F-GHG emissions by process can provide specific knowledge of proprietary device design and manufacturing processes that would compromise the trade secret nature of this information. SIA would like EPA to clarify that the Re-Proposed Rule does not ask for reporting of process recipe information and to adopt SIA's proposed alternative approach to emission reporting that would rely on less sensitive information.

b. § 98.96(b): The method of emissions calculation used in § 98.93.

The method of emissions calculation is used in the estimation of emissions and as such are is "emission data" in the practical or legal sense. Nor is this information, as long as it is not linked to mass inputs, a highly-guarded trade secret needing protection from public disclosure. SIA therefore requests that EPA adopt SIA's proposed alternative approach to emission reporting that would require the submission of less sensitive information. If, however, EPA retains this reporting requirement, SIA requests that the Re-Proposed Rule be modified to acknowledge that the mass of input F-GHG gas data are not "emission data" under EPA regulations and hence are not subject to public disclosure.

c. § 98.96(c): Production in terms of substrate surface area (e.g., silicon, PV-cell, LCD).

Facility production capacity and specific F-GHG usage and emission data can be used to inappropriately "characterize" semiconductor manufacturing operations because it can:

⇒ provide customers and competitors an incomplete picture of manufacturing efficiencies

⇒ influence prospective customer decisions based on perceived efficiencies and pricing; and

⇒ reveals customer or supplier sensitive product information.

Accordingly, facility production capacity is highly-proprietary CBI that is never released outside of individual companies. This information also is not "emission data" in the practical sense of the term, nor, given the alternative proposed by SIA is it "necessary" to determine emissions, and thus does not qualify as "emission data" under EPA regulations. SIA therefore requests that EPA adopt SIA's proposed alternative approach to emission reporting that

would require the submission of less sensitive information. If, however, EPA retains this reporting requirement, SIA requests that the Re-Proposed Rule be modified to acknowledge that facility production data are not "emission data" under EPA regulations and hence are not subject to public disclosure.

d. § 98.96(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.

This information is used in the calculation of emissions, but does not itself constitute "emission data" under EPA's regulations. Although this information is not necessarily considered CBI, SIA has proposed an alternative to calculating emissions that does not rely on this information and requests that EPA adopt its proposed alternative.

e. § 98.96(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.

This information does not itself constitute "emission data" under EPA's regulations. Descriptions of individual processes or process categories not included in the listed categories could potentially be used to discern sensitive proprietary information about manufacturing processes and production capacities and output. SIA therefore requests that the Re-Proposed Rule be modified to explicitly acknowledge that discriptions of additional processes or process categories are not "emission data" under EPA regulations and hence are not subject to public disclosure.

f. § 98.96(f): For each fluorinated GHG and N_2O, annual gas consumed during the reporting year and facility-wide gas specific heel-factors used.

This information does not itself constitute "emission data" under EPA's regulations. To the extent it can be linked to process-specific mass of input F-GHG gases, annual gas consumed during the reporting year is a highly-proprietary, key parameter of a company's process "recipes"; as a result, disclosure of this information could cause substantial competitive harm. Facility-wide gas specific heel factors are not necessarily highly guarded proprietary information needing protection from public disclosure, so long as they cannot be linked to tank changeouts. SIA therefore requests that the Re-Proposed Rule be modified to explicitly acknowledge that annual gas consumed is not "emission data" under EPA regulations and hence is not subject to public disclosure, and to clarify that the reporting of heel factors used does not require reporting of the number of tank changeouts, unless that information also is determined not to be "emission data."

g. (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 facilitywide 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.

The fractions of each gas fed into individual process or process category do not themselves constitute emission data. This information, however, is highly-proprietary information, as it is a key parameter of a company's process "recipes" such that disclosure of this information could cause substantial competitive harm. Similarly a description of the engineering model used to apportion the gas usage, to the extent it can be linked to gas fractions would be proprietary. Any method used to develop a facility-wide apportioning factor also could be potentially linked to individual process gas use, so would also be highly proprietary. SIA therefore requests that the Re-Proposed Rule be modified to explicitly acknowledge that the fraction of gas fed into each process type with abatement device is not "emission data" under EPA regulations and hence is not subject to public disclosure.

h. § 98.96(h): Fraction of each gas fed into each process type with abatement devices.

Similar to the mass of input F-GHG data, the fraction of each gas fed into each process type is used in the calculation of abatement, and therefore emissions, but is not itself "emission data" under EPA's regulations. In addition, this information could potentially be used (in particular with other gas usage information) to discern proprietary information about manufacturing processes and recipes. SIA therefore requests that the Re-Proposed Rule be modified to explicitly acknowledge that the fraction of gas fed into each process type with abatement device is not "emission data" under EPA regulations and hence is not subject to public disclosure.

i. § 98.96(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.

The description and number of abatement devices used by each facility and their destruction or removal efficiencies and records of such clearly are not "emission data" in the legal or practical sense of the term. The same is true of a description of associated tools and processes. Moreover, this information could reveal confidential information about the types and number of different manufacturing processes that occur in each facility. Therefore, SIA requests that, if EPA retains this requirement, the Re-Proposed Rule be modified to explicitly acknowledge that the number and types of abatement devices used at each facility is not "emission data" under EPA regulations and hence are not subject to public disclosure.

j. § 98.96(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.

None of the information requested in § 98.96(j) qualifies as "emission data" in the legal or practical sense of the term. Much of the information could be used to discern sensitive proprietary information about the types and number manufacturing processes and production capacities and output at a facility:

§ (1) – certification of each abatement system could be used to determine the number of different kinds of systems in use, which could potentially be linked to specific tools and processes;

§ (2) – DRE uptime could be linked to production;

§ (3) – default DRE values for systems could be used to determine the number of different kinds of systems in use, which could potentially be linked to specific tools and processes;

§ 4: certification of systems where default DRE is used could be used to determine the number of different kinds of systems in use, which could potentially be linked to specific tools and processes;

§ (5)(i) – a description of the class and model number of the abatement systems, could be used to determine the number of different kinds of systems in use, which could potentially be linked to specific tools and processes;

§ 5(ii) and (iii) – the total number of systems in a class for a year and total number of systems measured in a year, which although less direct than an accounting of actual systems in use, could be used to determine the number of different kinds of systems in use, which could potentially be linked to specific tools and processes;

§ 5(vi) – a description of the method used to randomly select class members, which to the extent it includes information about the number of devices in each class could potentially be linked to specific tools and processes. [NB: there is no subsection 5(v).]

Therefore, SIA requests that, if EPA retains this requirement, the Re-Proposed Rule be modified to explicitly acknowledge that the information requested in subsection (j) is not "emission data" under EPA regulations and hence are not subject to public disclosure.

k. § 98.96(k): For heat transfer fluid emissions, inputs in the mass-balance Equation.

The inputs to the mass-balance equation for F-HTFs is information used in the calculation of emissions, but not itself "necessary" to determine emissions and therefore not "emission data" under EPA regulations. In addition, certain of the inputs to the mass balance equation, such as the nameplate capacity of equipment that contains F-HTF is sensitive CBI that could reveal information about specific production processes and capacities. If EPA retains its proposed F-HTF reporting requirement, SIA requests that the Re-Proposed Rule be modified to explicitly acknowledge that F-HTF mass balance inputs are not "emission data" under EPA regulations and hence are not subject to public disclosure.

l. § 98.96(l): Example calculations for F-GHG, N_2O, and heat transfer fluid emissions.

As explained above, providing the input variables necessary to perform example calculations for F-GHG, N_2O and F-HTF emissions would reveal certain CBI that is not "emission data." We therefore request that EPA adopt SIA's proposed alternative approaches to emission reporting. If, however, EPA retains the proposed reporting requirements and requires sample calculations, SIA requests that the Re-Proposed Rule be modified to explicitly acknowledge that any CBI information provided with such calculations is not "emission data" under EPA regulations and hence is not subject to public disclosure.

C. Comments On General Provisions

1. CO2e Conversion

The Re-Proposal would appear to require gas-by-gas reporting of usage and emissions information by process category or sub-category on a mass basis without any CO2e conversion. SIA is concerned about this reporting approach. In particular, the Re-Proposal provides no indication of whether EPA plans to make this information (to the extent not claimed as CBI) publicly available, or instead, will undertake to convert it to CO2e. If EPA intends to undertake a conversion, SIA would question what methodology and what GWP factors will

get used, and how the resulting numbers will get displayed and explained to the public.

SIA PROPOSED ALTERNATIVE

EPA should require any CO2e conversation be performed by the reporting entity using the latest IPCC Global Warming Potentials.

2. Infeasibility of CEMS

The Re-Proposal seeks comment on the possibility of utilizing methods other than the Refined Method, including continuous emissions monitors (CEMS). CEMS are not employed in, nor are they appropriate for, semiconductor manufacturing facilities for several reasons:

- ⇒ **A typical semiconductor manufacturing facility (a "fab") would require monitoring of 8-10 different fluorinated gases in the exhaust stream. CEMS are typically only used for monitoring single pollutant exhaust streams.**
- ⇒ **Semiconductor fab exhaust typically has very dilute pollutant concentrations. As a result, individual pollutant concentrations are near or even below instrument detection levels for significant periods of time. Thus, continuous monitoring would result in a large measurement error.**
- ⇒ **The most frequently used technology for discrete short term measurements of the mix of fluorinated gases used in semiconductor manufacturing is Fourier transform infrared spectroscopy, or "FTIR." This is not a proven CEM technology as it is not known to be suited for long-term, continuous measurement.**

In short, no CEM methodology exists for our industry. Even if the tools that are used for short-term measurements could be adapted for CEMS, the results yielded would be extremely inaccurate.

3. EPA Enforcement Policy

EPA has identified a number of violations subject to EPA enforcement. The current final GHG rule at 40 C.F.R. § 98.8 provides:

> **Any violation of the requirements of this part shall be a violation of the Clean Air Act. A violation includes, but is not limited to, failure to report GHG emissions, failure to collect data needed to calculate GHG emissions, failure to continuously monitor and test as required, failure to retain records needed to verify the amount of GHG emission, and failure to calculate GHG emissions following the methodologies specified**

in this part. Each day of a violation constitutes a separate violation.

EPA has cited Clean Air Act § 307(d)(1)(V)[9] "[S]uch other actions as the Administrator may determine." as legal authority for the captioned GHG regulations, and the mandatory reporting of GHG. As such, violations of the proposed GHG emission reporting rules would be enforced as violations of the Clean Air Act under § 113 and §§ 203-205.[10] EPA enforcement actions should be legally justifiable, uniform and consistent, and the enforcement response should be appropriate for the violations committed and the equitable facts surrounding the identified reporting violation.

SIA appreciates that the Re-Proposed Rule, when finalized, would be legally enforceable. We would urge EPA, however, to recognize the significant initial challenges that will be posed by any new GHG reporting regime. Not only will companies need to create new compliance systems, but EPA also likely will need to supplement any final rule creating such a regime with guidance to address technical nuances or to clarify ambiguities. Consistent with EPA's existing enforcement policies and practice, therefore, SIA believes that enforcement should account for these initial challenges by using less aggressive mechanisms, such as the warning letter, and by encouraging industry to perform auditing and otherwise to take advantage of EPA's Self-Disclosure Policy.[11]

4. <u>Reporting Timeframe</u>

EPA should allow facilities more time than the current three (3) months to report prior calendar year data. That period is insufficient to collect, analyze, prepare, and certify data for submission to EPA. Other reporting programs allow longer time intervals for reporting – EPA's Toxic Release Inventory allows six (6) months and California's mandatory GHG reporting program allows five (5) months.

SIA PROPOSED ALTERNATIVE

The reporting timeframe should be six months.

---

9 42 U.S.C. § 7607(d)(1)(V)(2008).

10 42 U.S.C. § 7413 and 42 U.S.C. § 7522-7524 (2008).

11 Incentives for Self-Policing; Discovery, Disclosure and Prevention of Violations; Notice, 65 Fed. Reg. 19618 (Apr. 11, 2000).

III. ATTACHMENTS: ISMI SURVEYS

A. Original ISMI Surveys

1. Results of the ISMI ESH Technology Center Greenhouse Gas Facility Survey, 09065012A (Jun. 9, 2009)

2. Results of the ISMI Fluorinated Heat Transfer Fluids Survey, 09065014A (Jun. 9, 2009)

3. Analysis of Nitrous Oxide Survey Data, 09065015A (Jun. 9, 2009)

B. Supplemental ISMI Surveys

1. SIA presentations from meeting with EPA 10 June 2010

2. 2010 ISMI Survey report

3. 2010 ISMI EPA Protocol

DC\1311168.1

ATTACHMENT A1:

RESULTS OF THE ISMI ESH TECHNOLOGY CENTER GREENHOUSE GAS FACILITY SURVEY, 09065012A (JUN. 9, 2009)

Results of the ISMI ESH Technology Center Greenhouse Gas Facility Survey

International SEMATECH Manufacturing Initiative

Technology Transfer #09065012A-TR

Results of the ISMI ESH Technology Center Greenhouse Gas Facility Survey

Technology Transfer #09065012A-TR
International SEMATECH Manufacturing Initiative
June 8, 2009

Abstract: This report from the International SEMATECH Manufacturing Initiative (ISMI) ESH Technology Center (ESHT001) presents the results and analysis of a greenhouse gas facility survey of ISMI and Semiconductor Industry Association (SIA) members. The purpose was to gather facility-specific data on the impact on fab operations of Environmental Protection Agency's proposed Mandatory Greenhouse Gas (GHG) Reporting Rule published in the Federal Register on April 10, 2009. Results of other surveys in this series are in Technology Transfers #09065014A-TR and #09065015A-TR.

Keywords: Greenhouse Effect, Government Regulations, Emissions Monitoring

Authors: Laurie Beu

Approvals: Laurie Beu, Author
Steve Trammell, Project Manager
Ron Remke, Program Manager
Joe Draina, Director
Laurie Modrey, Technology Transfer Team Leader

Table of Contents

List of Figures

List of Tables

Disclaimer

Disclaimer of Liability

- This report has been prepared upon request using collected survey results and is subject to change without notice at the authors' discretion for reasons including, without limitation, receipt of additional relevant information and continued analysis of survey results and other pertinent material.
- The authors' intent is to report survey findings and to provide non-partisan analysis to the intended audience. This report is not intended to constitute lobbying, and shall not be interpreted as lobbying.
- This information in this report is provided "as is." The authors of and contributors to this report disclaim any and all loss or liability, incurred either directly or indirectly as a consequence of applying or using the information presented herein. Neither ISMI, nor SIA, nor any of their members, employees or officers, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information disclosed or discussed herein.
- The estimates, assessments, analyses, views, and opinions of document authors and contributors, whether expressed herein or expressed orally during related conversations and meetings, do not necessarily state or reflect those of any individual entity or company, including, without limitation, ISMI, the SIA or any of their member companies.

Disclaimer of Forward-looking Statements

- Portions of this report contain forward-looking statements that are based on the authors' and contributors' current expectations, estimates, projections and assumptions. These statements are based on assessment of uncertain factors and therefore are not guarantees of future events and outcomes. Actual future results may differ materially from what is forecast. All forward-looking statements speak only as of the submission date of this report.
- All related written and oral forward-looking statements attributable to the authors, contributors, ISMI, SIA or any person acting on behalf of those entities are qualified by the cautionary statements in this section.
- The authors and contributors do not undertake any obligation to update or publicly release any revisions to forward-looking statements to reflect events, circumstances or changes in expectations after the date of this report.

Acknowledgments

The author wishes to acknowledge the members of the ISMI Greenhouse Gas Working Group and SIA PFC Committee for their participation in the survey.

1 EXECUTIVE SUMMARY

In support of the industry's response to the U.S. Environmental Protection Agency (EPA) proposed rule Mandatory Reporting of Greenhouse Gases, the International SEMATECH Manufacturing Initiative (ISMI) and the Semiconductor Industry Association (SIA) developed and sent to their members a series of surveys to collect technical data on greenhouse gases (GHGs). The first survey gathered facility-specific data on the impact of the proposed rule on semiconductor manufacturing facilities.

Twenty-one responses were received from companies representing 58% of total U.S. silicon area production capacity. Survey respondents included 25 of the EPA's estimated 29 large fabs.

Results showed that the industry is not currently collecting significant portions of the data required by the proposed rule. The rule also requires that the industry spend large amounts of money and devote significant resources to track process GHG emissions. The final year compliance costs will be 26X to 44X greater than estimated by the EPA, and it is not clear whether the required data will be more accurate than what is already being generated.

2 BACKGROUND

The EPA's Mandatory Reporting of Greenhouse Gases was published in the Federal Register on April 10, 2009, beginning the 60-day comment period. The preamble explains the EPA's basis for the proposed rule. Subpart I outlines specific requirements for semiconductor manufacturing facilities. After reviewing the preamble and proposed rule, semiconductor industry members felt strongly that accurate data reflecting industry practice and assessing the cost impact of the rule must be collected and analyzed by a third party. ISMI's Environment, Safety, and Health Technology Center was asked to develop surveys, collect survey responses, and complete data analysis for ISMI and SIA members. Data analysis has been completed independent of the SIA to preserve respondent confidentiality.

3 SURVEY OVERVIEW

The survey consisted of the following parts:

- Background: Brief overview of the proposed rule and its requirements.
- Definitions of the terms used in the rule and survey.
- Part 1: General Facility Information
- Part 2: Information to Scope the Size and Cost of Fluorinated GHG and Nitrous Oxide (N_2O) Emissions Characterization Efforts—Data was used to estimate the potential scope and cost impact of process and point-of-use (POU) abatement emissions characterization that would be required of the industry under the proposed rule.
- Part 3: Information on Perfluorocompound (PFC) and N_2O Gas Distribution and Measurement of Gas Usage—Data was used to determine the way process GHGs are distributed in semiconductor fabrication lines (fabs), and methods by which gas consumption is currently tracked and the installation and operational costs to comply with the gas consumption measurement requirements of the rule.

- Part 4: Combustion Related Emissions
- Part 5: Recordkeeping and Reporting Requirements

The report compares the proposed requirements with industry practice in estimating GHG consumption, characterizing GHG POU abatement, and estimating GHG emissions. Recordkeeping and reporting practices are also summarized; however, N_2O and combustion-related emissions are not addressed.

4 SURVEY RESPONSES

Twenty-one responses were received from the U.S., representing 12 companies and 32 fabs. The respondents make up 58% of total U.S. production capacity based on silicon area (*World Fab Watch*, February 2009) and represent one-third of the EPA's estimated 91[1] semiconductor fabs that must report under the proposed rule. Under the proposed rule, large fabs (i.e., annual production capacity ≥10,500 m^2 silicon) have more stringent reporting requirements than other fabs (annual production capacity <10,500 m^2 silicon but ≥1,080 m^2 silicon); 71% of respondents were large facilities and the remaining 29% were not considered large but will still be required to report. The large facility respondents represent 9 companies, 17 facilities, and 25 fabs or 86% of the EPA's estimated 29 large U.S. fabs.

Responses were also received from four facilities located outside the U.S.; however, the survey results discussed herein are for U.S. respondents only.

4.1 Estimating Gas Consumption

4.1.1 Proposed Rule Requirements and Implications

The proposed rule requires the subject semiconductor facilities to

- Monitor changes in container mass and inventories using weigh scales with ±1% full scale accuracy or better

  or

- Monitor the mass flow of pure gas into the system using flowmeters with ±1% full scale accuracy or better (April 10, 2009 FR, p.16649).

Scales and flowmeters must be calibrated using suitable National Institute of Standards and Technology (NIST)-traceable standards and suitable methods published by a standards organization or, alternatively, calibration procedures specified by the manufacturer. The scales and flowmeters must be recalibrated at least annually or at a frequency specified by the manufacturer, whichever is more frequent (April 10, 2009 FR, p.16650).

Because emissions must be estimated by process type (CVD or etch), gas consumption must be tracked using Tier 2b methods at a minimum. Large facilities may be required to track consumption at the process equipment level. If flowmeters (e.g., MFCs) are used, software modifications or additional software to total the gas flow is required.

---

[1] Clarified with D. Ottinger on May 27, 2009, that EPA compliance estimates are based on number of fabs, not facilities. EPA estimates the rule will apply to 91 fabs and 29 fabs are large fabs under the rule.

4.1.2 Survey Questions

The additional required resources to track gas consumption according to the proposed rule will vary among fabs based on existing infrastructure (e.g., process gas distribution systems and gas consumption monitoring methods).

Figure 1 shows the survey questions asked to determine gas supply infrastructure and the expected cost to comply with the proposed rule's gas consumption monitoring requirements.

1. **How are CVD and etch gases distributed within your facility (check all that apply):**
   - ☐ **Individual gas cylinders feed individual process chambers**
   - ☐ **Cylinders feed multiple like process chambers (etch-only or CVD-only)**
   - ☐ **Bulk distribution systems feed multiple process types and chambers**
   - ☐ **Other (please describe)**
2. **Please indicate how gas consumption is monitored at your facility (check all that apply):**
   - ☐ **Estimated based on purchases and assuming a heel factor**
   - ☐ **Measured by weighing cylinders before and after each cylinder change on scale with 1% accuracy/precision or better**
   - ☐ **Measured with mass flow controllers with 1% accuracy/precision or better**
   - ☐ **Measured by weighing cylinders before and after each cylinder change on scale with less than 1% accuracy/precision**
   - ☐ **Measured with mass flow controllers with less than 1% accuracy/precision**
   - ☐ **Other (please describe)**
3. **What is or would be the additional cost to your facility (installation costs), for compliance with the gas consumption measurement requirements of the proposed rule (include cost of scales, distribution modifications, MFCs, data collection systems, etc.). Please provide answer in $US Dollars.**
4. **What is or would be the additional cost to your facility (operating costs), for compliance with the gas consumption measurement requirements of the proposed rule? (e.g. calibration by NIST or manufacturer recommended procedure, software/hardware maintenance, general preventive maintenance, data collection and analysis costs) Please provide answer in $US Dollars.**
5. **Provide any additional comments regarding installation and/or operating costs.**

Figure 1 Survey Questions to Determine Gas Supply Infrastructure and Compliance Cost of Gas Consumption Monitoring Requirements

4.1.3 Survey Results and Analysis

Respondents use a variety of methods to distribute gases to process equipment; 11 of 21 use more than one method within their fab(s). Two respondents use only individual gas cylinders to feed individual process chambers; neither gathers gas consumption data by process but, instead, estimates consumption based on gas purchases, assuming a 10% heel as described in the 2006 Intergovernmental Panel on Climate Change (IPCC) guideline (IPCC2006, Vol.3, 6.16). Eight respondents use only bulk distribution systems or large cylinders to feed multiple process types and chambers; seven of these respondents estimate gas consumption based on gas purchases and assumed heel factor.

As seen in Figure 2, 81% of respondents monitor gas consumption by tracking purchases and assuming a heel factor; 24% use scales with ±1% accuracy to track some gas consumption. None of the respondents use mass flow controllers (MFCs) with ±1% accuracy as required by the proposed rule.

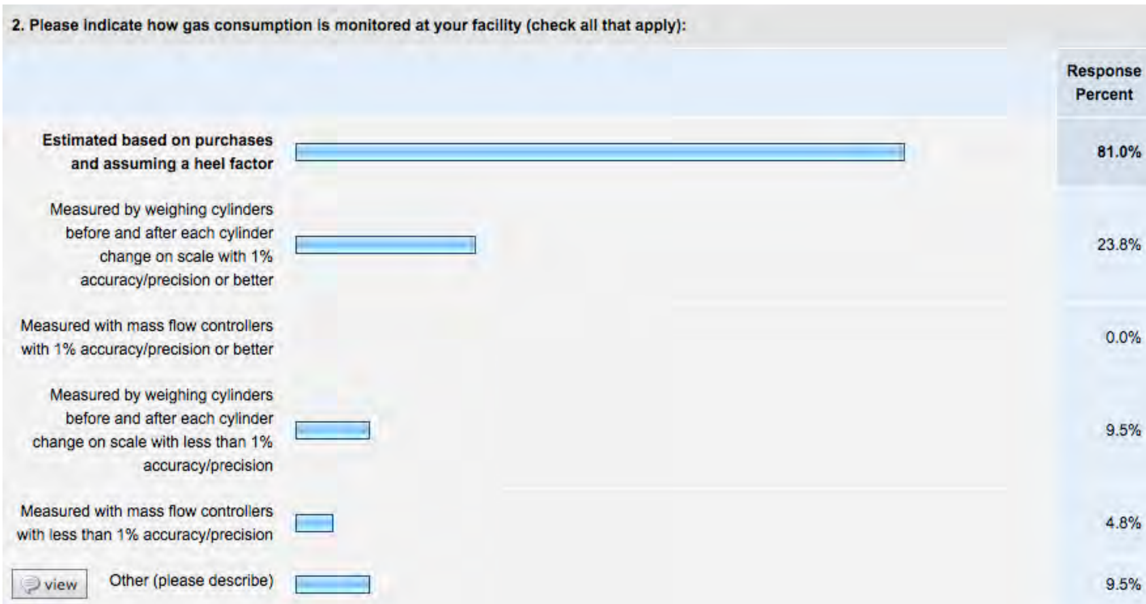


Figure 2 Gas Consumption Monitoring

The survey revealed several EPA misperceptions about the industry and its gas consumption tracking.

EPA Statement	Industry Practice
"Information on gas consumption by process is often gathered as business as usual…" (p16498).	62% of respondents have some bulk gas distribution feeding multiple tools and process types; 67% have some cylinders feeding multiple chambers and processes. For these respondents, consumption is not tracked by process.
"…electronics manufacturers commonly track fluorinated GHG consumption using flow metering systems calibrated to ±1 percent or better accuracy" (p16498).	80% estimate consumption based on purchases and assumed heel factor. 25% track by weighing some cylinders to ±1% accuracy. One respondent measures some usage with MFCs. None use MFCs with ±1% accuracy.

Although the industry uses MFCs within process equipment, they regulate gas flow rates and do not track gas consumption, which would require new or modified software. Additionally, respondents indicated that, although newer (<5 year old) process equipment may contain digital MFCs with ±1% full scale accuracy, much of the current installed base of process equipment is equipped with analog MFCs. These analog MFCs are not accurate to ±1% full scale and do not provide the digital output required by most control systems.

Survey respondents provided additional comments about how they currently track gas usage[2]:

- Scales are adjusted to zero without the cylinder on them. Using our cylinders weights (40 and 200lbs), scales are spanned to >60% full scale. The weights are verified themselves against the dock shipping scale (which is in the company cal program).
- The true weight of the gas is listed on the incoming cylinder spec. When the cylinder pressure reaches the fixed changeout pressure, it is changed. At this fixed pressure, the remaining quantity in the cylinder is known (PV = nRT) and is provided by the gas supplier.
- From a gas supplier supporting a respondent facility: We… do not calibrate our scales in the classical sense. We routinely conduct a performance verification during every cylinder change where we track the cylinder depletion using mass or scales. Historically, the term calibrate would refer to a quantitative method of generating a multipoint or 2-point calibration curve in which a know[n] mass or volume material is measured against a know[n] instrumental or equipment response. The equipment response is then adjusted to reflect the known values for the calibration curve. For the case of a scale a two point zero and span calibration reflects a linear relationship between mass and mV or mA output. Early in 2001 the ISO movement also required standards traceability, certifications, tamper proofing and records keeping. We do not have the manpower, facilities, or equipment to fully comply with the ISO requirements. As a result, we provide performance verifications and not calibrations. Our method of performance verification is very similar to calibration however it will not include requirement associated with tracking. certifications, tamper proofing or records keeping. We do use a 2-point, zero and span process in which we zero the scale by manually adjusting the zero potentiometer and span the scale by placing a know[n] traceable mass on the scale usually 25 lbs. and adjust the span potentiometer to read the correct value. Equipments … which require a true "calibration" are periodically certified by a 3rd party supplier of that service.

Respondents also expressed concern about implementing the gas consumption tracking requirements under the proposed rule. MFC manufacturers suggest that MFCs with ±1% accuracy be removed and shipped back to the manufacturer for annual calibration, requiring process equipment to be shut down and spare MFCs to be stocked. Respondents indicated that newer tools regulate flow with digital MFCs but that software changes are required to allow total consumption to be tracked. For older process equipment, some were able to estimate the cost of installing MFCs on each gas line at each tool and a data tracking system; others said they could not retrofit older equipment because of insufficient space.

Additionally, respondents indicated the following problems with the gas consumption tracking requirements[3]:

- Gas supplier indicates ±1% accuracy can't be achieved. Could probably get ±2% accuracy with new controllers, valves and monitoring systems.

[2] Responses are quotes from the survey with company names omitted.
[3] Responses are quotes from the survey with company names omitted.

- The gas systems engineer is not really sure if we can get that accuracy [±1%]... We have one MFC that is capable of ±2% precision/accuracy.
- Calibration would require evacuating the gas lines and purging all PFCs directly to the environment and would shut down all tools connected to the bulk system, significantly impacting production in our factories.
- If this is included in final rule, there is not enough time to implement changes to begin measuring at this level by Jan 1st to comply with 2010 adoption. Gas supplier indicates ±1% accuracy can't be achieved.
- Scales are basically of no value for cylinders with non-liquid gases.
- Review of a sample of PFC gas distribution systems indicated that 40%–50% of existing systems would need to be modified to segregate gas usage by process and platform for Tier 3 emissions inventory. Cost is for purchase and installation of additional gas distribution infrastructure only, and does not include cost of scales, or of equipment down time and lost production. It is likely that the systems could not be satisfactorily reconfigured, even at this high cost, due to the space constraints of the pre-existing fab layout.
- Most MFCs are calibrated to a Nitrogen standard – it was estimated that 95%+ of MFCs in our factories. You would have to have a correction factor for each MFC in each GHG. This is not done and characterizing this for each individual MFC if possible would be a multi-year and continual process as MFCs are recalibrated and replaced on an ongoing basis.
- Facility wide mass balance similar to acceptable EPA emissions inventory practices and air permit inventory requirements would be less costly.

4.1.4 Basis for Process GHG Consumption Cost Estimates

Survey respondents were given the requirements of the proposed rule for GHG consumption tracking and asked to estimate installation and annual operational costs. They reviewed their current fab infrastructure and identified requirements for scales or MFCs. Most also included the cost to modify equipment software or to install a gas consumption tracking system. Respondents did not include the costs associated with production downtime to make the required modifications. Twenty respondents provided installation costs estimates; 15 provided annual operational cost estimates.

Nineteen respondents provided descriptions of the basis for their cost estimates.

Method used by 1 respondent

- “Installation cost estimate includes
  - New and spare MFCs to be purchased
  - Labor cost to install new MFCs
  - Labor and material costs for wiring from the MFCs to hardware
  - Hardware to collect gas consumption data

- Contingency money for the unexpected operating cost estimate includes
  - Outsourced calibration services
  - Labor to install/reinstall MFCs for calibration.”

Method used by 1 respondent

- “Cost estimate is to replace ~500 MFCs that do not have +/-1% accuracy on process tools, install system to communicate and maintain all tracking data, and develop a PFC-specific software program to manage data. Estimate ~$1400/MFC plus 1 hour to install. $400,000 to install tracking system; $15,000 to install PFC-specific software program to manage data. Vendor has been located who performs calibrations. Rate for this service is $480 per MFC.”

Method used by 1 respondent

- “Measuring gas usage with flow meters and data management system: $600K to $1200K. Assumes replacement of 50%–100% of MFCs would be required to comply with proposed rule. (Does not include any cost for equipment downtime or lost production.) Assumes $250K–$400K data management expense. Measuring gas usage by weighing cylinders: up to $1500K. Review of a sample of PFC gas distribution systems indicated that 40%–50% of existing systems would need to be modified to segregate gas usage by process and platform for Tier 3 emissions inventory. Cost is for purchase and installation of additional gas distribution infrastructure only, and does not include cost of scales, or of equipment down time and lost production. It is likely that the systems could not be satisfactorily reconfigured, even at this high cost, due to the space constraints of the pre-existing fab layout.”

Method used by 3 respondents

- Basis for estimate
  - “Replace any existing MFCs that are not rated for ±1% accuracy with new
  - Purchase a supply of backup MFCs (estimated to be 50% of the current inventory) that can be installed while others are being calibrated throughout the year
  - Process data and prepare reports
  - Hire one full-time employee whose sole job function is the calibration of MFCs at each of our facilities
  - Wage data estimated based on rates referenced by EPA
  - Develop software queries to totalize flows from existing monitoring data.”

Method used by 1 respondent

- Basis for estimate
  - “Replace any existing MFCs that are not rated for ±1% accuracy with new

- Purchase a supply of backup MFCs (estimated to be 50% of the current inventory) that can be installed while others are being calibrated throughout the year
- Process data and prepare reports
- Develop software queries to totalize flows from existing monitoring data. Assume annual calibrations will be done by nearby facility."

Method used by 3 respondents

- "Estimate to install scales under all cylinders: 1 cylinder x (scale + programming/labor) = $1,835.00. Total conversion (70 cylinders) = $128,450 plus initial calibration costs and need to add some spare scales...total ~$150K if we stay with the 40 and 200 lb weight scenario. We would add a few extra scales for rotations. NOTE: Scales are basically of no value for cylinders with non-liquid gases. That is where we use the pressure transducers."

Method used by 1 respondent

- "We estimated our costs based on what it would take to install flow meters with a ±1% accuracy. Our cost estimate is based on installing flow meters on each HFC line, feeding each tool. The data comes from vendor quotes for equipment and labor. The estimate includes the cost of the meter, the labor costs to install the meter, and costs to install hardware and software to track the flow meters. This estimate did not include any annual costs to maintain the equipment. Nor did the estimate include any costs associated with down time of Fab tools."

Method used by 3 respondents

- "$1000 to $1500 per MFC operating cost is an estimate with the majority of the cost in providing MFCs capable of accuracy continuously in compliance. Cost data assumes a third party is needed to calibrate MFCs."

Method used by 1 respondent

- "Assume tool MFCs required at $1000 per MFC and that centralized data system costs $25,000. Cost data assumes a third party is needed to calibrate MFCs."

Method used by 1 respondent

- "MFCs have to be shipped out for calibration. Estimate basis:
  - $2,000 per MFC (purchase, install, and miscellaneous materials) with no digital output for tracking
  - $6,000 per MFC (purchase, install, and miscellaneous materials) with digital output for tracking
  - From $364,000 to $1,032,000. Assume $700,000 is good estimate."

Method used by 1 respondent

- "Estimate provided by our gas management company. Company says upgrades can get to a bulk gas accuracy of 2–3%. These upgrades will cost $143,000/fab and $50,000/year/site. These are only costs to improve bulk gas measurements as technology to measure at a tool level currently does not exist."

Method used by 1 respondent

- “Mass flow meters would be the least expensive option. MFMs would be installed on PFC sticks that go to each tool. MFMs will then be ethernetted together to a new central computer. Cost of tool downtime to install MFMs not accounted for. Maintenance costs assume MFMs are sent offsite annually for calibration. Spare MFMs are required to allow swaps for calibration.”

Method used by 1 respondent

- “The fab was not designed to and cannot provide the data necessary to comply with this regulation. Processes have not been characterized for gas use and emissions. Rule requires massive renovation of gas distribution system, new hardware and software to monitor MFCs, and replacement of existing MFCs.”

4.1.5 Estimated Cost for an Average Fab to Comply with Gas Consumption Tracking Requirements

The cost for an average fab to comply with the gas consumption tracking requirements was calculated by summing the estimated cost responses and dividing by the number of fabs represented by the total. When respondents provided a cost range, the minimum value of the range was used so that the calculated average cost represents an estimated minimum average cost. The average cost to install infrastructure to comply with the gas consumption tracking requirements of the proposed rule is $0.72 million per fab; the estimated annual operating cost is $0.22 million per fab.

4.2 Point-of-Use Abatement

4.2.1 Proposed Rule Requirements and Implications

The proposed rule defines abatement as “…a point-of-use (POU) abatement system whereby a single abatement system is attached to a single process tool or single process chamber of a multi-chamber tool.” This definition does not include multi-chamber POU abatement devices (which are commonly used in the industry) and larger non-POU abatement systems. If a facility uses POU abatement and wishes to claim reductions, the proposed rule requires that destruction or removal efficiency (DRE) be verified experimentally following a procedure outlined in the rule to measure dilution through the abatement system (April 10, 2009 FR, p.16649–50). Alternatively, the facility can, “Install abatement devices that have been tested by a third party (e.g., UL)” following EPA’s *Protocol for Measuring Destruction or Removal Efficiency of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing* (draft protocol). The majority of abatement devices currently installed in U.S. fabs have not been tested according to this draft protocol.

The frequency of abatement testing is not explicitly defined in the proposed rule; however, the Regulatory Impact Analysis (RIA) cost estimate addresses testing frequency by stating “[e]ach abatement device would be tested once every three years.”

The 2006 IPCC *Guidelines for National Greenhouse Gas Inventories* provides default DRE factors for POU abatement devices. The guidelines state that factors can be used only if the abatement devices

- "Are specifically designed to abate FCs [fluorocompounds]
- Are used within the manufacturer's specified process window and in accordance with specified maintenance schedules
- Have been measured and has [sic] been confirmed under actual process conditions using a technically sound protocol which accounts for know measurement errors including, for example, CF4 byproduct formation during C2F6 as well as the effect of dilution, the use of oxygen or both in combustion abatement technologies." (IPCC2006, Vol.3, 6.20)

The technical experts who developed the IPCC guideline for the electronics industry believed that a properly maintained abatement device would maintain DREs over time and did not require periodic retesting. Although the proposed rule uses the 2006 IPCC guideline as the basis for estimating emissions, it does not allow the guidelines' default abatement DRE factors to be used.

4.2.2 Survey Questions

Figure 3 shows the survey questions asked to ascertain the impact of the proposed rule's abatement testing requirements.

1. **Approximately how many PFC-specific abatement devices (capable of abating PFCs in CVD and etch) will you need to test if you want to claim DRE?**
2. **What percentage of the PFC POU abatement devices at your facility have been characterized by your company with a standard industry methodology that accounts for dilution of PFCs in the POU abatement device or by a third party using the draft EPA protocol?**
3. **What percentage of the PFC POU abatement devices at your facility have been characterized by your abatement supplier with a standard industry methodology that accounts for dilution of PFCs in the POU abatement device?**
4. **What methodology was used to characterize performance of POU abatement devices?**
   - ☐ **Emissions not characterized; using default emission factors**
   - ☐ **2001 ISMI Guideline**
   - ☐ **2006 ISMI Guideline**
   - ☐ **Draft EPA Protocol**
   - ☐ **Epson Method**
   - ☐ **Facility has no POU abatement installed**
   - ☐ **Other (e.g. internal testing, info from suppliers - please specify)**

Figure 3 Survey Questions on Characterization of Abatement Devices

4.2.3 Survey Results and Analysis

POU abatement for process GHG emissions is currently used by 10 of 21 survey respondents representing 21 of the 29 respondent fabs. Survey respondents have 1111 GHG POU abatement devices currently installed in fabs. Eleven of the 21 (28% of respondent fabs) do not use POU abatement to reduce emissions. For fabs that will be operating when the proposed rule takes effect, the survey indicates that the average number of abatement devices per fab with abatement is 61; the high is 158. Here again, the survey revealed several EPA misperceptions about industry practice.

EPA Statement	Industry Practice
"…we propose an emission estimation method that would account for destruction by abatement equipment only if facilities verified the performance of their abatement equipment…" (April 10, 2009 FR, p.16498)	50% of all respondents with abatement have not characterized abatement DREs; of those 25% use defaults 25% use DRE measurements provided by suppliers Only one respondent has characterized the majority of its installed POU abatement units.
"…install abatement devices that have been tested according to EPA's Protocol by a third party (e.g., UL)…" (April 10, 2009 FR, p.16650)	<<1% of currently installed POU devices have been tested using the EPA's draft protocol.

Less than 1% of installed abatement devices have been tested using EPA's draft protocol, which has not yet been published. The preamble and proposed rule imply that, if a facility conducts POU abatement testing instead of using a third party, the facility must test all abatement devices (not just a representative process-specific sample). The survey did not address the cost of this testing. Testing will likely require extensive use of third parties because most companies do not have equipment or personnel to conduct in-house testing. Very few third parties in the U.S. have experience characterizing semiconductor process emissions or testing semiconductor POU abatement devices (UL, the example cited by the EPA, is not one of them); still fewer have experience testing in an operating manufacturing fab.[4] Only a single third party is known to have experience using the EPA draft protocol.

4.2.4 Basis for Cost Estimate: Compliance with POU Abatement Testing Requirements

Survey data were used to calculate the average number of abatement devices per fab for those fabs so equipped. This number was multiplied by the testing cost to calculate an average total POU abatement testing cost per fab. If respondents provided a range for the number of abatement devices, the minimum of the range was used in calculations to ensure that the reported costs were a minimum.

The following assumptions were made:

- Emissions testing would be conducted by a third party
- Estimates would be based on testing one-third of the installed POU abatement devices because the proposed rule allows testing of a "random sample" (April 10, 2009 FR, p.16499) when testing is conducted by a third party

[4] Feedback of ISMI Greenhouse Gas Working Group Members.

- Third-party testing would cost $35,000/week based on testing three POU abatement devices per week (including set-up, testing and data analysis according to the EPA draft protocol, and report generation).

4.2.5 Estimated Cost for an Average Fab to Comply with POU Abatement Testing Requirements

The average cost per fab to test POU abatement devices is $0.24 million over 7 weeks. A fab with 158 POU devices will spend $0.62 million over 18 weeks to test 53 devices. These costs for testing one-third of all devices would also equal the average cost per year if each abatement device must be tested once every three years as stated in the RIA cost estimate. Given the lack of experienced third parties, it is unlikely that most semiconductor facilities would be able to meet the POU abatement testing requirements of the proposed rule unless they develop in-house analytical capabilities (i.e., hire personnel and acquire analytical instrumentation). The proposed rule requires those facilities that use in-house capabilities to test 100% of their POU abatement devices (April 10, 2009 FR, p.16499), an approach the preamble acknowledges is likely to be more costly than third-party testing (April 10, 2009 FR, p.16499). For these reasons, industry POU abatement testing costs are likely to be significantly greater than the minimum estimates above.

4.3 Estimating Emissions

4.3.1 Proposed Rule Requirements and Implications

The proposed rule establishes production capacity-based reporting thresholds rather than emissions-based thresholds (April 10, 2009 FR, p.16497). Semiconductor production facilities with production capacity >1,080 m^2 silicon must report. Large semiconductor facilities (production capacity >10,500m2 silicon) are required to estimate emissions using an approach based on the IPCC Tier 3 (company-specific emission factors) while all other semiconductor facilities must use an approach based on the IPCC Tier 2b method (process-specific default emission factors) (April 10, 2009 FR, p.16498). Both approaches require gas consumption data by process that the EPA believes “is often gathered as business as usual” (April 10, 2009 FR, p.16498). EPA further contends that “…DRE for each process is readily available from tool manufacturers…” (April 10, 2009 FR, p.16498). The proposed rule requires that gas utilization and byproduct formation measurements as required by the Tier 3 method be conducted using the *Guideline for Environmental Characterization of Semiconductor Process Equipment* (2006 ISMI Guideline).

4.3.2 Survey Questions

Figure 4 shows the survey questions asked to ascertain the impact of the proposed rule's process emissions estimating requirements.

4.3.3 Survey Results and Analysis

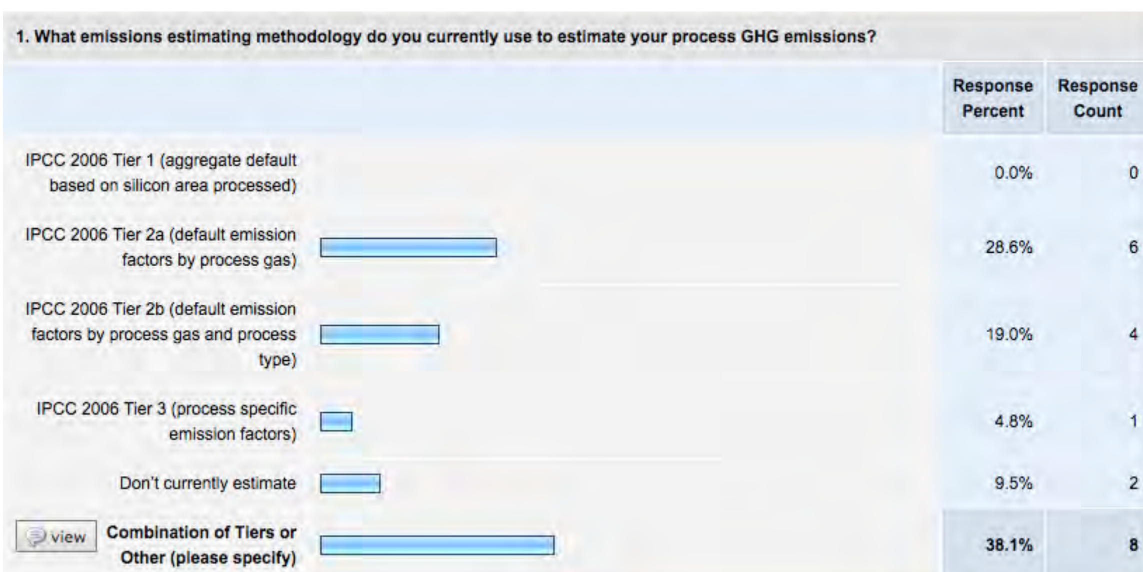
Respondents were asked what methodology they currently use to estimate process GHG emissions. Results are shown in Figure 5.

1. **What emissions estimating methodology do you currently use to estimate your process GHG emissions?**
   - ☐ **IPCC 2006 Tier 1 (aggregate default based on silicon area processed)**
   - ☐ **IPCC 2006 Tier 2a (default emission factors by process gas)**
   - ☐ **IPCC 2006 Tier 2b (default emission factors by process gas and process type)**
   - ☐ **IPCC 2006 Tier 3 (process specific emission factors)**
   - ☐ **Don't currently estimate**
   - ☐ **Combination of Tiers or Other (please specify)**

For large facilities:

2. **Approximately how many "unique process platforms running varying PFC gases" in representative processes does your facility have?**
3. **What is the approximate maximum number of unique PFC-using recipes with varying process conditions run in your facility?**
4. **What methodology was used to characterize process emissions and byproducts?**
   - ☐ **Emissions not characterized; using default emission factors**
   - ☐ **2001 ISMI Guideline**
   - ☐ **2006 ISMI Guideline**
   - ☐ **Epson Method**
   - ☐ **Other (please specify)**

Figure 4 Survey Questions on Emissions Characterization Methodology



1. What emissions estimating methodology do you currently use to estimate your process GHG emissions?

	Response Percent	Response Count
IPCC 2006 Tier 1 (aggregate default based on silicon area processed)	0.0%	0
IPCC 2006 Tier 2a (default emission factors by process gas)	28.6%	6
IPCC 2006 Tier 2b (default emission factors by process gas and process type)	19.0%	4
IPCC 2006 Tier 3 (process specific emission factors)	4.8%	1
Don't currently estimate	9.5%	2
view Combination of Tiers or Other (please specify)	38.1%	8

Figure 5 Percentage of Respondents Using Various Estimating Methods

One responding company uses the IPCC Tier 3 method. Two respondents do not currently track process GHG emissions. The operation for one of those respondents is “large” as defined by the proposed rule (>10,500 m^2 silicon); however, the facility has only one PFC-using process tool and, thus its process GHG emissions are low. The second respondent is not an SIA member and is therefore not a party to the voluntary PFC Reduction/Climate Partnership for the Semiconductor Industry. Thirty-eight percent of respondents are using a combination of tiers to estimate emissions; the majority uses a combination of Tiers 2a and 2b.

Most of the respondents do not track gas consumption by process. Those that do report emissions by process (i.e., are using Tiers 2b or 3) apply engineering estimates to determine the split of gas consumption between chemical vapor deposition (CVD) and etch.

The survey highlighted several EPA misperceptions about the impact of requiring large facilities to estimate emissions using a Tier 3-like approach.

EPA Assertion	Industry Practice
Large semiconductor facilities are already using Tier 3 methods. (April 10, 2009 FR, p.16498)	Only one U.S. company is estimating emissions using IPCC Tier 3. Others use Tier 2a, 2b, or a combination.
Large facilities have the data required to use Tier 3. (proposed rule requires use of 2006 ISMI guideline) (April 10, 2009 FR, p.16498)	50% of large companies do not have any data required to use Tier 3. For 75% of the responding companies with some emissions data, the data were not generated with ISMI’s 2006 guidelines (instead earlier versions of industry guidelines were used). Only 10% of all emissions characterizations used ISMI’s 2006 guidelines.

While the proposed rule requires ISMI’s 2006 guidelines to be used to develop utilization and byproduct emission factors, the survey shows that only 10% of all process emissions characterizations were based on those guidelines; much of the data were generated using earlier versions of ISMI and industry guidelines. The Tier 3 requirement is based on process emissions data being “…readily available from tool manufacturers…” (April 10, 2009 FR, p.16498). When required by purchase specifications, process equipment manufacturers may provide baseline process emissions characterizations to semiconductor companies purchasing new equipment. Growth in U.S. semiconductor manufacturing capacity has slowed in recent years, and since the 2006 guideline was published, only three large volume manufacturing fabs have been built in the U.S. (*SEMI World Fab Watch*, May 2009). Process equipment manufacturers have little motivation to characterize baseline emissions from tool sets that are already in manufacturing fabs.

For large facilities, the proposed rule calls for the use of “process-specific utilization and byproduction formation factors” (April 10, 2009 FR, p.16648); however, it does not define “process-specific.” Large facility respondents representing 15 fabs provided data on the approximate number of unique process platforms and unique perfluorocompound (PFC)-using recipes run in their fabs. “Unique process platform” was defined in the survey as specific tool models using a specific PFC for either CVD chamber cleans or etch, with examples provided. “Unique PFC-using recipes with varying process conditions” was defined as the estimated total number of different process platforms running different PFC gases, gas flow rates, gas ratios, process times, and/or stabilization times in the fab. “Unique process platforms” and “unique PFC-using recipes” can serve as a lower and upper bound, respectively, for the range of process emission characterizations required of large facilities. An average number of unique process platforms and PFC-using recipes was calculated by adding the number of process platforms or recipes reported by each respondent and dividing by the total number of fabs represented by the responses. When respondents provided a range, the lower end of the range was used to calculate the average so that a minimum estimate was generated. For large fabs, the average number of unique process platforms was 37, while the average number of unique process recipes was 455.

4.3.4 Basis for Cost Estimate: Large Facility Process-specific Emission Factors

Because the EPA does not define "process-specific," the scope of emissions characterization efforts required by large facilities is uncertain. A minimum cost estimate was developed for the average large facility to comply with rule requirements to develop process-specific utilization and byproduct formation factors. The following assumptions were made:

- Emissions testing would be conducted by a third party because most semiconductor facilities do not have the qualified personnel or equipment to conduct in-house testing;
- Third-party testing would cost $35,000/week
  - For estimating the cost of process emissions testing on a per platform basis, assume a third party can test three unique process platforms per week (including set-up, testing, data analysis, report generation).
  - For estimating the cost of process emissions testing on a per unique recipe basis, assume the third party can test six process recipes per week (including set-up, testing, data analysis, report generation).

4.3.5 Estimated Cost for an Average Large Facility to Develop Process Emission Factors

The cost to develop Tier 3 emission factors for an average large fab ranges from $0.43 million over 12 weeks if testing is required on a per platform basis. If each individual process recipe must be characterized, the cost for the average large fab rises to $2.7 million over 76 weeks. Few third parties have experience testing semiconductor process equipment emissions in a manufacturing fab. Given the amount of emissions characterization required by the proposed rule and the lack of experienced third parties, it is unclear how EPA's estimated 29 large manufacturing fabs will develop process-specific emission factors in the timeline outlined in the proposed rule.

4.4 Comparison of IPCC Methodologies (Supplementary Data from One Survey Respondent)

The preamble states, "The use of the IPCC Tier 3 method and standard site-specific DRE measurement would provide the most certain and practical emission estimates for large facilities" (April 10, 2009 FR, p.16498). One survey respondent provided additional data from an analysis to compare the results of the 2006 IPCC Tier 2a, 2b and 3 methods for three 200 mm fabs over 3 years and three 300 mm fabs (one for 1 year and two for 3 years each). Figure 6 presents the results of 16 sets of comparison data.

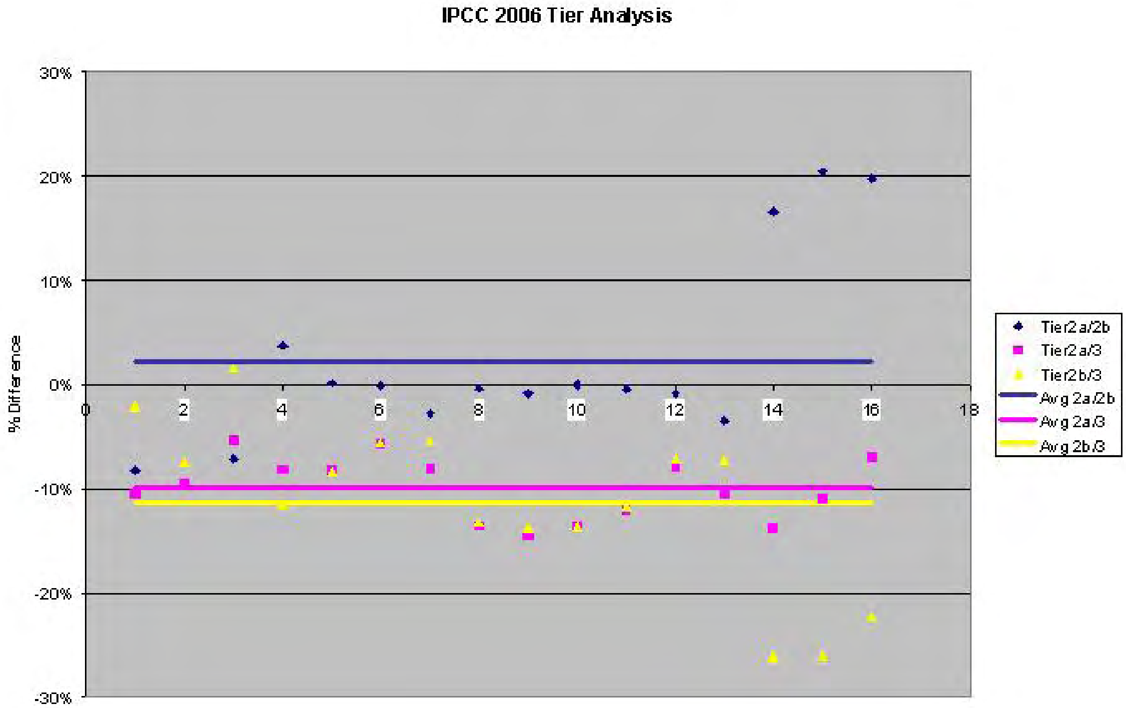


Figure 6 2006 IPCC Tier Analysis for Six Fabs

The data sets show that Tier 2a and Tier 2b produce similar results with Tier 2a averaging +2% higher (standard deviation 9%). Compared to Tier 2a and 2b, Tier 3 yielded an estimated 10% and 11% lower, respectively (standard deviation 3% and 8%). The IPCC methods for the electronics industry require 100-year time horizon global warming potentials (GWP100) to calculate CO_2 equivalent emissions. As noted in the IPCC Fourth Assessment Report, uncertainties for GWP100 are ±35% (IPCC 4th ARWG1, Ch.2, p.214). The greatest difference among methods is less than one-third of the uncertainties for GWP100.

The Tier 3 method offers only incremental improvement in accuracy over the Tier 2 methods; this improvement is small compared to the overall uncertainty in these calculations due to the uncertainties in the GWP100.

4.5 Recordkeeping and Reporting

The proposed rule lists several data reporting requirements for semiconductor facilities that could be made available to the public. Survey respondents were asked to indicate whether the data elements listed are currently available for each facility and which elements they consider Confidential Business Information (CBI). Table 1 lists those data elements that >50% of the respondents do not currently have available or consider CBI.

Table 1 Required Data that Majority of Respondents Do Not Have Available or Consider CBI

Rule required data that >50% of respondents do not currently have available or that >50% consider to be Confidential Business Information (CBI).

Required Data	Data Available (% of All Respondents)	Data Not Available (% of All Respondents)	CBI
GHG emissions for all plasma etching	45%	55%	55%
GHG emissions for all chamber cleaning	45%	55%	55%
GHG emissions for all CVD processes	20%	80%	55%
GHG emissions for all HTF use	5%	95%	10%
Mass of each gas fed into each process type	25%	75%	95%
Production capacity (m2 Si)	95%	5%	90%
Emission control technology DREs and their uncertainties	10%	90%	30%
Fraction of gas fed into each process type w/ emissions control technologies	30%	70%	70%
Description of abatement controls	45%	55%	5%
Inputs to mass balance calculations (for heat transfer fluids)	25%	75%	10%

5 IMPACT ASSESSMENT

The impact of the proposed rule on the semiconductor industry has been underestimated by EPA.

EPA Proposed Rule	Estimated Industry Costs
The rule contains stringent requirements for tracking gas consumption that require ALL reporting facilities to undertake costly infrastructure modifications.	EPA estimates the rule applies to 91 semiconductor fabs. Based on survey results, the minimum estimated total industry cost to comply with gas consumption data requirements is $65 million for infrastructure installation and $20 million for annual operating costs.
To claim DRE for POU abatement, abatement units must be tested by the user or a third party using the EPA protocol.	The survey indicates 72% of fabs use GHG-specific POU abatement. Assuming 66 fabs (72% of 91 fabs) use abatement, the minimum estimated total industry cost to comply with POU abatement testing is $17 million over 450 weeks of testing.
Large semiconductor facilities are already using Tier 3 methods or have data available to perform Tier 3.	The minimum estimated cost for the EPA-estimated 29 large facilities to develop Tier 3 data is $13 million to $77 million over 360 to 2,200 weeks of testing.

EPA erroneously assumes that that manufacturing facilities “monitor gas consumption using equipment (e.g., flowmeters) that is already in place…” (RIA Cost Appendix, p.21). Based on this assumption, The EPA does not include capital or operating and maintenance (O&M) costs in the estimate. The total minimum industry cost for installing infrastructure to track gas consumption as required by the proposed rule is $65 million. O&M costs to calibrate and maintain gas consumption monitoring systems is $20 million per year. The EPA’s estimated cost for the industry to comply with POU abatement device testing is $1.359 million per year, while the estimated minimum cost based on survey data is $17 million per year. The EPA assumes that large facilities have the data to comply with the proposed rule and, therefore, incur no cost for compliance; for the large facilities, the cost to comply with the requirements for Tier 3 is $13 million to $77 million. Initial compliance with the proposed rule requires an estimated 16 to 51 years of third-party testing; ongoing POU abatement evaluations will require a minimum of 8.7 years of third-party testing each year (assuming the third party can test three process platforms, six process recipes, or three POU abatement devices per week).

In 1999, the members of the World Semiconductor Council (WSC) approved a goal to reduce aggregate absolute emissions of PFCs from semiconductor manufacturing facilities by 10% or more from baseline levels by 2010. They also agreed to use IPCC Tier 2 methods to estimate emissions so that a common methodology would be used across all regions and data would be comparable. Based on the survey responses from the four non-U.S. located respondents, semiconductor facilities in other countries are not subject to requirements comparable to those in the proposed rule.

6 CONCLUSIONS

ISMI’s survey to gather facility-specific data on the impact of the proposed rule on fab operations resulted in 21 responses from companies representing 58% of total U.S. silicon area production capacity. Survey respondents included 25 of the EPA’s estimated 29 large fabs.

Much of the EPA’s basis for the proposed rule is contradicted by survey data:

- Contrary to the EPA’s assertion, the industry is *not* currently collecting or equipped to collect significant portions of the data required by the proposed rule.
- The EPA assumes the industry will incurs no capital or O&M costs under the proposed rule. This assumption is incorrect. The minimum estimated industry capital cost to comply with gas consumption tracking requirements is $65 million and O&M costs are $20 million per year
- Analysis of the survey data indicates the industry’s first year compliance costs will be $95–159 million, 26X to 44X greater than the EPA’s estimated $3.6 million (RIA, p. 4-124). Ongoing compliance costs are estimated to be a minimum of $37 million per year. Note that the survey-based cost estimate is a minimum that does not include the costs associated with production downtime. It also does not include the costs to comply with requirements for fluorinated heat transfer fluids, combustion related emissions reporting, or reporting and recordkeeping requirements.

In its requirements for gas consumption tracking, process emissions characterization, and POU abatement testing, the proposed rule goes beyond the requirements of the IPCC Tier 2b and 3 methods. Based on responses received by the four respondents not located in the U.S., semiconductor facilities in other countries are not subject to requirements that are comparable to those in the proposed rule.

The proposed mandatory GHG reporting rule requires that the industry spend large amounts of money that the EPA does not accounted for in its regulatory impact assessment. The first year compliance costs will be 26X to 44X greater than estimated by the EPA, and subsequent compliance costs are >10X the EPA's estimate.

International SEMATECH Manufacturing Initiative
Technology Transfer
2706 Montopolis Drive
Austin, TX 78741

http://ismi.sematech.org
e-mail: info@sematech.org

ATTACHMENT A2:

RESULTS OF THE ISMI FLUORINATED HEAT TRANSFER FLUIDS SURVEY, 09065014A (JUN. 9, 2009)

Results of the ISMI Fluorinated Heat Transfer Fluids Survey

International SEMATECH Manufacturing Initiative
Technology Transfer #09065014A-TR

Results of the ISMI Fluorinated Heat Transfer Fluids Survey

Technology Transfer #09065014A-TR
International SEMATECH Manufacturing Initiative
June 8, 2009

Abstract: This report from the ESHT001 project presents the results of a fluorinated heat transfer fluids survey of International SEMATECH Manufacturing Initiative (ISMI) and Semiconductor Industry Association (SIA) members. The purpose was to gather data on the use, volatility, purchase and waste tracking, and status of emission measurements of fluorinated heat transfer fluids. Results of other surveys in this series collecting technical data on greenhouse gases are in Technology Transfers #09065012A-TR and #09065015A-TR.

Keywords: Greenhouse Effect, Government Regulations, Fluids

Authors: Walter Worth

Approvals: Steve Trammell, Project Manager
Ron Remke, Program Manager
Joe Draina, Director
Laurie Modrey, Technology Transfer Team Leader

Table of Contents

List of Tables

Disclaimer

Disclaimer of Liability

- This report has been prepared upon request using collected survey results and is subject to change without notice at the authors' discretion for reasons including, without limitation, receipt of additional relevant information and continued analysis of survey results and other pertinent material.
- The authors' intent is to report survey findings and to provide non-partisan analysis to the intended audience. This report is not intended to constitute lobbying, and shall not be interpreted as lobbying.
- This information in this report is provided "as is." The authors of and contributors to this report disclaim any and all loss or liability, incurred either directly or indirectly as a consequence of applying or using the information presented herein. Neither ISMI, nor SIA, nor any of their members, employees or officers, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information disclosed or discussed herein.
- The estimates, assessments, analyses, views, and opinions of document authors and contributors, whether expressed herein or expressed orally during related conversations and meetings, do not necessarily state or reflect those of any individual entity or company, including, without limitation, ISMI, the SIA or any of their member companies.

Disclaimer of Forward-looking Statements

- Portions of this report contain forward-looking statements that are based on the authors' and contributors' current expectations, estimates, projections and assumptions. These statements are based on assessment of uncertain factors and therefore are not guarantees of future events and outcomes. Actual future results may differ materially from what is forecast. All forward-looking statements speak only as of the submission date of this report.
- All related written and oral forward-looking statements attributable to the authors, contributors, ISMI, SIA or any person acting on behalf of those entities are qualified by the cautionary statements in this section.
- The authors and contributors do not undertake any obligation to update or publicly release any revisions to forward-looking statements to reflect events, circumstances or changes in expectations after the date of this report.

Acknowledgments

The author wishes to acknowledge the members of the ISMI Greenhouse Gas Working Group and SIA PFC Committee for their participation in the survey.

1 EXECUTIVE SUMMARY

In support of the industry response to the U.S. Environmental Protection Agency (EPA) proposed mandatory greenhouse gas (GHG) reporting rule, the International SEMATECH Manufacturing Initiative (ISMI) Environment, Safety, and Health Technology Center was asked to develop surveys, collect survey responses, and analyze data for ISMI and Semiconductor Industry Association (SIA) members. A total of three surveys were conducted. Responses have been collected independent of the SIA to preserve respondent confidentiality. Reported herein are results of a survey on the use, volatility (i.e., vapor pressure at room temperature), purchase and waste tracking, and status of emissions measurements of fluorinated heat transfer fluids.

Fourteen companies participated, providing 37 separate responses.

Results showed that the semiconductor industry uses at least 17 different fluorinated heat transfer fluids with ambient vapor pressures ranging from 6 to 30,000+ Pascals. Four fluids may be candidates for exemption from the proposed regulation due to their exceptionally low vapor pressure.

The fluids are mostly used in closed-loop chillers for processes such as etch, chemical vapor deposition (CVD), implant, and device testing.

Most companies do not quantitatively track usage, recycling, and disposal of these fluids. Only two companies track the quantity of fluids lost in spills and leaks, and four track the quantity of fluids recycled or disposed off site. Off-site disposal usually consists of high temperature incineration or fuel blending. Currently, one company has tested for traces of these fluids in fab air, finding that concentrations are below 5 ppb.

2 SURVEY OVERVIEW

The survey asked the following questions:

- Do you operate processes that use fluorinated heat transfer fluids? If so, which ones do you use?
- What is the name of the process?
- What is the vapor pressure of each fluorinated heat transfer fluid?
- Are spills, leaks, material recycling, and waste disposal being tracked to complete a mass balance for the fluorinated heat transfer fluids used?
- Has fab air sampling been done? If so, what were the results?

3 RESULTS

Fourteen companies participated in the survey, providing data for 37 separate responses (two of them overseas). Based on the survey, the fluorinated heat transfer fluids are almost exclusively used in point-of-use (POU) chillers for etch, CVD, implant, and automatic testing. A few companies mentioned that in some isolated cases these fluids are used for resist stripping (wet tool), chamber cleaning, and leak testing. One respondent that uses the fluorinated heat transfer fluids in a process abates emissions with the house thermal oxidizer

Table 1 lists the fluorinated heat transfer fluids used and their corresponding vapor pressures in Pascals (Pa) and psia. 3M and Solvay Solexis are the main suppliers of the fluids. Based on the survey, the most popular are marked by a pound sign (#). The vapor pressures range from a low of 6 Pa to a high of 30,324 Pa. However, one company reported vapor pressures ranging from 800–55,000 Pa, with the most widely used compounds in the 800–2000 Pa range. The vapor pressure of water was included in the table for comparison only.

Table 1 Names of Heat Transfer Fluids Used and Their Vapor Pressures

Heat Transfer Fluid	Vapor Pressure @ 20–25°C	
Name	Pascals	psia
3M Fluorinert FC 40 # &	400	0.058
3M Fluorinert FC 77 #	5,600	0.81
3M Flourinert FC 3283 #	1,867	0.27
3M HFE 7100 #	26,931	3.90
3M HFE 7200 #	14,532	2.10
3M HFE 7300	5,585	0.81
3M HFE 7500 &	6	0.0009
*Galden HT – 70 #	18,798	2.72
*Galden HT - 90	13,332	1.93
*Galden HT – 110 #	2,266	0.33
*Galden HT – 200 &	<133	0.019
DuPont HFC - 134a **	655,405	95
ZT - 130	NA	
ZT – 180 &	266	0.0386
*Galden D02 - TS	NA	
*Galden D02 - TSX	NA	
*Galden PFS 2	30,324	4.39
WATER (for comparison only)	*2493*	*0.36*

***** offered by Solvay Solexis
****** liquefied gas with boiling point of -26.5°C
# most popular fluids based on number of survey responses
& recommend exclusion from regulation due to very low vapor pressure

One company pointed out that the Global Warming Potentials (GWPs) of fluorinated heat transfer fluids range from 55–9,400, whereas an EPA report published in 2006 (EPA 430-R-06-901) states that the GWPs range from >6,000–9,000.

Most fluorinated heat transfer fluid use is associated with the replacement of electrostatic chucks (ESCs), which are cooled directly by the fluorinated heat transfer fluid. When the tool is opened and the ESC removed, some fluorinated heat transfer fluid is “lost” and later replaced by topping off the chiller reservoir. The “lost” material is collected either separately or, more typically, blended with other mixed solvent waste. Then, the solvent waste is shipped off site for incineration or use as fuel in cement production. In most cases, spills are wiped up and the “solvent”-contaminated wipes are collected in covered waste cans as hazardous waste and sent off site for high temperature thermal oxidation (i.e., incineration); however, the quantity of the waste is not tracked.

Most companies have records for only purchases of fluorinated heat transfer fluids. Just two companies track the quantity of fluids lost in spills and leaks. Four companies track the quantity of fluids recycled or disposed off site. None of the companies seem to attempt a comprehensive mass balance for the fluids.

One company provided data from airborne emission measurements (Appendix A), which detected fluorinated heat transfer fluids in very low concentrations in the air of several different semiconductor manufacturing fabs. Twenty-one samples were collected and analyzed by thermal desorption followed by gas chromatography and mass spectrometry. The concentrations ranged from about 1–99 ng/L (in the form of fluoroalkyl ethers). Using the ideal gas law to convert from ng/L to ppb shows that the calculated air concentrations for these measurements are all below 5 ppb.

Using the data for several commonly used fluorinated heat transfer fluids, a calculation was made to estimate how quickly these fluids would evaporate after a spill or leak (Appendix B). A 4 ft^2 spill 1/8 inch deep would contain about 4.68 pounds of fluid. To evaporate that much material would take 1 to 94 hours, depending on the molecular weight and vapor pressure of the fluid. If one assumes that a leak of that size would not go unnoticed in a 3-hour period, given the cleanliness of semiconductor manufacturing fabs, the whole spill would go unnoticed and ultimately evaporate if only one fluid spilled.

4 CONCLUSIONS

The survey of 37 responses from 14 companies showed that the semiconductor industry uses at least 17 different fluorinated heat transfer fluids with ambient vapor pressures ranging from 6 to 30,000+ Pascals. Four of the fluids reported have exceptionally low (<400 Pa) vapor pressures.

The fluids are mostly used in closed-loop chillers for processes such as etch, CVD, implant, and device testing.

The majority of companies do not quantitatively track usage, recycling, and disposal of these fluids. Currently only two companies track the quantity of fluids lost in spills and leaks, and only four companies track the quantity of fluids recycled or disposed off site. Off-site disposal usually consists of high temperature incineration or fuel blending.

So far, just one company has tested for traces of these fluids in fab air, finding that concentrations are below 5 ppb.

Appendix A –Testing Fab Air Samples for the Presence of Hydrocarbons

In 2006, one U.S. semiconductor manufacturing company tested several fabs for air contaminants, including traces of fluorinated hydrocarbons.

A.1 Sampling and Analysis

The sampling and analysis consisted of the following. Pumps set at a preset flow rate of 100 mL/min. pulled fab air through stainless steel tubes packed with multiple beds of proprietary adsorbents. The air was typically sampled in three locations in the fab over a 23-hour period.

After sampling, the sealed tubes were shipped to an analytical laboratory where they were analyzed by thermal desorption followed by gas chromatography and mass spectrometry. The test method was designed to analyze for semi-organic compounds in the n-heptane (boiling range ~100°C) to n-octacosane (boiling range ~430°C) range. Each compound detected was identified by a search of a Wiley library of 275,000 mass spectra or, when no matches were found, by the analyst's interpretation or best estimate of the most probable compound or class of compounds.

A.2 Results

Table A-1 summarizes the relevant results identified as fluoralkyl ethers. The typical spectrum for each sample contains many more compounds that were not fluorinated. The organic compounds are classified into three boiling ranges: low boiling (C7–C10), medium boiling (>C10–C20, and high boiling (>C20). The values are shown here as supporting evidence of the presence of larger molecules that may originate from the fluorinated heat transfer fluids.

A.3 Conclusion

As can be seen from Table A-1, the concentration of fluoroalkyl ethers in the air ranged from <0.1 to 99.8 ng/L.

If one assumes that in 2006 the air make-up rate in a typical fab was 200,000 scfm, then the quantity of fluorinated heat transfer fluids lost in the fab exhaust air is approximately 700 lbs/yr for a worst case concentration of 5 ppb. This would be 10% of the ~7000 lbs/year (based on 500 gallons) of fluorinated heat transfer fluids that the EPA estimates a typical fab loses in a year (EPA 430-R-06-901).

A.4 Sample Calculations

The data in Table A-1 indicate that the highest concentration detected was 99.8 ng/L (say 100 ng/L). This can be converted to ppb as follows: 100 ng × 0.08206 (atm x L)/(moles × °K) × 296K / (1.0 atm × 500 g/mole) = 4.9 ng/g or ppb.

If one assumes the air make-up rate for a typical fab is 200,000 scfm and, in turn, that much air is exhausted from the fab carrying 4.9 ppb of fluoroalkyl ether emissions, the loss of fluorinated hydrocarbons to the atmosphere can be calculated as follows: 4.9 ppb × 200,000 scfm × 500 lbs/lbmole × 60/(1E+09 × 359 ft^3/lbmole) = 0.082 lbs/hr or 717 lbs/year.

Table A-1 Air Samples Taken in High Volume Manufacturing Fabs in 2006

	Concentration			
	Fluoroalkyl ether	C7-C10	>C10-C20	>C20
Sample #	ng/L	ng/L	ng/L	ng/L
1	4.8	39.5	39	1.4
2	61.6	57.6	23.4	0.7
3	99.8	74.7	23.6	0.6
4	24.7	42.1	4.9	0.5
5	16.3	15.0	4.1	<0.1
6	18	16.3	3.8	0.2
7	56.7	43.7	5.3	0.1
8	1.8	19.3	19.4	0.9
9	1.2	13.3	11.5	1.4
10	1.0	20.2	17.8	1.5
11	1.2	23.7	17.8	1.7
12	<0.1	2.0	0.8	0.1
13	<0.1	8.5	6.4	0.4
14	29	34.3	10.8	0.6
15	24.1			
16	35.4			
17	22.9			
18	15.5			

Appendix B – Estimate of the Time to Evaporate a 4 ft^2 by 1/8" Deep Spill

B.1 Conclusions

- A spill of 4 ft^2 × 1/8" deep = 4.68 lbs (assumed density of 1.8 g/cc).[1]
- The amount evaporated in 3 hours ranges from 0.15 to 13.47 lbs for these commonly used fluorinated heat transfer fluids.
- The time to evaporate a 4 ft^2 spill ranges from 1 to 94 hours, depending on the vapor pressure and molecular weight of the fluid.
- Since the POU chillers that use fluorinated heat transfer fluids have closed systems, it is reasonable to assume such spills are rare.
- A 4 ft^2 spill would most likely be discovered and cleaned up in 3 hours.

Table B-1 Estimate of the Time to Evaporate a 4 ft^2 by 1/8" Deep Spill

Heat Transfer Fluid	MW lb/lb-mole	Mass Transfer Co. K (feet/sec)	Surface Area (ft^2)	Vapor Press. (psia)	Ideal Gas Constant (psi-ft^2/R/lb-mole)	Temp. (° R)	Est. Evaporation (lbs/hr)	Evaporation in 3 hours (lbs)	Time to Evaporate 4ft^2 Spill (hrs)
FC-77	415*	0.0016	4	0.81	10.73	529	1.36	4.08	3.4
FC-3283	521*	0.0014	4	0.27	10.73	529	0.50	1.50	9.4
HT-70	410*	0.0016	4	2.7	10.73	529	4.49	13.47	1.0
HT-110	580*	0.0014	4	0.33	10.73	529	0.68	2.04	6.9
HT-200	870*	0.0012	4	0.019	10.73	529	0.05	0.15	93.6

*(according to EPA Burton report 430-R-06-901)

[1] Sample calculation: 4ft^2 × 1/8" spill= 4 × 0.125/12 (ft^3) × 28.32 (L/ft^3) × 1000 (cc/L) × 1.8 (g/cc)/454 (g/lb) = 4.68 lbs.

International SEMATECH Manufacturing Initiative
Technology Transfer
2706 Montopolis Drive
Austin, TX 78741

http://ismi.sematech.org
e-mail: info@sematech.org

ATTACHMENT A3:
ANALYSIS OF NITROUS OXIDE SURVEY DATA, 09065015A
(JUN. 9, 2009)

Analysis of Nitrous Oxide Survey Data

International SEMATECH Manufacturing Initiative
Technology Transfer #09065015A-TR

Analysis of Nitrous Oxide Survey Data
Technology Transfer #09065015A-TR
International SEMATECH Manufacturing Initiative
June 8, 2009

Abstract: This report from the ESHT001 project presents the results of a survey on the use of nitrous oxide in semiconductor manufacturing by International SEMATECH Manufacturing Initiative (ISMI) and Semiconductor Industry Association (SIA) members. The data were gathered to deveop a response to the U.S. Environmental Protection Agency (EPA) proposed mandatory greenhouse gas (GHG) reporting rule. Results of other surveys in this series are in Technology Transfers #09065012A-TR and #09065014A-TR.

Keywords: Greenhouse Effect, Government Regulations, Nitrous Oxide

Authors: Walter Worth

Approvals: Steve Trammell, Project Manager
Ron Remke, Program Manager
Joe Draina, Director
Laurie Modrey, Technology Transfer Team Leader

Table of Contents

List of Tables

Disclaimer

Disclaimer of Liability

- This report has been prepared upon request using collected survey results and is subject to change without notice at the authors' discretion for reasons including, without limitation, receipt of additional relevant information and continued analysis of survey results and other pertinent material.
- The authors' intent is to report survey findings and to provide non-partisan analysis to the intended audience. This report is not intended to constitute lobbying, and shall not be interpreted as lobbying.
- This information in this report is provided "as is." The authors of and contributors to this report disclaim any and all loss or liability, incurred either directly or indirectly as a consequence of applying or using the information presented herein. Neither ISMI, nor SIA, nor any of their members, employees or officers, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information disclosed or discussed herein.
- The estimates, assessments, analyses, views, and opinions of document authors and contributors, whether expressed herein or expressed orally during related conversations and meetings, do not necessarily state or reflect those of any individual entity or company, including, without limitation, ISMI, the SIA or any of their member companies.

Disclaimer of Forward-looking Statements

- Portions of this report contain forward-looking statements that are based on the authors' and contributors' current expectations, estimates, projections and assumptions. These statements are based on assessment of uncertain factors and therefore are not guarantees of future events and outcomes. Actual future results may differ materially from what is forecast. All forward-looking statements speak only as of the submission date of this report.
- All related written and oral forward-looking statements attributable to the authors, contributors, ISMI, SIA or any person acting on behalf of those entities are qualified by the cautionary statements in this section.
- The authors and contributors do not undertake any obligation to update or publicly release any revisions to forward-looking statements to reflect events, circumstances or changes in expectations after the date of this report.

Acknowledgments

The author wishes to acknowledge the members of the ISMI Greenhouse Gas Working Group and SIA PFC Committee for their participation in the survey.

1 EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) proposed Mandatory Reporting of Greenhouse Gases rule was published in the Federal Register on April 10, 2009, beginning the 60-day comment period. The preamble explains the EPA's basis for the proposed rule. Subpart I outlines specific requirements for semiconductor manufacturing facilities. The proposed rule requires electronics manufacturing facilities to report "nitrous oxide emissions from chemical vapor deposition" (April 10, 2009 FR, p. 16648). It further requires facilities to report annual nitrous oxide (N_2O) consumption as emissions (April 10, 2009 FR, p. 16649). The International SEMATECH Manufacturing Initiative (ISMI) Environment, Safety, and Health Technology Center conducted a survey of ISMI and Semiconductor Industry Association (SIA) members to identify the semiconductor manufacturing processes that use N_2O and the utilization efficiency (UE) for those processes.

2 SURVEY QUESTIONS

The survey asked for the following information:

- Do you manufacture or operate chemical vapor deposition (CVD) process equipment that uses N_2O? If so, what is the name of the process?
- What is the wafer diameter for this equipment (in mm)?
- What is the general name for the process?
- Have you characterized the N_2O emissions from the process?
- What methodology was used to characterize the N_2O emissions and process byproducts?
- Please provide the percentages (of total) that each methodology was used to characterize process emissions and byproducts.
- What was the measured N_2O utilization efficiency? (please provide answer as w/w% with indicator of accuracy of measurement (+/-))

3 SURVEY RESULTS

Seventeen companies submitted 37 responses (34 U.S., 3 overseas).

3.1 Processes that Use N_2O

The survey identified N_2O use in the following semiconductor manufacturing processes:

- Chemical vapor deposition (nitride, polysilicon glass, oxide, etc.)
- Diffusion (oxidation, nitridation, etc.)
- Rapid thermal processing
- Chamber seasoning

3.2 Emissions Characterization

Respondents reported using N_2O in 150 mm, 200 mm, and 300 mm process tool sets; however, no emissions characterization data were available for 150 mm processes and only one data set was provided for 200 mm processes. Only two of the responding companies have N_2O emissions characterization data. Characterization data were collected using either the 2001 or the 2006 *ISMI Equipment Environmental Characterization Guideline*. Both guidelines describe the protocol for quantitative measurements of tool emissions using quadrupole mass spectrometry or fourier transform infrared mass spectrometry. Two other companies estimated utilization efficiency using a stoichiometric and material balance approach. One company estimated N_2O UE after abatement and assumed a 99% destruction or removal efficiency (DRE) in the abatement device.

3.3 Utilization Efficiency

Eleven respondents reported the N_2O utilization efficiencies shown in Table 1. Responses 1 through 8 are measured data while 9 through 11 are estimated. The measured utilization efficiencies range from 1–20% for a 200 mm process (response 7) to a high of 83.5% for a 300 mm process. The average measured UE is 40%. Results 1–6 and 8 were from 300 mm tool sets. For responses 7 and 8, the mid-point of the range was used to calculate the overall average. The large difference between responses 7 and 8 is attributed to the method by which N_2O is supplied to certain 200 mm tools compared to 300 mm tools. If only the 300 mm results are considered, the average UE is 43%.

Table 1 N_2O Utilization Efficiency

Utilization			
Fab	Efficiency (%)	Accuracy (± %)	Comments
1	18	10	*
2	18	N/A	*
3	13.95	3.26	*
4	33.1	0.39	* deposition
4	54.1	1.37	* seasoning
5	83.5	4.92	*
6	64.7	0.73	* deposition
6	34.6	0.11	* seasoning
7	1 to 20	N/A	200 mm tools
8	50–80	N/A	*
9	44	N/A	estimated
10	99	N/A	estimated after abatement with burners
11	100	N/A	estimated

***** process in 300 mm tool

4 CONCLUSIONS

N_2O is used in a variety of semiconductor processes in both older and newer generation tool sets. Survey respondents provided little emissions characterization data for older generation tools; the majority of data is for 300 mm tools. The survey did not attempt to determine the quantity of N_2O used in the various processes but instead focused on collecting UE data. The measured UE of N_2O varies widely from a low of 1–20% in characterized 200 mm processes to a high of 83.5% for a 300 mm process. The average of all measured UE is ~40%. If only 300 mm results are considered, the average measured UE is 43%.

International SEMATECH Manufacturing Initiative
Technology Transfer
2706 Montopolis Drive
Austin, TX 78741

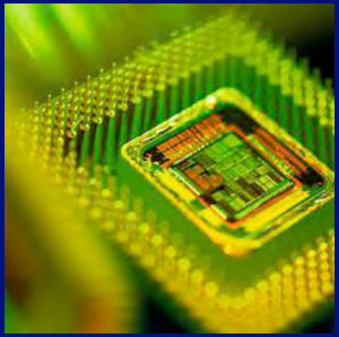
http://ismi.sematech.org
e-mail: info@sematech.org

ATTACHMENT B1:
ISMI PRESENTATIONS FROM MEETING WITH EPA 10 JUNE 2010

Accelerating Sustainable Manufacturing

ISMI Uncertainty Analysis: Refined Method and IPCC Tier 2b

Laurie Beu, P.E.
Consultant to ISMI
Laurie.beu@ismi.sematech.org
Diane K. Michelson, Ph.D.
ISMI Member of the Technical Staff



Disclaimer

- Disclaimer of Liability
  - This presentation has been prepared upon request using preliminary survey results and is subject to change without notice at the authors' discretion for reasons including, without limitation, receipt of additional information and continued analysis of survey results.
  - The authors' and presenters' intent is to report survey findings and to provide non-partisan analysis to the intended audience. This presentation is not intended to constitute lobbying, and shall not be interpreted as lobbying.
  - This information is provided "**as is**". The authors, contributors and presenters of this information disclaim any and all loss or liability, incurred either directly or indirectly as a consequence of applying or using the information presented herein. Neither ISMI, nor SIA, nor any of their members, employees or officers, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information disclosed or discussed herein.
  - The estimates, assessments, analyses, views and opinions of document authors and contributors and the presenters, whether expressed herein or expressed orally during the presentation and related meetings, do not necessarily state or reflect those of any individual entity or company, including, without limitation, ISMI, the SIA or any of their member companies.
- Disclaimer of Forward-looking Statements
  - Portions of this presentation contain forward-looking statements that are based on the authors' and contributors' current expectations, estimates, projections and assumptions. These statements are based on assessment of uncertain factors and therefore are not guarantees of future events and outcomes. Actual future results may differ materially from what is forecast. All forward-looking statements speak only as of the date of this presentation.
  - All related written and oral forward-looking statements attributable to the authors, presenters, ISMI, SIA or any person acting on behalf of those entities are qualified by the cautionary statements in this section.
  - The authors, contributors and presenters do not undertake any obligation to update or publicly release any revisions to forward-looking statements to reflect events, circumstances or changes in expectations after the date of this report.

Background

- EPA published proposed Mandatory Reporting of Greenhouse Gases Rule on April 12, 2010 with 60 day comment period.
- EPA published Technical Support Document (TSD) with uncertainty analysis in support of Subpart I.
- Notice of Data Availability (NODA) with proposed Refined Method default emission factors published May 13, 2010.

EPA Goal for Refined Method

- ***IMPROVE DATA QUALITY WITH SIMPLER REQUIREMENTS THAN 2006 IPCC TIER 3.***
  - *"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."* (Apr. 12, 2010 FR, p. 18662)
  - *"EPA intent is to reduce the uncertainties relative to the Tier 2b factors in Chapter 6 of the 2006 Guidelines. To accomplish this, in part, EPA intends to develop emission factors for 150 mm, 200 mm and 300 mm wafer processing technologies to the extent feasible, as opposed to one set that would apply to all wafer technologies, as is the case for the 2006 IPCC Tier 2b emission factors."* (TSD, p.30)

EPA Justification for 9 Refined Method Sub-categories

- ***INCREASED BURDEN JUSTIFIED BY IMPROVED UNCERTAINTY:***

  "The selection of the methods to compare in this uncertainty analysis was aimed to confirm there is a sufficient decrease in uncertainty in emissions estimates when using a refined process category method as opposed to the 2006 IPCC Tier 2b method, such that any additional burden associated with a refined process category method is justifiable." (TSD, p.25)

- ***HALVING OF UNCERTAINTY:***

  "The uncertainty results indicate that a refined process category method is about twice as certain as the 2006 IPCC Tier 2b approach." (TSD, p.29)

EPA Uncertainty Basis

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

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.

- ***EMISSION FACTORS ONLY SOURCE OF UNCERTAINTY:***
  - Only uncertainties in emission factors (1-U_{ij}) across sets of factors were considered.
  - EPA assumes uncertainties in usage C_{ij} are the same for both Tier 2b and Refined methods.

- ***COMPARED REFINED METHOD UNCERTAINTY TO OLD TIER2b ANALYSIS:***
  - Relative errors for the 2006 IPCC Tier 2b emission factors were taken from the 2006 IPCC Guidelines, Table 6.9. (TSD, p.26).

Development of Refined Method Defaults

- ***ALL DATA USED TO DEVELOP DEFAULTS IS IN NODA TABLE 5***
  - *Table 5: Emission Factor (EF) Development Database* contains all data used to develop EF and estimate relative errors (NODA, p.3).
- ***ONLY NEW DATA BEYOND 2006 IPCC DATA SET WAS PROVIDED THROUGH SEMI***
  - EPA used industry data provided in cooperation with SEMI (NODA, p.3).
  - All other data entries are those used to develop 2006 IPCC EF (EPA statement in May 19 meeting).

Continued Use of Tier 2b is Warranted

- ***No demonstrated improvement in certainty of emissions estimate using Refined Method.***
- ***Analysis of Refined Method EF supports continued use of Tier 2b.***
  - No emission factors provided for 8% of gas usage
  - New factors are provided for only 20% of F-GHG usage
  - 72% of F-GHG usage has same emission factors in Refined Method as in Tier 2b
- ***Tier 2b uncertainty analysis should be revised to reflect improved uncertainties for 72% of F-GHG use where EF are unchanged.***

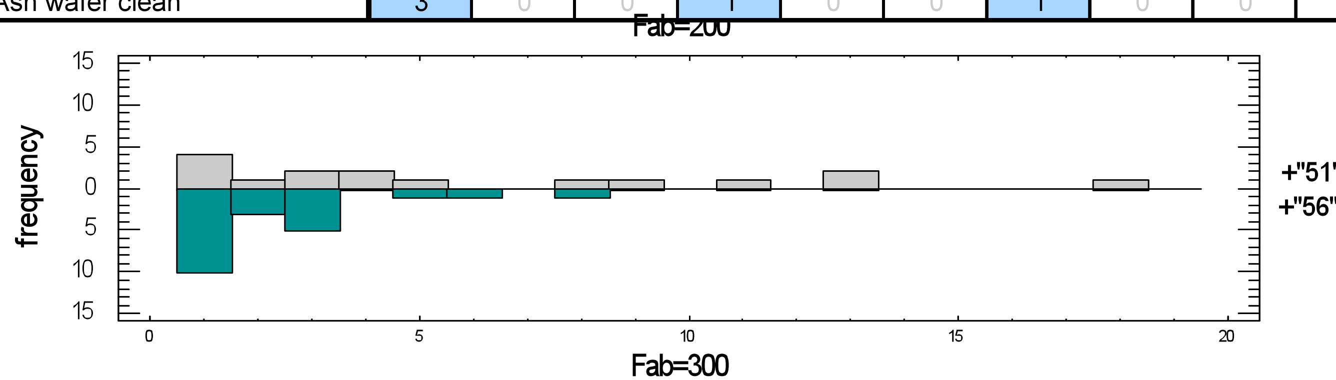
No Demonstrated Improvements in Certainty of Emissions Estimate Using Refined Method

ISMI Review of NODA Refined Method EF and Associated Uncertainty Analysis

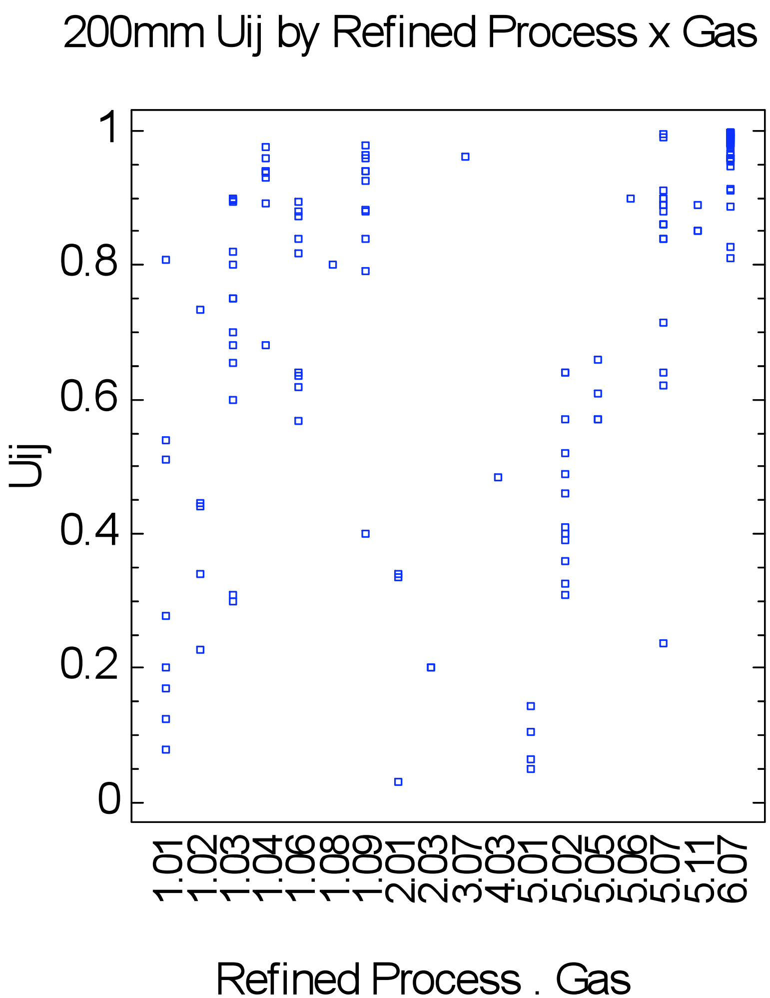
- ***NODA TWO SIGNIFICANT FIGURE DEFAULTS NOT JUSTIFIED:***
  - Data set is not substantively increased from Tier 2b for most EF and is smaller for most sub-categories. Table 5 data set does not support Refined Method EF reported as two significant figures instead of one in Tier 2b.
- ***ISMI CAN DUPLICATE DEFAULT EF BUT CANNOT DUPLICATE RELATIVE ERRORS:***
  - ISMI is able to use NODA Table 5 data set to calculate the same EF listed in Tables 3 and 4.
  - ISMI is not able to duplicate relative errors listed in Table B-1 of the Re-proposed Rule Technical Support Document (TSD).
  - ISMI believes we have identified the original Tier 2b data set and are unable to duplicate relative errors reported for Tier 2b CVD chamber cleans (IPCC Table 6.9).
  - As of June 9, EPA unable to provide sample calculation.

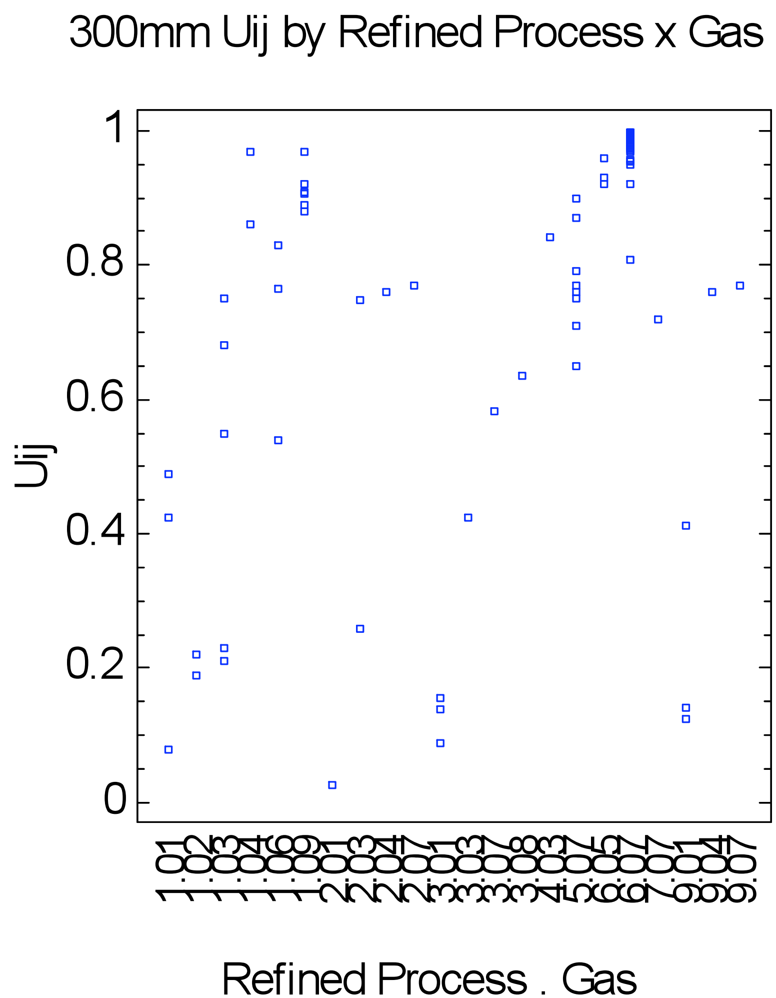
Number of Data Values Used to Develop Refined Category Emission Factors

Fab	RefinedProcess	1_ CF4	2_ C2F6	3_ CHF3	4_ CH2F2	5_ C3F8	6_ C4F8	7_ NF3	8_ SF6	9_ C4F6	10_ C5F8	11_ C4F8O
200	1_Oxide etch	8	5	13	8	0	9	0	1	11	0	0
200	2_Nitride etch	3	0	2	0	0	0	0	0	0	0	0
200	3_Silicon etch	0	0	0	0	0	0	1	0	0	0	0
200	4_Metal etch	0	0	1	0	0	0	0	0	0	0	0
200	5_In situ plasma clean	4	13	0	0	4	1	18	0	0	0	3
200	6_Remote plasma clean	0	0	0	0	0	0	51	0	0	0	0
200	7_In situ thermal chamber clean	0	0	0	0	0	0	0	0	0	0	0
200	8_Bezel clean	0	0	0	0	0	0	0	0	0	0	0
200	9_Ash wafer clean	0	0	0	0	0	0	0	0	0	0	0
300	1_Oxide etch	3	2	5	2	0	3	0	0	6	0	0
300	2_Nitride etch	1	0	2	1	0	0	1	0	0	0	0
300	3_Silicon etch	3	0	1	0	0	0	1	1	0	0	0
300	4_Metal etch	0	0	1	0	0	0	0	0	0	0	0
300	5_In situ plasma clean	0	0	0	0	0	0	8	0	0	0	0
300	6_Remote plasma clean	0	0	0	0	3	0	56	0	0	0	0
300	7_In situ thermal chamber clean	0	0	0	0	0	0	1	0	0	0	0
300	8_Bezel clean	0	0	0	0	0	0	0	0	0	0	0
300	9_Ash wafer clean	3	0	0	1	0	0	1	0	0	0	0



Data for U_{ij} by Refined Process x Gas





Example: In-situ plasma NF_3

ISMI Review of NODA Emission Factors: *200 mm Etch Sub-categories*

- ***Refined Method factors are incomplete:*** EPA has provided EF for only eleven 200 mm etch sub-categories; no EF for eighteen F-GHG uses in etch sub-categories.
- ***3 of provided EF are based on a single data entry.***
  - A single measurement is likely not representative of variable process conditions.
  - EPA assumption of 10% relative error is application of ISMI emissions characterization guideline. 10% assumes a single process. Variation between processes in same sub-category will be higher than 10%.
- ***3 EF are based on 4 or fewer data entries.***
  - EFs and relative errors based on average of a few data entries are likely not representative of all sub-category processes.

ISMI Review of NODA Emission Factors: *300 mm Etch Sub-categories*

- ***Refined Method factors are incomplete:*** EPA has provided only 14 needed 300 mm etch sub-categories; no EF for 14 F-GHG uses in etch sub-categories.
- ***7 of 14 provided EF are based on a single data entry.***
  - A single measurement is likely not representative of variable process conditions.
  - EPA assumption of 10% relative error is application of ISMI emissions characterization guideline. 10% assumes a single process. Variation between processes in same sub-category will be higher than 10%.
- ***6 EF are based on 3 or fewer data entries.***
  - EFs and relative errors based on average of a few data entries are likely not representative of all sub-category processes.

ISMI Review of NODA Emission Factors: *CVD Chamber Clean Sub-categories*

- The ***only*** in-situ plasma or remote plasma chamber clean ***EF*** which is ***changed*** from IPCC Tier 2b is for ***150/200 mm NF_3 remote plasma.***
  - Accounts for 7.5% of total F-GHG used.
- ***All other EF are the same as Tier 2b*** but may appear different because EPA reports as two significant figures instead of one.
- ***EF have not changed***; however, EPA ***presents improved uncertainties***.
- If improvements are valid, ***Tier 2b uncertainties should also be revised to reflect this improvement***.

Summary: Improvements in Uncertainty Not Demonstrated

- ***Refined Method defaults are incomplete*** – factors not provided for 8% of F-GHG gas uses.
- Refined Method ***EF were developed with extremely limited data set***.
- ***Variability in data set does not support reporting EF with 2 significant digits***.
- ***Variability for sub-categories with multiple points is high*** - indicates that EPA assumed 0 or ***10% variability*** for single data points are ***incorrect*** for multiple processes measured in the same sub-category.

Analysis of Refined Method EF Supports Continued Use of Tier 2b Defaults

% F-GHG Usage and EF

Process Gas	CVD Chamber Cleaning: In situ plasma	CVD Chamber Cleaning: Remote plasma	CVD Chamber Cleaning: In-situ thermal	Etch: Silicon Etch	Etch: Oxide Etch	Etch: Nitride Etch	Etch: Metal Etch	Wafer Cleaning: Bevel Cleaning	Wafer Cleaning: Ashing
CF4	2%	0.05%	—	2%	5%	2%	0.4%	0.1%	0.3%
C2F6	12%	—	—	0.4%	0.4%	0.1%	—	—	0.6%
C3F8	2%	—	—	—	0.007%	—	—	—	—
c-C4F8	0.6%	—	—	0.03%	2%	0.2%	0.0002%	—	—
CHF3	—	—	—	0.3%	1%	0.5%	0.1%	—	0.01%
CH3F	—	—	—	—	0.02%	0.1%	—	—	—
SF6	0.1%	—	—	1%	0.6%	0.8%	0.4%	0.1%	0.0003%
NF3	17%	41%	0.3%	0.9%	1%	0.9%	2%	—	0.007%
C4F6	—	—	—	—	0.3%	0.04%	—	—	—
C5F8	—	—	—	—	0.1%	0.01%	—	—	—
C4F8O	0.2%	—	—	—	—	—	—	—	—
CH2F2	—	—	—	0.1%	0.1%	0.1%	—	—	—
F-gas Totals	34%	41%	0%	5%	11%	4%	3%	0%	1%

Refined Method EF Matches Tier 2b
Refined Method EF Matches Tier 2b for at least one wafer size
Refined MethodEF different from Tier 2b
Refined Method EF different from Tier 2b; no EF provided for at least one wafer size
No Refined Method EF Provided

- Etch is ~24% of F-GHG usage; EPA does not provide etch EF for 7.4% of total gas used.
- CVD chamber cleans is 75% of F-GHG usage; EF unchanged for cleans gases totaling 66% of F-GHG used.
- Refined EF unchanged for 72% of total usage.

ISMI EF and Relative Error Review

- ISMI reviewed NODA Tables 3,4 and 5, TSD Table B-1, and 2006 IPCC guideline Tables 6.3 and 6.9.
- Using Table 5:
  - NODA Refined Method default EF were calculated.
  - When possible, IPCC Tier 2b EF were calculated.
  - Relative error were calculated for Refined EF and Tier 2b EF when possible:
    - RE = Standard Deviation/Mean*100
- Following tables present analysis of EF and Relative Errors for 200 mm, 300 mm and Tier 2b.

200 mm Default EF Comparison: Etch

200 mm Wafer Size Emission Factors: Refined Method and Tier 2b Defaults

Refined Process Category	Process Gas i										
	CF4	C2F6	CHF3	CH2F2	C3F8	C4F8	NF3	SF6	C4F6	C5F8	C4F8O
PATTERNING/ETCHING											
Oxide etch											
1-Ui (Refined Method)	0.66	0.56	0.3	0.093	—	0.25	—	0.2	0.14	—	—
Refined 1-Ui reported to 1 significant figure	0.7	0.6	0.3	0.09	—	0.3	—	0.2	0.1	—	—
1-Ui (Tier 2b)	0.7	0.4	0.4	0.06	—	0.2	0.2	0.2	0.1	0.2	—
Nitride etch											
1-Ui (Refined Method)	0.77	—	0.8	—	—	—	—	—	—	—	—
Refined 1-Ui reported to 1 significant figure	0.8	—	0.8	—	—	—	—	—	—	—	—
1-Ui (Tier 2b)	0.7	0.4	0.4	0.06	—	0.2	0.2	0.2	0.1	0.2	—
Silicon etch											
1-Ui (Refined Method)	—	—	—	—	—	—	0.038	—	—	—	—
Refined 1-Ui reported to 1 significant figure	—	—	—	—	—	—	0.04	—	—	—	—
1-Ui (Tier 2b)	0.7	0.4	0.4	0.06	—	0.2	0.2	0.2	0.1	0.2	—
Metal etch											
1-Ui (Refined Method)	—	—	0.52	—	—	—	—	—	—	—	—
Refined 1-Ui reported to 1 significant figure	—	—	0.5	—	—	—	—	—	—	—	—
1-Ui (Tier 2b)	0.7	0.4	0.4	0.06	—	0.2	0.2	0.2	0.1	0.2	—

(red)	EF based on single data point
(yellow)	EF based on average of less than 5 data entries
GREEN Font	Tier 2b and Refined Defaults are the same to 1 significant figure

- Oxide etch CF_4 EF is same for Refined Method and Tier 2b. 4th largest F-GHG use.
- NODA Table 5 contains insufficient sub-category data to establish defaults for majority of 200 mm etch gases.

200 mm Relative Error Comparison: Etch

200 mm Wafer Size Emission Factors: Refined Method and Tier 2b Relative Errors

Refined Process Category	Process Gas i										
	CF4	C2F6	CHF3	CH2F2	C3F8	C4F8	NF3	SF6	C4F6	C5F8	C4F8O
PATTERNING/ETCHING											
Oxide etch											
ISMI Calculated % Refined Relative Error (STD/AVERAGE*100)	39%	33%	65%	101%	—	54%	—		120%	—	—
Tier 2b Relative Error (%)	60	100	100	700	—	200	300	300	300	200	—
Nitride etch											
ISMI Calculated % Refined Relative Error (STD/AVERAGE*100)	23%	—	70%	—	—	—	—	—	—	—	—
Tier 2b Relative Error (%)	60	100	100	700	—	200	300	300	300	200	NA
Silicon etch											
ISMI Calculated % Refined Relative Error (STD/AVERAGE*100)	—	—	—	—	—	—		—	—	—	—
Tier 2b Relative Error (%)	60	100	100	700	—	200	300	300	300	200	NA
Metal etch											
EPA Reported Refined Method Relative Error (%)	43%	35%	47%	26%	—	—	—	—	14%	—	—
ISMI Calculated % Refined Relative Error (STD/AVERAGE*100)	—	—		—	—	—	—	—	—	—	—
Tier 2b Relative Error (%)	60	100	100	700	NA	200	300	300	300	200	NA

Single data point; unable to calculate relative error

Based on average of less than 5 data entries

- Limited data precludes relative error comparison for majority of etch gases.
- No EF provided for 4 metal etch gases with TSD Table B-1 reported uncertainties. Basis for EPA reported relative errors is not clear.

300 mm Default EF Comparison: Etch

300 mm Wafer Size Emission Factors: Refined Method and Tier 2b Defaults

Refined Process Category	Process Gas i										
	CF4	C2F6	CHF3	CH2F2	C3F8	C4F8	NF3	SF6	C4F6	C5F8	C4F8O
PATTERNING/ETCHING											
Oxide etch											
1-Ui (Refined Method)	0.67	0.80	0.52	0.086	—	0.29	—	—	0.09	—	—
Refined 1-Ui reported to 1 significant figure	0.7	0.8	0.5	0.09	—	0.3	—	—	—	—	—
1-Ui (Tier 2b)	0.7	0.4	0.4	0.06	—	0.2	0.2	0.2	0.1	0.2	—
Nitride etch											
1-Ui (Refined Method)	0.97	—	0.50	0.24	—	—	0.23	—	—	—	—
Refined 1-Ui reported to 1 significant figure	1.0	—	0.5	0.2	—	—	0.2	—	—	—	—
1-Ui (Tier 2b)	0.7	0.4	0.4	0.06	—	0.2	0.2	0.2	0.1	0.2	—
Silicon etch											
1-Ui (Refined Method)	0.87	—	0.58	—	—	—	0.42	0.37	—	—	—
Refined 1-Ui reported to 1 significant figure	0.9	—	0.6	—	—	—	0.4	0.4	—	—	—
1-Ui (Tier 2b)	0.7	0.4	0.4	0.06	—	0.2	0.2	0.2	0.1	0.2	—
Metal etch											
1-Ui (Refined Method)	—	—	0.16	—	—	—	—	—	—	—	—
Refined 1-Ui reported to 1 significant figure	—	—	0.2	—	—	—	—	—	—	—	—
1-Ui (Tier 2b)	0.7	0.4	0.4	0.06	—	0.2	0.2	0.2	0.1	0.2	—

(red)	EF based on single data point
(yellow)	EF based on average of less than 5 data entries
GREEN Font	Tier 2b and Refined Default EF are the same to 1 significant figure

- Oxide etch CF_4 EF is same for Refined Method and Tier 2b. 4^{th} largest F-GHG use.
- NODA Table 5 contains insufficient sub-category data to establish defaults for majority of 300 mm etch gases.

300 mm Relative Error Comparison: Etch

300 mm Wafer Size Emission Factors: Refined Method and Tier 2b Relative Errors

Refined Process Category	Process Gas i										
	CF4	C2F6	CHF3	CH2F2	C3F8	C4F8	NF3	SF6	C4F6	C5F8	C4F8O
PATTERNING/ETCHING											
Oxide etch											
ISMI Calculated % Refined Relative Error (STD/AVERAGE*100)	33%	3%	49%	89%	—	53%	—	—	35%	—	—
Tier 2b Reported Relative Error (%)	60	100	100	700	—	200	300	300	300	200	—
Nitride etch											
ISMI Calculated % Refined Relative Error (STD/AVERAGE*100)		—	70%		—	—		—	—	—	—
Tier 2b Relative Error (%)	60	100	100	700	—	200	300	300	300	200	NA
Silicon etch											
ISMI Calculated % Refined Relative Error (STD/AVERAGE*100)	4%	—		—	—	—			—	—	—
Tier 2b Relative Error (%)	60	100	100	700	—	200	300	300	300	200	NA
Metal etch											
EPA Reported Refined Method Relative Error (%)	43%	35%	47%	26%					14%		
ISMI Calculated % Refined Relative Error (STD/AVERAGE*100)	—	—		—	—	—	—	—	—	—	—
Tier 2b Relative Error (%)	60	100	100	700	NA	200	300	300	300	200	NA

Single data point; unable to calculate relative error

Based on average of less than 5 data entries

- Limited refined method data precludes relative error comparison for majority of etch gases.

200 mm Emission Factor Comparison: Plasma CVD Chamber Clean

200 mm Wafer Size Emission Factors: Refined Method and Tier 2b Defaults

Refined Process Category	Process Gas i										
	CF4	C2F6	CHF3	CH2F2	C3F8	C4F8	NF3	SF6	C4F6	C5F8	C4F8O
CHAMBER CLEANING											
In situ plasma cleaning											
1-Ui (Refined Method)	0.91	0.55	—	—	0.4	0.1	0.18	—	—	—	0.14
Refined 1-Ui reported to 1 significant figure	0.9	0.6	—	—	0.4	0.1	0.2	—	—	—	0.1
ISMI Calculated 1-Ui (Refined Method)	0.9	0.6	—	—	0.4	0.1	0.2	—	—	—	0.1
1-Ui (Tier 2b)	0.9	0.6	—	—	0.4	0.1	0.2	—	—	0.1	0.1
ISMI Calculated 1-Ui (Tier 2b)	0.9	0.6	—	—	0.4	0.1	0.2	—	—	—	0.1
Remote plasma cleaning											
1-Ui (Refined Method)	—	—	—	—	—	—	0.029	—	—	—	—
Refined 1-Ui reported to 1 significant figure	—	—	—	—	—	—	0.03	—	—	—	—
ISMI Calculated 1-Ui (Refined Method)	—	—	—	—	—	—	0.03	—	—	—	—
1-Ui (Tier 2b)	—	—	—	—	—	—	0.02	—	—	—	—
ISMI Calculated 1-Ui (Tier 2b)	—	—	—	—	—	—	0.02	—	—	—	—

(red)	EF based on single data point
(yellow)	EF based on average of less than 5 data entries
GREEN Font	Tier 2b and Refined Defaults are the same to 1 significant figure

- ISMI able to duplicate Refined Method and Tier 2b default EF for all gases.
- EF are unchanged for all gases except NF_3 remote plasma clean.

200 mm Relative Error Comparison: Plasma CVD Chamber Clean

200 mm Wafer Size Emission Factors: Refined Method and Tier 2b Relative Errors

Refined Process Category	Process Gas i										
	CF4	C2F6	CHF3	CH2F2	C3F8	C4F8	NF3	SF6	C4F6	C5F8	C4F8O
CHAMBER CLEANING											
In situ plasma cleaning											
EPA Reported Refined Relative Error (%)	46	8	—	—	8	—	9	—	—	—	—
ISMI Calculated % Refined Relative Error (STD/AVERAGE*100)	4%	20%	—	—	11%	—	97%	—	—	—	17%
IPCC Reported Tier 2b Relative Error (%)	10	30	—	—	0.4	30	70	—	—	30	40
ISMI Calculated Tier 2b % Relative Error (STD/AVERAGE*100)	4%	20%	—	—	11%	—	88%	—	—	—	17%
Remote plasma cleaning											
EPA Reported Refined Relative Error (%)	—	—	—	—	—	—	156	—	—	—	—
ISMI Calculated Tier 2b % Relative Error (STD/AVERAGE*100)	—	—	—	—	—	—	137%	—	—	—	—
IPCC Reported Tier 2b Relative Error (%)	—	—	—	—	—	—	400	—	—	—	—
ISMI Calculated Tier 2b % Relative Error (STD/AVERAGE*100)	—	—	—	—	—	—	157%	—	—	—	—

Red: Single data point; unable to calculate relative error
Yellow: Based on average of less than 5 data entries

- ISMI is unable to duplicate uncertainty calculations; however, ISMI analysis demonstrates Refined Method and Tier 2b uncertainties are the same for all gases except NF_3.
- ISMI anticipates NF_3 relative errors may differ because of increased Refined Method data set.
- ISMI calculations find Tier 2b and Refined Method relative errors are same order of magnitude.

300 mm Emission Factor Comparison: Plasma CVD Chamber Clean

300 mm Wafer Size Emission Factors: Refined Method and Tier 2b Defaults

Refined Process Category	Process Gas i										
	CF4	C2F6	CHF3	CH2F2	C3F8	C4F8	NF3	SF6	C4F6	C5F8	C4F8O
CHAMBER CLEANING											
In situ plasma cleaning											
1-Ui (Refined Method)	—	—	—	—	—	—	0.23	—	—	—	—
Refined 1-Ui reported to 1 significant figure	—	—	—	—	—	—	0.2	—	—	—	—
ISMI Calculated 1-Ui (Refined Method)	—	—	—	—	—	—	0.2	—	—	—	—
1-Ui (Tier 2b)	—	—	—	—	—	—	0.2	—	—	—	—
ISMI Calculated 1-Ui (Tier 2b)	—	—	—	—	—	—	0.2	—	—	—	—
Remote plasma cleaning											
1-Ui (Refined Method)	—	—	—	—	0.063	—	0.017	—	—	—	—
Refined 1-Ui reported to 1 significant figure	—	—	—	—	0.06	—	0.02	—	—	—	—
ISMI Calculated 1-Ui (Refined Method)											
1-Ui (Tier 2b)	—	—	—	—	—	—	0.02	—	—	—	—
ISMI Calculated 1-Ui (Tier 2b)	—	—	—	—	—	—	0.02	—	—	—	—

(yellow)	EF based on average of less than 5 data entries
GREEN Font	Tier 2b and Refined Defaults are the same to 1 significant figure

- ISMI is able to duplicate Refined Method and Tier 2b default EF for NF_3.
- NF_3 EF are the same for Refined Method and Tier 2b $\Rightarrow$ Largest gas use sub-categories.

300 mm Relative Error Comparison: Plasma CVD Chamber Clean

300 mm Wafer Size Emission Factors: Refined Method and Tier 2b Relative Errors

Refined Process Category	CF4	C2F6	CHF3	CH2F2	C3F8	C4F8	NF3	SF6	C4F6	C5F8	C4F8O
CHAMBER CLEANING											
In situ plasma cleaning											
EPA Reported Refined Relative Error (%)	—	—	—	—	—	—	9	—	—	—	—
ISMI Calculated Tier 2b % Relative Error (STD/AVERAGE*100)	—	—	—	—	—	—	36%	—	—	—	—
IPCC Reported Tier 2b Relative Error (%)	—	—	—	—	—	—	70	—	—	—	—
ISMI Calculated Tier 2b % Relative Error (STD/AVERAGE*100)	—	—	—	—	—	—	88%	—	—	—	—
Remote plasma cleaning											
EPA Reported Refined Relative Error (%)	—	—	—	—	2	—	156	—	—	—	—
ISMI Calculated Tier 2b % Relative Error (STD/AVERAGE*100)	—	—	—	—	33%	—	164%	—	—	—	—
IPCC Reported Tier 2b Relative Error (%)	—	—	—	—	—	—	400	—	—	—	—
ISMI Calculated Tier 2b % Relative Error (STD/AVERAGE*100)	—	—	—	—	33%	—	157%	—	—	—	—

Based on average of less than 5 data entries

- ISMI is unable to duplicate EPA reported uncertainty values.
- ISMI calculations find Tier 2b and Refined Method relative errors are same order of magnitude.

Summary:
Analysis of Refined Method EF Supports Continued Use of Tier 2b Defaults

- Emission factors are unchanged for 72% of F-GHG usage.
- Insufficient data is available to establish refined method etch defaults and evaluate relative errors.
- ISMI calculated relative errors for CVD plasma Refined Method and Tier 2b defaults finds identical EF for all gases except 200 mm NF_3 remote chamber cleans.
- Relative errors for Refined Method and Tier 2b CVD chamber cleans are of similar magnitude.

Tier 2b Uncertainty Analysis Should Be Revised

EPA uncertainty analysis over-estimates relative error of Tier 2b while under-estimating uncertainty of Refined Method

- TSD shows much smaller relative errors for Refined Method chamber clean default emission factors (EF) while EF have not substantively changed from Tier 2b.
- Basis for this improvement is unknown and relative error difference cannot be demonstrated from the data.
- EPA mistakenly equates etch measurement repeatability with relative error associated with emissions for varying process conditions.
- This results in under-estimation of Refined Method etch default EF uncertainties.

Summary

- EPA goal for proposed Refined Method is good; however, Refined Method does not accomplish the goal.
  - Current data set is inadequate; data to develop more certain EF is currently not available.
  - Imposes significantly greater burden on industry than EPA estimates.*
- F-GHG usage patterns and improved relative errors for largest uses support continued use of Tier 2b.
  - Refined EF are unchanged for 72% of F-GHG usage.
  - If uncertainty improved for unchanged EF, EPA should revise Tier 2b uncertainty to reflect these improvement.

Reference: May 19, 2010 ISMI presentation to EPA and *2010 ISMI Semiconductor Greenhouse Gas (GHG) Reporting Rule Survey Results*, June 2010 available on ISMI website

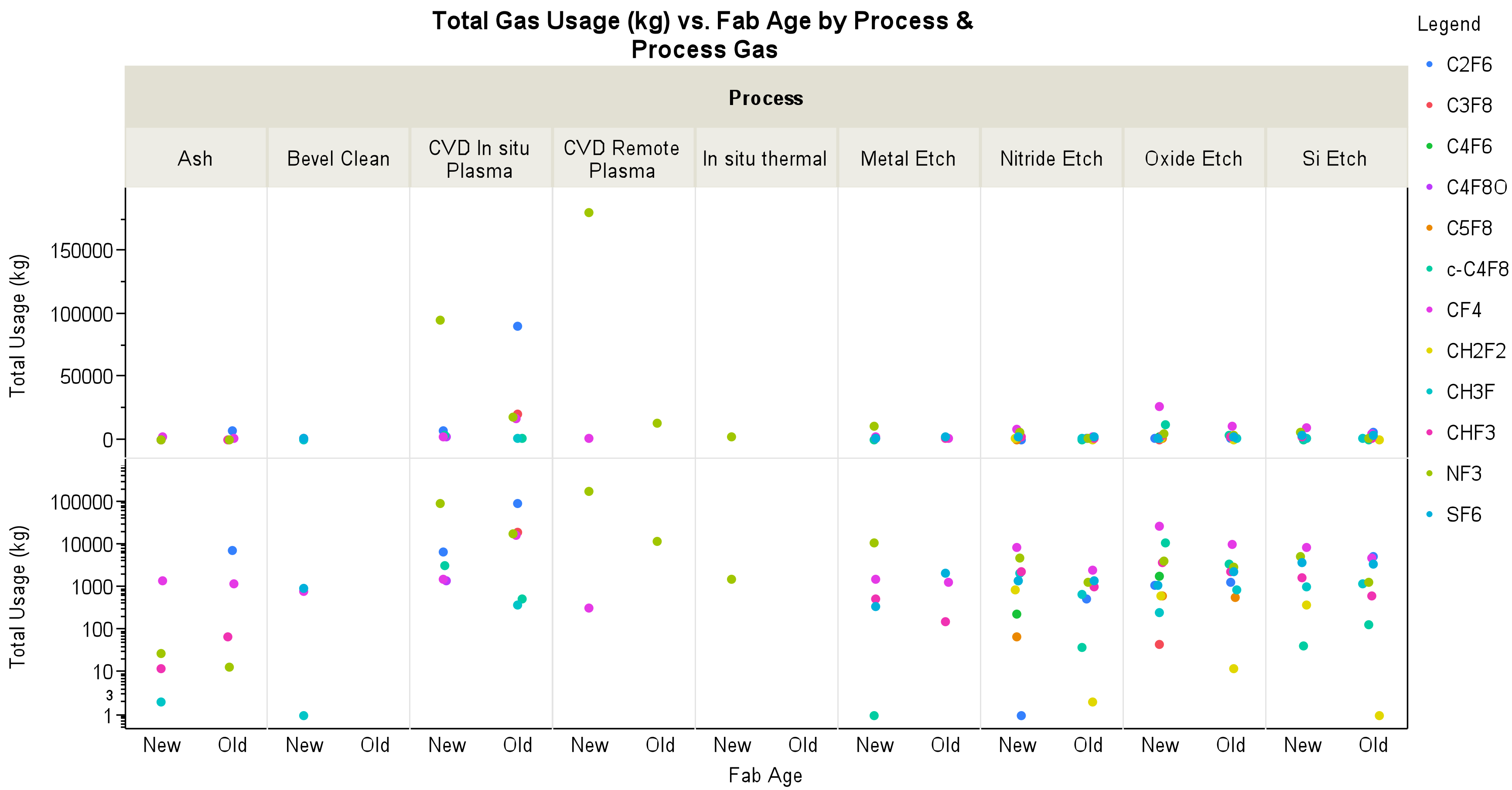
Summary (continued)

- ISMI survey identifies largest industry uses of F-GHG by process
  - Should be used to review current default emission factors for largest uses and determine if additional data is needed to develop more accurate default emission factors
  - If deemed necessary, weighted etch emission factors using better emission data can be developed in the future

Back-up

Total Gas Usage (kg)

- The graph below represents the total gas usage, by subcategory, process gas, and fab age.
- The top row is total usage on a linear scale; the bottom row is the <u>same data</u> on a log scale.



Presented 19-May-2010 to EPA by Laurie Beu

Preliminary Burden Estimate: *Estimating and Reporting F-Gas Emissions*

INTERNATIONAL SEMATECH ISMI MANUFACTURING INITIATIVE ESH Technology Center

EPA EIA F-Gas Emission Estimate and Reporting

- EPA estimate of industry labor burden to collect activity data for F-Gas emission estimate and report: **$2.55 Million**.
- Capital Costs: **$0**.
- O&M Costs: **$0**.

ISMI Estimate F-Gas Emission Estimate and Reporting

- Estimated labor cost: **$12.85 Million**.
- Estimated cost: **$39.95 Million** (likely low because some survey respondents did not understand engineering judgment not adequate for apportioning gas usage).
- Estimated cost: **$49.31 Million** (likely low because some respondents did not account for data tracking software and measurement equipment calibration requirement).

Presented 19-May-2010 to EPA by Laurie Beu

Preliminary Burden Estimate: *Estimating and Reporting F-Gas Emissions*

INTERNATIONAL SEMATECH ISMI MANUFACTURING INITIATIVE ESH Technology Center

Industry cost to apportion F-GHG usage into 9 process sub-categories

	Labor Burden For Collecting Data					Instrumentation Burden For Monitoring Data		
Activity	Industry Legal Cost	Industry Managerial Costs	Industry Technical Costs	Industry Clerical Costs	**Total Industry Labor Costs**	Total Industry Capital Cost	Total Industry O&M Cost	**Total Industy Capital and O&M Costs**
Industry cost to develop F-Gas heel factor and track data.	$4,596	$19,824	$513,295	$127	**$537,841**	$2,290,167	$3,254,767	**$5,544,934**
Industry cost to develop and track F-Gas apportionment by 9 "Refined Method" process categories.	$7,996	$41,820	$8,029,035	$16,792	**$8,095,643**	$13,839,583	$2,645,067	**$16,484,650**
Estimating emissions and by-products by specific process type - EPA refined process categories.	$8,915	$53,455	$3,411,899	$180,236	**$3,654,506**	$22,514,917	$3,130,400	**$25,645,317**
Collecting all data required to be reported/retained for POU abatement devices.	$303	$36,197	$386,481	$134,557	**$557,538**	$1,304,333	$333,667	**$1,638,000**
Total Industry Burden for estimating F-GHG emissions per refined process categories and collecting data to be reported/retained for POU abatement	$21,810	$151,297	$12,340,709	$331,711	**$12,845,528**	$39,949,000	$9,363,901	**$49,312,901**
EPA estimate of industry burden to collect activity data for F-GHG emission estimate and to report.	$2,757	$116,347	$2,411,981	$22,664	**$2,553,750**	$0	$0	**$0**

INTERNATIONAL SEMATECH ISMI MANUFACTURING INITIATIVE ESH Technology Center

Accelerating Sustainable Manufacturing

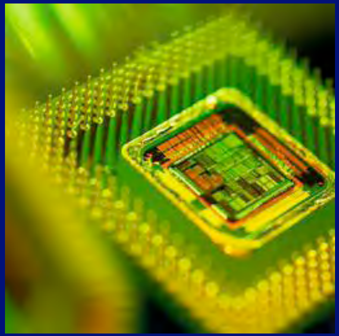
Semiconductor F-GHG Usage Data

Laurie Beu, P.E.

Consultant to ISMI

Diane K. Michelson, Ph.D.

ISMI Member of the Technical Staff



Disclaimer

- Disclaimer of Liability
  - This presentation has been prepared upon request using preliminary survey results and is subject to change without notice at the authors' discretion for reasons including, without limitation, receipt of additional information and continued analysis of survey results.
  - The authors' and presenters' intent is to report survey findings and to provide non-partisan analysis to the intended audience. This presentation is not intended to constitute lobbying, and shall not be interpreted as lobbying.
  - This information is provided "**as is**". The authors, contributors and presenters of this information disclaim any and all loss or liability, incurred either directly or indirectly as a consequence of applying or using the information presented herein. Neither ISMI, nor SIA, nor any of their members, employees or officers, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information disclosed or discussed herein.
  - The estimates, assessments, analyses, views and opinions of document authors and contributors and the presenters, whether expressed herein or expressed orally during the presentation and related meetings, do not necessarily state or reflect those of any individual entity or company, including, without limitation, ISMI, the SIA or any of their member companies.
- Disclaimer of Forward-looking Statements
  - Portions of this presentation contain forward-looking statements that are based on the authors' and contributors' current expectations, estimates, projections and assumptions. These statements are based on assessment of uncertain factors and therefore are not guarantees of future events and outcomes. Actual future results may differ materially from what is forecast. All forward-looking statements speak only as of the date of this presentation.
  - All related written and oral forward-looking statements attributable to the authors, presenters, ISMI, SIA or any person acting on behalf of those entities are qualified by the cautionary statements in this section.
  - The authors, contributors and presenters do not undertake any obligation to update or publicly release any revisions to forward-looking statements to reflect events, circumstances or changes in expectations after the date of this report.

Background

- EPA published proposed Mandatory Reporting of Greenhouse Gases Rule on April 12, 2010 with 60 day comment period.
- EPA published Technical Support Document with uncertainty analysis in support of Subpart I.
- NODA with proposed Refined Method default emission factors published May 13, 2010.

Data description

- ISMI commissioned a survey of member companies and SIA.
- Data was collected from thirty-two (32) 150mm, 200mm and 300mm fabs.
- The data represents total usage per wafer outs, in kg/cm^2, for each fab, process gas, and process type.

Data categories

- Descriptive data was also documented. These categories are:
  - wafer size (150mm / 200mm / 300mm)
  - fab age (Older, carbon-based cleans / Newer, NF3-based cleans)
  - fab size* (Medium, <10,500 m^2 / Large, >10,500 m^2)
  - process gas (C_2F_6, C_3F_8, C_4F_6, c-C_4F_8, CF_4, CH_2F_2, CH_3F, CHF_3, NF_3, SF_6, C_4F_8O, C_5F_8)
  - process type, with subcategories
    - Etch (Metal etch, Nitride etch, Oxide etch, Si etch)
    - CVD chamber clean (In situ plasma, Remote plasma, In situ thermal)
    - Wafer clean (Ash, Bevel clean)
  - production in cm^2 wafer outs

* note that there were not enough small fabs to give meaningful results, thus they were combined with medium fabs

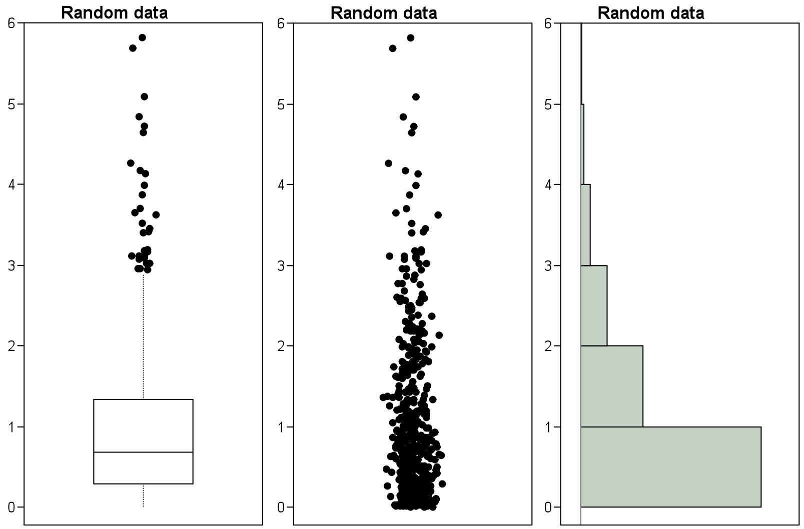
Usage Data Review

- EPA requests reviewing usage data grouped based on:
  - 2 groups: 150 mm/older 200 mm fabs and newer 200 mm/300 mm fabs
  - 3 groups: Relatively small, medium, and large fabs
  - 3 groups: Logic, memory and ASIC

- ISMI able to analyze data as:
  - 2 groups: 150 mm/200 mm with predominantly carbon-based chamber cleans fabs (old) and 200 mm with predominantly NF3-based chamber cleans/300 mm fabs (new)
  - 2 groups: Medium (<10,500 m^2) and Large (>10,500 m^2 fabs)
  - *unable to provide* – there are not enough companies per group to assure confidentiality

Analysis

- Of interest is whether there are differences in usage for the different categories.
- Graphical analysis
  - boxplots of data by category
  - A boxplot is a graph which summarizes the minimum, 25th percentile, median, 75th percentile, and maximum of a dataset. It also shows "outliers" or tail points.
  - For example, here is a boxplot, a dot plot, and a histogram of the same dataset.
  - Boxplots are provided for both the raw usage data and the logarithm of the usage.



Analysis

- Numerical analysis
  - all data distributions are highly skewed to the right, thus ordinary analysis of variance is not appropriate for testing hypotheses.
  - log(usage) has generally symmetric distributions, thus all numerical analysis has been performed on the logarithms.
  - Two sample t-tests or oneway analysis of variance were performed on the log(usage) data to test the hypothesis of equal means per group.
  - A hypothesis test for equal variances per group was also performed.

Example analysis

vs new

Old [...] mm using carbon-based cleans

New [...] mm using NF3-based cleans

Description of the groups

Boxplots of usage and log(usage) by group

Fab Age N Mean(usage) Stdev(usage)

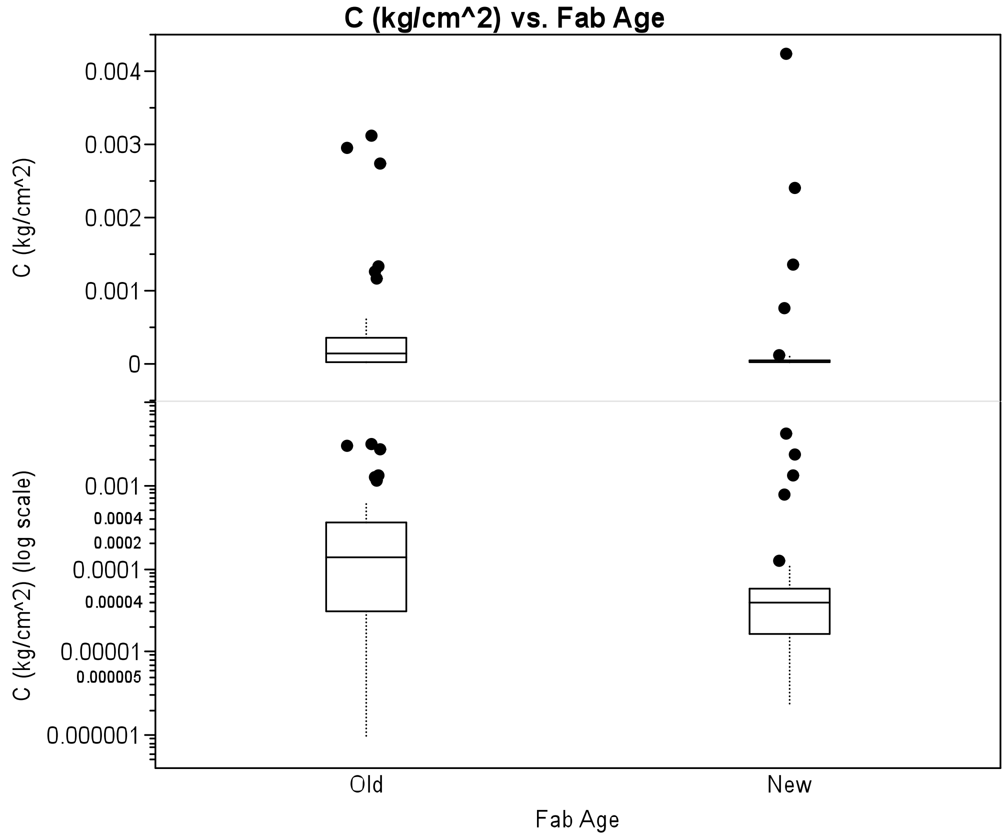
Mean and standard deviation of usage by group

- There is a significant difference in the means of the logarithm of usage – the mean of us[...] (p=.003)
- There is no[...]ns of the logarithm of usage (p=.18)

Results of statistical hypothesis tests

CVD chamber clean – *old vs new*

Old fabs are 150mm and 200mm using carbon-based cleans
New fabs are 300mm and 200mm using NF3-based cleans

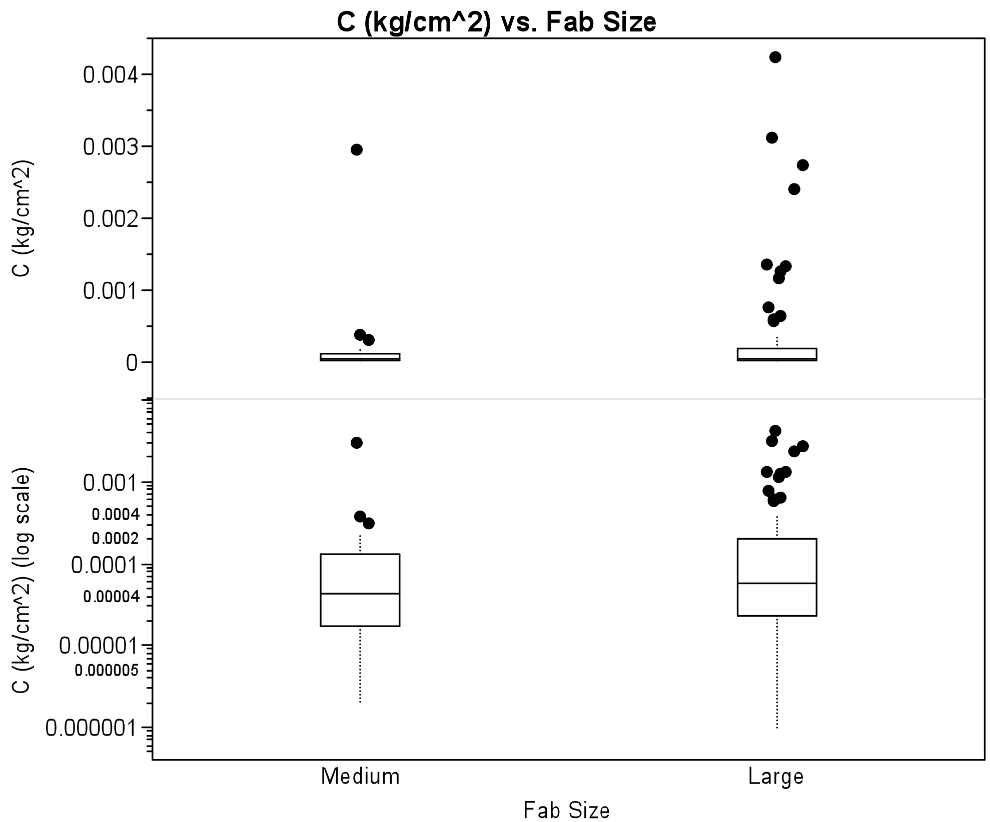


Fab Age	N	Mean(usage)	Stdev(usage)
Old	44	0.0004218	0.00076127
New	53	0.00020113	0.00068266

- There is a significant difference in the means of the logarithm of usage – the mean of usage of old fabs is about double that of new fabs (p=.003)
- There is not a significant difference in the standard deviations of the logarithm of usage (p=.18)

CVD chamber clean – *medium vs large*

Medium fabs produce <10,500 m^2 Si per year
Large fabs product >10,500 m^2 Si per year

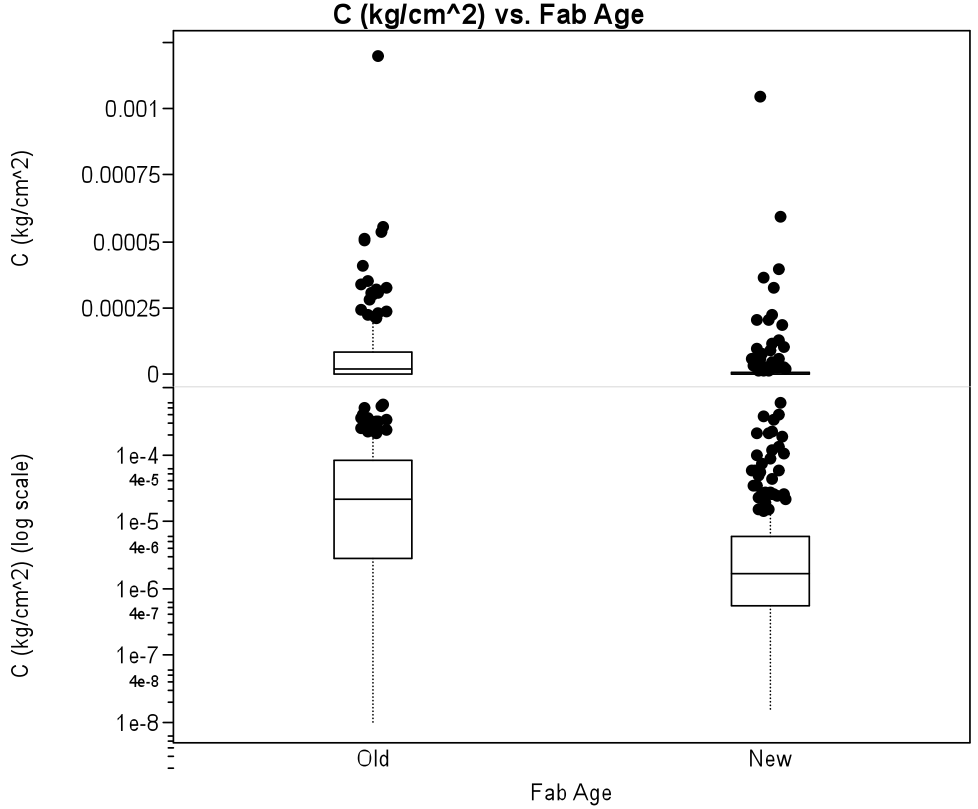


Fab Size	N	Mean(usage)	Stdev(usage)
Medium	22	0.0002085	0.00062158
Large	75	0.00032843	0.00075306

- There is not a significant difference (p=.44) in the means of the logarithm of usage between medium and large fabs.
- There is not a significant difference (p=.54) in the standard deviations of the logarithm of usage between medium and large fabs.

Etch process – *old vs new*

Old fabs are 150mm and 200mm using carbon-based cleans
New fabs are 300mm and 200mm using NF3-based cleans

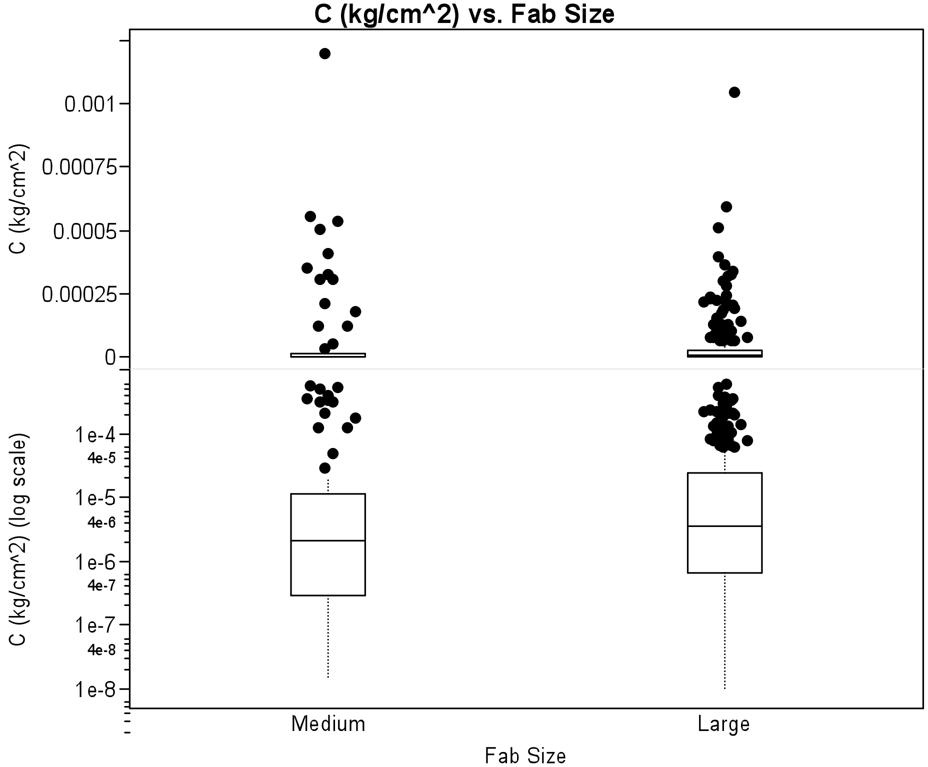


Fab Age	N	Mean(usage)	Stdev(usage)
Old	143	8.12E-05	0.00015114
New	275	0.00001959	8.51E-05

- There is a significant difference in the means of the logarithm of usage – the mean of old fabs is about four times that of new fabs (p=<.0001)
- There is not a significant difference in the standard deviations of the logarithm of usage (p=.10)

Etch process – *medium vs large*

Medium fabs produce <10,500 m^2 Si per year
Large fabs product >10,500 m^2 Si per year



Fab Size	N	Mean(usage)	Stdev(usage)
Medium	77	7.01E-05	0.00018493
Large	341	0.00003402	9.24E-05

- There is not a significant difference (p=.22) in the means of the logarithm of usage between medium and large fabs.
- There is a significant difference (p=.0008) in the standard deviations of the logarithm of usage between medium and large fabs. The test of the means took this into account. The standard deviation for medium fabs is about double that of large fabs.

Presented 19-May-2010 to EPA by Laurie Beu

Apportioning F-GHG Consumption:

Refined Method

2009 Gas Usage Apportioned into Refined Method Categories (% Total)

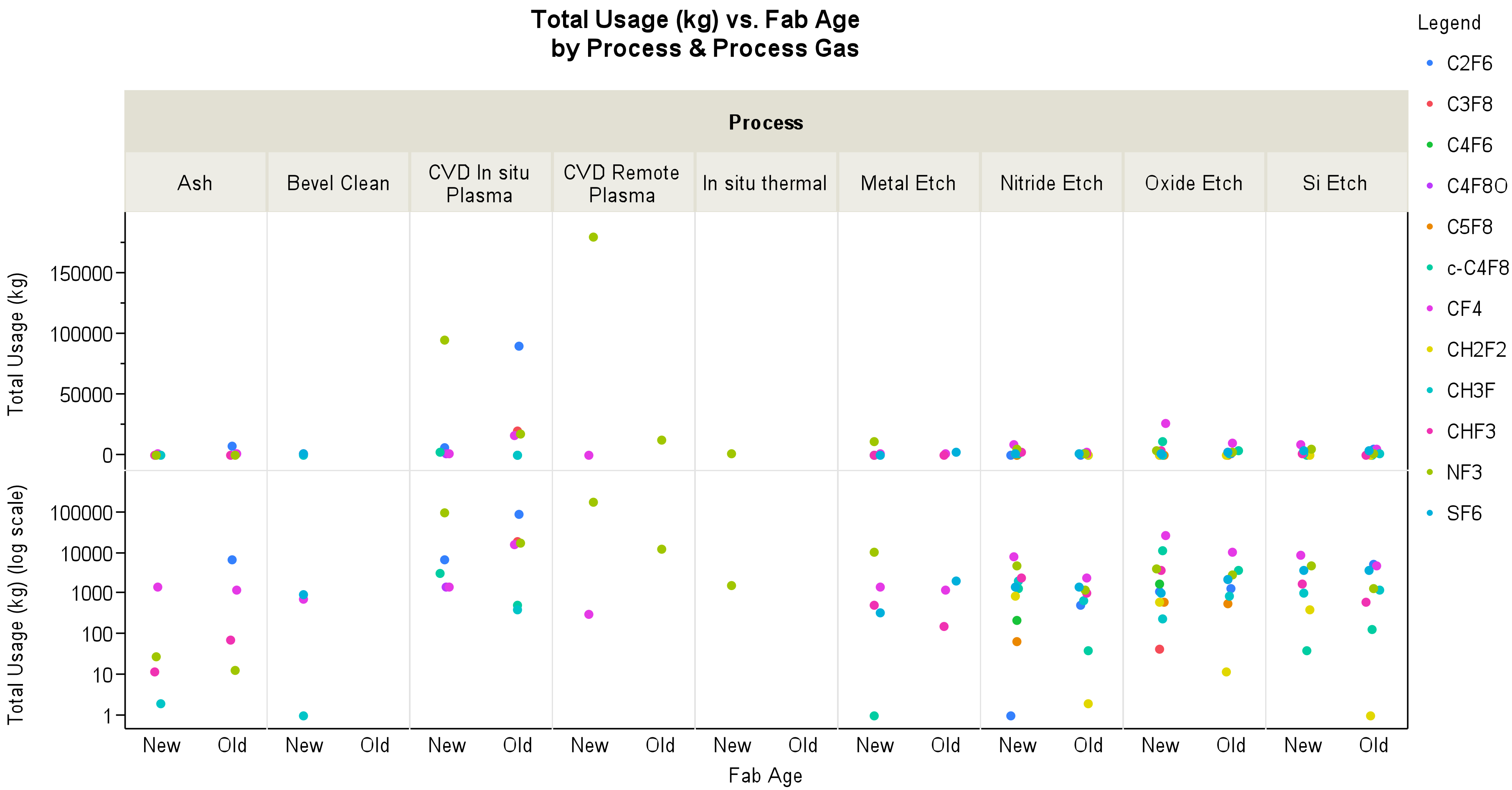
	CVD Chamber Cleaning			*Etch*				*Wafer Cleaning*	
Process Gas	**In situ plasma**	**Remote plasma**	**In-situ thermal**	**Silicon Etch**	**Oxide Etch**	**Nitride Etch**	**Metal Etch**	**Bevel Cleaning**	**Ashing**
CF4	2.8%	0.1%	—	2.1%	6.1%	1.8%	0.5%	0.1%	0.4%
C2F6	13.4%	—	—	0.4%	0.4%	0.1%	—	—	0.6%
C3F8	1.9%	—	—	—	0.008%	—	—	—	—
c-C4F8	0.7%	—	—	0.03%	2.6%	0.3%	0.0003%	—	—
CHF3	—	—	—	0.4%	1.0%	0.6%	0.1%	—	0.01%
CH3F	—	—	—	—	0.02%	0.1%	—	—	—
SF6	0.1%	—	—	1.7%	0.7%	0.9%	0.4%	0.2%	0.0003%
NF3	19.1%	33.8%	0.3%	1.0%	1.2%	1.0%	1.9%	—	0.007%
C4F6	—	—	—	—	0.3%	0.04%	—	—	—
C5F8	—	—	—	—	0.2%	0.01%	—	—	—
C4F8O	0.3%	—	—	—	—	—	—	—	—
CH2F2	—	—	—	0.1%	0.1%	0.2%	—	—	—
Totals	**38.2%**	**33.9%**	**0.3%**	**5.7%**	**12.6%**	**4.9%**	**3.0%**	**0.5%**	**1.0%**

Totals: Percent across all gases for that category

- Apportioning into Refined Method Categories increases burden for fabs.
- Gases must be apportioned into up to 8 different categories (CF_4 and NF_3).
- Etch gases must be apportioned across multiple etch categories for 10 of 11 etch gases.

Total Gas Usage (kg)

- The graph below represents the total gas usage, by subcategory, process gas, and fab age.
- The top row is total usage on a linear scale; the bottom row is the <u>same data</u> on a log scale.



Summary

- Select usage data from the ISMI survey has been presented.
- Results show that there are some differences in usage for fab age. No significant differences were found when categorizing by fab size.

What the Usage Data Tells Us

- ISMI survey identifies largest industry uses of F-GHG by process
  - Should be used to review current default emission factors for largest uses and determine if additional data is needed to develop more accurate default emission factors
  - If deemed necessary, weighted etch emission factors using better emission data can be developed in the future

ATTACHMENT B2:
2010 ISMI SURVEY REPORT

2010 ISMI Semiconductor Greenhouse Gas (GHG) Reporting Rule Survey Results

International SEMATECH Manufacturing Initiative
Technology Transfer #10065097A-TR

2010 ISMI Semiconductor Greenhouse Gas (GHG) Reporting Rule Survey Results

Technology Transfer #10065097A-TR

International SEMATECH Manufacturing Initiative

June 15, 2010

Abstract: This report from the ESHI004M project presents the results and analysis of the International SEMATECH Manufacturing Initiative (ISMI) 2010 Semiconductor Industry Process Greenhouse Gas (GHG) Survey, the Technical Support Document (TSD), and the Economic Impact Assessment (EIA) in response to the U.S. Environmental Protection Agency (EPA) Proposed Mandatory Reporting of Greenhouse Gases (GHG): Additional Sources of Fluorinated GHGs. Included is a comparison of reproposed rule requirements for fluorinated greenhouse gas heel determination, consumption estimation, point-of-use abatement requirements, and recordkeeping and reporting with industry practice; an estimate of the semiconductor industry burden to comply with these requirements; and an analysis of the EPA's uncertainty analysis to support the reproposed rule Refined Method Default Emissions process sub-categories. A companion report, Technology Transfer #10065098A-ENG, presents the results of a supplemental survey asking for comments about and cost information associated with data collection and annual data reporting under the reproposed rule.

Keywords: Cost Analysis, Government Regulations, Greenhouse Effect, Point of Use Abatement

Authors: Laurie S. Beu, Walter Worth, and Steve Trammell

Approvals: Laurie S. Beu, Author
Walter Worth, Author
Steve Trammell, Project Manager/Author
Ron Remke, Program Manager
Joe Draina, Director
Laurie Modrey, Technology Transfer Team Leader

Table of Contents

List of Figures

List of Tables

Acknowledgments

The authors wish to acknowledge the members of the ISMI Greenhouse Gas Leadership Working Group and SIA PFC Committee for their participation in the survey.

1 EXECUTIVE SUMMARY

This report presents results and analysis of the ISMI 2010 Semiconductor Industry Process Greenhouse Gas (GHG) Survey, and the U.S. Environmental Protection Agency's (EPA's) Mandatory Reporting of Greenhouse Gases (GHG): Additional Sources of Fluorinated GHGs Re-proposed Rule (reproposed rule), Technical Support Document (TSD). and Economic Impact Assessment (EIA).

The reproposed rule attempts to improve the accuracy of estimates of semiconductor fluorinated greenhouse gas (F-GHG) emissions by improving methods to determine gas consumption using facility-specific, gas-specific heel factors instead of a 10% default heel factor and requiring all semiconductor facilities to estimate emissions using the EPA's proposed Refined Method, which establishes default emission factors in nine process sub-categories. A previous International SEMATECH Manufacturing Initiative (ISMI) survey found 81% of respondents use the 10% default heel factor; consequently, developing facility-specific, gas-specific heel factors will improve emissions estimates. The EPA's assumption that estimating emissions using the Refined Method imposes the same burden on the industry as the Intergovernmental Panel on Climate Change (IPCC) Tier 2b is incorrect. The survey finds that the industry is neither currently collecting nor equipped to collect data required to apportion F-GHGs in the nine Refined Method sub-categories and that apportioning etch gas usage into the Refined Method's four etch sub-categories will introduce a new source of error in emissions estimates.

The EPA claims that the Refined Method will result in more accurate emissions estimates than Tier 2b method, "*…such that any additional burden associated with a refined process category method is justifiable*" (TSD, p.25). Data collected in the 2010 survey indicate that the EPA has underestimated the labor burden associated with developing facility-specific, gas-specific heel factors and apportioning F-GHG usage. The EPA's EIA assumes the industry will incur no capital or annual operating and maintenance (O&M) costs to comply with the reproposed rule; however, this assumption is incorrect.

ISMI has been unable to recreate the EPA's data analysis demonstrating the Refined Method results in emissions estimates that are 2X more accurate than Tier 2b. ISMI's review of the uncertainty analysis shows that EPA assumptions underestimate the relative error of the Refined Method etch process sub-category defaults. The relative error of Tier 2b chamber clean defaults, on the other hand, appears to be overestimated. These errors (coupled with industry F-GHG usage patterns and improvements in gas consumption estimates based on facility-specific, gas-specific heel factors) support continued use of the IPCC Tier 2b default emission factors.

The survey finds the EPA has also underestimated the number of point-of-use (POU) abatement devices installed in fabs and, thus, the industry cost to annually test POU abatement, which is estimated to be 4.4X higher than the EPA's estimate.

The requirement that emissions be reported by process, process category, or process type is considered confidential business information (CBI) by 92% of the respondents. Also, much of the data required to be reported for POU abatement are not currently collected or even retained. Consequently, EPA is underestimating the cost burden of reporting semiconductor F-GHG as required by the reproposed rule.

1.1 Survey Overview

ISMI's 2010 Semiconductor Industry Process Greenhouse Gas (GHG) Survey, which was distributed to ISMI and SIA member companies, collected responses to the EPA's Mandatory Reporting of Greenhouse Gases (GHG): Additional Sources of Fluorinated GHGs reproposed rule and its Technical Support Document (TSD), and the Economic Impact Assessment (EIA). Main topics addressed by the survey included the following (see Appendix A for the full survey questionnaire):

- Overview of the reproposed rule and its requirements
- Definitions of terms in the reproposed rule and survey
- Determination of facility-specific, gas-specific heel factors and gas utilization by process
- Estimation of default emission process sub-categories
- POU abatement requirements
- Recordkeeping and reporting requirements
- Cost burden for estimating process greenhouse gas emissions using proposed alternatives

Completed surveys were returned to ISMI to compile and analyze.

This report compares reproposed rule requirements with industry practice in F-GHG heel determination, consumption estimation, POU abatement requirements, and recordkeeping and reporting and estimates the semiconductor industry cost burden to comply with these requirements. Also included is an analysis of the EPA's uncertainty analysis to support the reproposed rule's Refined Method Default Emissions process sub-categories.

1.2 Overview of Survey Responses

Twenty-one responses to various parts of the survey were received from 14 semiconductor companies representing 32 fabs that are currently operating or under construction in the U.S. The number of respondent fabs are more than one-third of the EPA's estimated 91[1] semiconductor fabs that must report under the reproposed rule. Survey respondents made up 66% of the 2010 U.S. semiconductor manufacturing capacity and an estimated 69% of the projected 2012 capacity.[2] Twenty of the fabs are large facilities under the EPA's original definition (manufacturing capacity >10,500m^2); ~70% of EPA's estimated large facilities participated in the survey.

One respondent has a wafer manufacturing capacity <1,080 m^2 silicon but will be required to report Subpart I emissions under the reproposed rule because CO_2 emissions from electricity and steam generation facilities exceed 25,000 metric tons per year.

---

[1] April 12, 2010 Federal Register, p.18659.

[2] SEMI World Fab Watch, Feb 2010 edition.

2 BACKGROUND

The U.S. EPA's Proposed Mandatory Reporting of Greenhouse Gases (GHG): Additional Sources of Fluorinated GHGs (reproposed rule) was published in the Federal Register (FR) on April 12, 2010, beginning the 60-day comment period. The preamble explains the EPA's basis for the reproposed rule while Subpart I delineates specific requirements for semiconductor manufacturing facilities. The EPA published a TSD[3] to accompany Subpart I that explains the options EPA considered for estimating and apportioning gas consumption, and for estimating emissions. Additionally, the EPA published the EIA[4] that documents the EPA's cost analysis method and an estimate of the semiconductor industry's cost to comply with the reproposed rule.

While the reproposed rule addresses many of the concerns expressed by the semiconductor industry in comments to the original 2009 proposed rule, it and supporting documents reflect the EPA's incomplete understanding of semiconductor fabrication facilities and their operation. Consequently, ISMI's Environment, Safety, and Health Technology Center was asked to develop a survey, collect survey responses, and compile and analyze the responses for ISMI and SIA members. To preserve respondent confidentiality, the survey data was analyzed independent of the SIA. ISMI was also asked to review the TSD and EIA.

3 SURVEY RESPONSES

3.1 Estimating Gas Consumption

3.1.1 Reproposed Rule Requirements: Heel Factor Determination

The reproposed rule requires facility-wide gas-specific heel factors to be developed based on "the residual weight or pressure of a gas cylinder/container that the facility uses to change out that cylinder/container for each gas used" (April 12, 2010 FR, p.18700). These heel factors are used together with the fab's purchase records and inventory to determine gas consumption. While not specifying a calibration requirement, the reproposed rule requires that all flowmeters, weigh scales, pressure gauges, and thermometers have an accuracy of 1% or better of full scale (April 12, 2010 FR, p.18702).

Additional requirements for calibrating flowmeters and other measurement devices can be found in the Final Mandatory Greenhouse Gas Reporting Rule, Subpart A-General Provisions, 40CFR§98.3:

> *All measurement devices must be calibrated according to the manufacturer's recommended procedures, an appropriate industry consensus standard, or a method specified in a relevant subpart of this part. All measurement devices shall be calibrated to an accuracy of 5 percent…Subsequent calibrations shall be performed at the frequency specified in each applicable subpart.*

---

[3] U.S. EPA, "Technical Support Document (Revised) for Process Emissions from Electronics Manufacturing (e.g., Semiconductors, Liquid Crystal Displays, Photovoltaics, and Micro-electric-Mechanical Systems: Proposed Rule for Mandatory Reporting of Greenhouse Gases," March 22, 2010)

[4] U.S. EPA, "Economic Impact Analysis for the Mandatory Reporting of Greenhouse Gas Emissions F-Gases: Subparts I, L, QQ, SS," March 2010.

The general provisions appear to require an initial calibration to an accuracy of 5%, but subsequent calibrations are not specified.

3.1.2 Current Industry Practice: Heel Factor Determination

In a 2009 ISMI[5] survey conducted, 81% of the respondents indicated they estimated F-GHG consumption by tracking purchases and assuming a heel factor, typically the 2006 Intergovernmental Panel on Climate Change Guideline (2006 IPCC GL)[6]-specified 10% default. The reproposed rule requirement to develop container specific heel factors based on residual weight or pressure is less time-consuming than the requirements in the 2009 rule.

3.1.3 Survey Results and Analysis: Heel Factor Determination

Respondents were asked how they plan to develop facility-wide, gas-specific, container-specific heel factors. All respondents currently plan to measure residual weight or pressure as described in the reproposed rule. According to one respondent,

> *"Typically, liquefied gases are tracked using scales and compressed gas usage is tracked by measuring container pressure. Heels are calculated using the appropriate Z factor for the gas. Indoor temperatures are controlled and are maintained within a reasonable range. The temperature is assumed to be constant. Cylinder changes are manually logged by technicians and change-out set points are different depending on the specific gas. Gas supplies located outside will be subject to fluctuations in the ambient temperature. Other process gasses located inside are subject to minor room temperature fluctuations. Gas storage room temperatures are monitored and controlled."*

Another respondent noted that they do not have a clear solution to end-of-year reporting, when partial bottles are in service.

3.1.3.1 Measuring Devices With 1% Full Scale Accuracy

The reproposed rule requires that measuring devices have an accuracy of 1% or better of full scale; 74% of the respondents stated that their measuring devices meet this requirement, while 26% said they do not. When asked to explain their responses, those with devices that do not meet the requirement stated,

- *"It is likely some did when purchased, but spec sheets may or may not be available."*
- *"No – the cylinders weigh less than the full scale, no way to calibrate full scale."*
- *"Our current method DOES NOT meet the requirement, although we have systems in place to meet this requirement."*
- *"No, not all of them (achieve this accuracy). We have some pressure transducers, pressure switches and scales on these systems. The pressure transducers and scales are better than 1.0% accurate, but the pressure switch (accuracy) is 2.0%."*

---

[5] Beu, ISMI, June 8, 2009.

[6] Chapter 6, "Electronics Industry Emissions" of 2006 *IPCC Guidelines for Greenhouse Gas Inventories* (2006 IPCC GL).

Respondents that do not meet the 1% of full scale accuracy requirement were asked what the accuracy of their current measuring devices was:

- *“2% of Full scale on the pressure switches for some of the systems.”*
- *“Unknown.”*
- *“2–4%.”*
- *“We estimate better than ±5%.”*
- *“Devices are not certified when field calibrated by manufacturer as calibrated to 1%FS.”*
- *“Many components could have accuracy at >1% due to vintage. Older 3000 psi mechanical gauges without monitoring systems have auto-switching, but have no analog scale gradations below 300 psi.”*
- *“Do not have 1% accuracy for MFCs used on-site.”*

For those fabs that do not meet the 1% requirement, new equipment will be required. Respondents were asked to estimate the cost of replacing devices that do not meet the 1% requirement with devices that do:

- *“Replacement of the current (2% FS accurate) pressure switches will cost approx $3000.”*
- *“$90K to $120K.”*
- *“$100K.”*
- *“Cost to replace mechanical gauges: ~ $660K. We expect to weigh these cylinders at a central location instead. Additional scales needed: $2K.”*
- *“We would purchase a separate, individual scale and locate it at the chemical dock for the purpose of weighing cylinders as they leave the site (cost ~$2K – $1K/scale).”*
- *“Would propose to add temperature measurement devices for each cylinder, if required. This would mean two devices per piece of equipment. Would also have to set up data collection for each device, because our gas cabinet controllers do not have spare inputs for extra devices. Then, would have to change our consumption calculation software to use each temperature in volume calculations. A second option would be to use scales for all gases, but this would require the purchase of additional scales.”*

3.1.4 Conclusion: Heel Factor Requirements

Compared to the 2009 proposed rule, the reproposed rule significantly reduces the burden of tracking F-GHG consumption. The 2009 ISMI survey found that 81% of respondents estimated F-GHG usage using a default heel factor. Requiring development of fab- and gas-specific defaults heel factors based on residual weight or pressure will improve accuracy; however, assuming survey respondents are a representative cross section of the semiconductor facilities that must report, 26% of the industry can be expected to incur additional capital costs to meet the requirement to develop heel factors.

In addition to the original cost of purchasing and installing pressure switches, pressure transducers, scales, and temperature measurement devices, operating and maintaining these devices (including periodic calibration) will incur significant annual costs for reporting facilities.

3.2 Reproposed Rule Requirements: Apportioning F-GHG Consumption

The reproposed rule establishes different emissions estimating requirements for fabs processing 300 mm, or smaller, wafers and those processing >300 mm wafers. All fabs processing 300 mm and smaller wafers must calculate annual emissions from the facility either from all individual processes (2006 IPCC GL Tier 3 fab-specific measurements) or from process categories (EPA Refined Method). If process categories are used, the reproposed rule provides default emission factors for process categories based on wafer size (150 mm, 200 mm, 300 mm) (§98.93(a)(1)(i-ii) and Tables I-5, I-6, I-7). These default emission factor tables have been further clarified in the Notice of Data Availability (NODA) EPA, May 13, 2010.

The reproposed rule requires that all reporting fabs apportion F-GHG consumption using a facility-specific engineering model based on wafer passes (April 12, 2010 FR, pp.18701-18702). The preamble states, *"The use of engineering judgment is not based on a quantitative metric and would not be considered an acceptable quantifiable indicator of gas usage"* (p.18662).

While the 2006 IPCC GL uses three process categories to estimate emissions (in situ chemical vapor deposition [CVD] chamber cleans, remote CVD chamber cleans, and etch), the reproposed rule divides chamber cleaning into three sub-categories (in situ plasma, remote plasma, and in situ thermal) and divides etch processes into four sub-categories (silicon, oxide, nitride, and metal) and adds two wafer cleaning sub-categories (bevel cleaning and ashing). The EPA calls this expanded nine process sub-category method the "Refined Method." Its preamble states:

> *"…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 to report estimate emissions using the Refined Method. We have concluded the method we are proposing is the most appropriate taking into account both the cost to the reporter as well as accuracy of emissions achieved."* (p.18656)

Further documentation of the Refined Method is provided in the Technical Support Document[7] in which the EPA states, "Results from an uncertainty analysis performed by EPA indicate that an emissions estimation method that uses refined process categories, such as the Refined Method, is approximately twice as certain as the 2006 IPCC Tier 2b approach."

3.3 Current Industry Practice: Apportioning F-GHG Consumption

Tier 2a of the 2006 IPCC GL requires that facilities determine their F-GHG consumption and then estimate emissions using default factors for each gas, while Tier 2b requires apportioning gas consumption into three process categories (in situ plasma CVD chamber cleans, remote plasma CVD chamber cleans, and etch) and applying defaults for those three categories. Neither the IPCC Tier 2a nor Tier 2b requires development of a facility-specific engineering model based on wafer passes to estimate F-GHG emissions. The 2009 ISMI survey found that 66% of fabs are currently estimating F-GHG emissions using a method less stringent than Tier 2b while 27% are

---

7 U.S. Environmental Protection Agency (EPA). 2010. Technical Support Document (Updated) for Process Emissions From Electronics Manufacture (e.g., Semiconductors, Liquid Crystal Displays, Photovoltaics, and Micro-electro-mechanical Systems): Proposed Rule for Mandatory Reporting of Greenhouse Gases. Available at: http://www.epa.gov/climatechange/emissions/downloads10/Subpart-I_TSD.pdf

using some form of Tier 2b. While imposing an increased cost burden on the industry, requiring that emissions be estimated using Tier 2b instead of Tier 2a would result in more accurate emissions estimates for the majority of the industry.

3.3.1 Survey Results and Analysis: Industry Plans for Apportioning F-GHG Consumption

Respondents were asked to describe how their fabs plan to apportion process gas usage by process category or individual process as required by the reproposed rule. All respondents indicate that they do not meet the apportioning requirements with current systems.

Existing fab infrastructure poses a challenge to some respondents:

- *"The Fab is equipped with manifolded systems and therefore, accurate apportioning is not possible. To comply with the proposed rule, our fab will need to install mass flow controllers and servers which integrate chemical use with individual process recipes."*
- *"Gas cylinders are currently installed to support specific process categories (ex. Plasma etch, PECVD chamber cleaning). Capability does not exist to capture by process sub-categories (ex. Oxide etch, Nitride etch). Engineering model would need to be developed for sub-category data."*

The requirement to apportion among nine process sub-categories results in labor, capital, and O&M burdens because fabs do not currently collect the required data. The EPA has not accounted for these costs in its EIA. Respondents described their challenges in meeting the apportioning requirement and the approach they would take to comply:

- *"The facility can measure gas usage by individual tool or, in some cases with etch, groups of similar tools. For CVD chamber cleaning, the apportioning is straightforward as nearly all of the tools have dedicated gas cylinders and the tools that have RPS (most) are noted. And, only one type of chamber clean is performed for each tool. For etch, each tool typically runs only certain types of processes -- but each tool can have multiple recipes for those processes. We will have to analyze each tool's individual recipes to determine which gases are used, how often each recipe has been run (e.g., wafer pass for each recipe), and what film was etched since each etch pass can consist of multiple films in a stack. For a given period of time, a "ratio" of how often each film was etched and what gases were used would have to be developed and this "ratio" will vary for each time period. This data is currently not tracked or extracted as a course of business."*
- *"Our cylinder stations serve up to eight tools. Many of these stations are NOT segregated by the nine process groups proposed by EPA. Using an engineering model based on wafer passes and nominal gas flows to allocate gas usage would be very complex in our fab due to large numbers of recipes per tool and constantly changing product mix. Data from ~ 1000 recipes would have to be assessed and maintained on an ongoing basis. Customized software tied to our logistics system would be required to collect and aggregate the data for reporting. Based on our current understanding of the proposed rule, we believe that dealing with this level of complexity would be expensive and would pose a high degree of compliance risk. Our current plan is to segregate our gas distribution systems by process category instead."*

3.3.2 Determining Gas Consumption by Wafer Pass

When asked how they plan to determine gas consumption per wafer pass, some respondents indicated they would install additional cylinder and delivery systems or mass flow controllers (MFCs) and software which integrate gas consumption with individual process recipes and wafer passes. Others will build tracking spreadsheets or modify currently existing spreadsheets. When asked whether additional monitoring, software, redistribution of gas cylinders, etc., would be required for the fab to apportion gases by process category based on wafer passes, 11 respondents said “Yes,” four respondents said “No,” but several had qualifiers, such as “Not if there is no specific requirement for accuracy of the estimate” and “Not if engineering modeling methods are deemed compliant with this requirement. Existing process data is available detailing use by wafer pass, but requires additional work beyond current methods which generally tie use to wafer start. In addition, presenting information by wafer pass is an additional burden and raises additional confidentiality concerns.” One respondent said they would have no additional costs if the EPA adopts the IPCC 2006 Table 6.3 (Tier 2a or 2b defaults).

Respondents were asked how their facility would determine process gas usage by process category or individual process if the fab could use an alternative method to wafer passes. Multiple respondents indicated a preference for the method proposed by the SIA in 2009 comments (SIA method):

> *“Once the total amount of each gas used by the facility is determined, the amount of each gas used in each process type (etch and chamber cleans) can be reasonably approximated using engineering estimates where gas distribution systems feed multiple tools and processes. First all of the tools that use a particular gas are determined and sorted by process type (etch and chamber cleans). The total usage of a particular gas is then apportioned between etch and chamber clean processes by using knowledge of factors such as process recipes, typical flow rates and times, groups of similar tools running similar processes, and the average utilization or throughput of individual tools or groups of similar tools.”*

The SIA method uses engineering judgment to split gases into the 3 IPCC Tier 2b categories: in situ chamber clean, remote chamber clean, and etch. The industry’s ability to use the SIA method is contingent upon the EPA reverting to IPCC Tier 2b process categories.

Apportioning F-GHG usage into the nine Refined Method sub-categories by developing an engineering model based on wafer passes will incur significant costs that are not comprehended in the EPA’s EIA. When asked to provide comments to explain their burden estimates, one respondent stated,

> *“Approximately 1000 recipes using GHGs; estimate ~1 man-hr for each recipe to extract required information. O&M costs include potential need for carbon accounting software/licensing.”*

Another said,

> *“60 hours for Gas Vendor to track & provide reports on gas usage by tool as currently done (no additional requirements). 740 hours (at a minimum) for process engineering to sort through each tool, recipe, gas usage, wafer pass, etc. to apportion gas usage by refined category type. Alternatively, an IT solution may be required but would require likely greater than 740 hours for programming and data entry time.”*

A third responded,

> *"It would take significant labor hours to continually update recipe databases so that gas could be apportioned by wafer pass and process category. Estimating four full-time process engineering positions required to maintain process recipe information and enter all engineering/test wafers through the fab tracking system. This would also require four full-time staff members to integrate this information into the facility's current recipe management system. Estimate significant IT resources would be required to create and maintain systems to pull information from the tools and fab tracking systems. This would include four IT engineers and two Host (tool interface) engineers. Additional equipment for data storage would also be required."*

A fourth said, "Significant information systems (IS) work will be required."

3.3.3 Survey Results and Analysis: Estimating F-GHG Usage

Part 3 of the survey asked respondents to provide estimates of 2009 F-GHG usage apportioned into 2006 IPCC Tier 2b categories, "updated" Tier 2c categories (in situ plasma chamber clean, remote chamber clean, in situ thermal chamber clean, etch and wafer clean), and the reproposed rule Refined Method categories. Responses were received from five 150 mm fabs, eleven 200 mm fabs, and twelve 300 mm fabs. Respondents were asked to describe their data collection procedures and any deficiencies they noted with using the Tier 2b or Refined Method process sub-categories. In 2009, 10% default heel factors were typically applied to gas inventory records to determine the amount of gas used. Refined Method estimates typically were not made as required by the reproposed rule, but instead employed engineering judgment and estimates.

3.3.3.1 Apportioning Gas Usage into Tier 2b Categories

All survey respondents estimated gas consumption from purchase records. Companies generally used the 10% heel to correct for material left in the "empty" gas bottle. However, at least one company pointed out that it uses 98% of every bottle's content and that the 10% heel default overestimates emissions.

Other responses to estimating total gas usage using the Tier 2b Method are as follows (see Appendix C for all comments):

- *"We used a combination of purchase data, tool information, and cylinder data."*
- *"We have Purchasing (department) supply us with the amount of full cylinders used per year to start the data collection process. The heel and amount of gas used is based on the full cylinder weight/pressure."*
- *We use "amount of gas purchased and heel factor (10%)."*

When required, the respondents apportioned gas usage between etch and CVD chamber cleans based on the following:

1. Number of tools performing each process
2. Nominal recipe gas flow and time
3. Engineering judgment considering process tool recipes and wafer pass data
4. Purchasing records and apportionment by cost center usage

When required, engineering estimates were used to apportion gas usage between in situ and remote plasma cleans. In some fabs, each gas cabinet is tied to a specific tool, which allows gas usage to be apportioned by tool and process type (i.e., in situ plasma chamber clean, remote plasma chamber clean, and etch).

Sample responses to apportioning of gas usage using the IPCC Tier 2b method are as follows (see Appendix C for all comments):

- *"We used the 100 most frequently run GHG-utilizing recipes to develop an engineering model to apportion gas consumption between the 3 categories. Gas consumption was apportioned using nominal recipe gas flow and time for 2009. The only gas for which apportioning came into play was CF4. All other gases are uniquely used in either CVD or etch."*
- *"CF4, C4F8, CHF3, CH3F, SF6, and C5F8 are used only for etch processes. NF3 was apportioned between etch and CVD based on engineering judgment considering process tool gas valve and wafer pass data. NF3 was apportioned between In Situ Plasma and Remote Plasma cleaning based on the number of tools using each technology. N2O is used only as a CVD process gas."*

3.3.3.2 Apportioning Gas Usage into EPA Refined Method Sub-categories

Collecting the data for this method represented a much greater effort and many more man-hours. As with Tier 2b, total gas consumption was generally obtained from purchase records using the 10% default heel factor. However, apportioning of gas usage by process sub-category and wafer passes introduces greater complexity. For the current survey, the primary barrier to data collection was the resources required to manually extract information from recipes. Consequently, much of the apportioning of the gas usage among the various etch and CVD clean processes relied on some kind of engineering estimates. In many fabs, apportioning gas usage is very complex due to the large numbers of etch recipes per tool and the constantly changing product mix. Most fabs do not routinely collect data at the granularity required by the EPA's reproposed Refined Method and would need major changes/upgrades in their data tracking capability. Based on the survey responses, in most instances, considerable engineering judgment and engineering estimation are needed to apportion gas usage among the refined method sub-categories.

Sample responses to apportioning of gas usage using the EPA Refined Method include the following (see Appendix C for all comments):

- *"CF4 was apportioned between CVD and etch based on the number of tools performing each process. The etch portion of CF4 was apportioned between individual etch and wafer cleaning processes based on the number of tools performing each process. C2F6 was apportioned between etch and CVD based on engineering judgment considering process tool gas valve and wafer passes data. The CVD portion of C2F6 was only used with In Situ Plasma cleaning. The etch portion of C2F6 was apportioned to individual etch processes based on the number of tools performing each process. C3F8 is used only for In Situ Plasma cleans. C4F8, CHF3, and SF6 are used only for etch processes and were apportioned to individual etch processes based on the number of tools performing each process. NF3 was apportioned between etch and CVD based on engineering judgment considering process tool gas valve and wafer pass data."*

- *"We used the 100 most frequently run GHG-utilizing recipes to develop an engineering model to apportion gas consumption between the five categories. Gas consumption was apportioned using nominal recipe gas flow and time for 2009. There is some CF4 used for ashing; however, the amount is believed to be relatively small compared to CVD chamber cleaning and etch. In addition, there is some SF6 used for metal etch which is not included here but believed to be a small fraction of total usage.*
- *"This data is based on purchasing records and apportioned by cost center billing. Engineering estimates were used to apportion gases between different processes. Gas use by refined process category is currently not tracked."*

3.3.3.3 Barriers to Apportioning Usage into Multiple Categories

The respondents identified several barriers to apportioning usage into multiple sub-categories (see Appendix C for all comments):

- *"Cannot accurately separate some etch processes due to complexity of processes in multi-stack films"*
- *"Gas usage per wafer also could not be determined due to the amount of process recipes used on each system, chamber unique gas flow correction factors, end pointed processes (which introduce variable wafer-to-wafer times per lot), process stabilization steps, automated system process routines (ESC chucking/de-chucking), process faults/lot aborts, variable chamber sequencing (multiple chambers utilized on a system), and wafer count variation from lot to lot."*
- *"Lot histories do not include processing that may bypass normal track-in procedures and/or do not utilize production wafers such as "quals" (etch rate, particle, MFC calibration, endpoint testing), engineering experiments, engineering lots, special work requests, new product and new test development, chamber conditioning, chamber in-situ cleans, chamber warm-up processes, engineering recovery procedures, etc."*

3.3.4 Conclusion: Apportioning and Estimating F-GHG Consumption

All survey respondents indicated they are not meeting the reproposed rule apportioning requirements with their current gas tracking systems. Existing fab infrastructure does not capture usage data in the nine Refined Method sub-categories. The requirement that an engineering model based on wafer passes be used to apportion gas usage demands that the majority of survey respondents install additional infrastructure and software to tie into existing production management systems. Because apportioning usage into the nine Refined Method process sub-categories is more challenging than the EPA estimates, it will increase labor burdens, require infrastructure changes, and result in significant capital and O&M expenditures.

3.4 Industry F-GHG Usage Per Process Category

The EPA established the reproposed Refined Method defaults based on their understanding that the nine sub-processes are common in the industry; however, limited data were available on the amount of F-GHG used in each category and the specific gases used in each sub-category. The ISMI survey collected information to fill these data gaps.

3.4.1 Analysis of Gas Usage Apportioned by IPCC Tier 2b Categories

The IPCC Tier 2b method estimates F-GHG emissions by applying a 10% heel factor and providing default emission factors for in situ plasma chamber cleaning, remote plasma chamber cleaning, and etch process categories. Use of IPCC Tier 2b categories greatly simplifies estimating the F-GHG emissions for many fabs because certain gases are used in only one process category (see Table 1).

Table 1 Number of IPCC Tier 2b Categories in Which F-GHG is Used

F-GHG	Number of IPCC Tier 2B Process Categories Gas is Used In		
	≤ 150 mm (5 fabs)	200 mm (11 fabs)	300 mm (12 fabs)
CF_4	2	2	1
C_2F_6	2	2	1
C_3F_8	1	1	1
$c\text{-}C_4F_8$	1	2	1
CHF_3	1	1	1
SF_6	1	2	1
CH_3F	1	1	1
NF_3	3	3	3
C_4F_6	0	1	1
C_5F_8	0	1	1
C_4F_8O	0	1	0
CH_2F_2	1	1	1

0 = Gas not used
1 = Gas used in one process category
2 = Gas used in two process categories
3 = Gas used in three process categories

For the 12 F-GHGs used in semiconductor manufacturing, three, are not used at all in 150 mm fabs while six are used in a single process category; seven are used in a single category in 200 mm fabs; one gas is not used at all while ten are used in a single process category in 300 mm fabs. Use of F-GHGs in a single category simplifies apportionment among the Tier 2b process categories when compared to the none sub-category apportionment required by the Refined Method.

3.4.2 Analysis of Gas Usage Apportioned into Refined Method Categories

To identify sub-categories for default emission factors, the amount of F-GHG used in the various semiconductor processes must be known. Table 2 shows the percentage of total F-GHG respondents reported using in the nine Refined Method sub-categories.

Apportioning gas usage into the Refined Method sub-categories significantly increases the burden for fabs. Some gases must be apportioned into up to eight different sub-categories (e.g., CF_4 and NF_3), a level of detail that is not currently tracked. Ten of 11 etch gases must be apportioned across multiple etch sub-categories, even though usage in these sub-categories is minimal for many F-GHGs. The EPA assumes that the cost burden of apportioning and estimating emissions based on the Refined Method sub-categories is the same as their previous estimate using Tier 2b.[8] This assumption is incorrect. Data in Table 2 demonstrate that small amounts of F-GHG are used in multiple Refined Method process sub-categories, adding a greater level of complexity than the Tier 2b method.

The reproposed rule provides separate Refined Method default emission factors for 150 mm, 200 mm, and 300 mm wafer fabs (see Table 3).

Table 2 Gas Usage Apportioned Into Refined Method Categories (% Total)

		CVD Chamber Cleaning			Etch				Wafer Cleaning	
	Process Gas	In situ Plasma	Remote Plasma	In situ thermal	Silicon Etch	Oxide Etch	Nitride Etch	Metal Etch	Bevel Cleaning	Ashing
Amount of each gas used in each process type (% of total)	CF_4	2%	0.05%	—	2%	5%	2%	0.4%	0.1%	0.3%
	C_2F_6	12.0%	—	—	0.4%	0.4%	0.1%	—	—	0.6%
	C_3F_8	2%	—	—	—	0.007%	—	—	—	—
	$c\text{-}C_4F_8$	0.6%	—	—	0.03%	2%	0.2%	0.0002%	—	—
	CHF_3	—	—	—	0.3%	1%	0.5%	0.1%	—	0.01%
	CH_3F	—	—	—	—	0.02%	0.1%	—	—	—
	SF_6	17%	41%	0.3%	0.9%	1%	0.9%	2%	—	0.007%
	NF_3	0.1%	—	—	1%	0.6%	0.8%	0.4%	0.1%	0.0003%
	C_4F_6	—	—	—	—	0.3%	0.04%	—	—	—
	C_5F_8	—	—	—	—	0.1%	0.01%	—	—	—
	C_4F_8O	0.2%	—	—	—	—	—	—	—	—
	CH_2F_2	—	—	—	0.1%	0.1%	0.1%	—	—	—

Table 3 Percent of Total 2009 F-GHG Used per Process Category and Wafer Size

Process Sub-category	≤ 150 mm (5 fabs)	200 mm (11 fabs)	300 mm (12 fabs)
In situ plasma	5%	16%	13%
Remote plasma	1%	8%	32%
In situ thermal	—	0.02%	0.2%
Silicon	1%	1%	3%
Oxide	2%	3%	6%
Nitride	0.5%	1.0%	3.0%
Metal	1%	0.03%	2%
Bevel Clean	—	0.0002%	0.3%
Ashing	0.04%	1%	0.2%
% of Total F-GHG Used	10%	29%	61%

Based on actual industry F-GHG usage, the need for in situ thermal, bevel clean, and ashing sub-categories is not apparent for any wafer size. Additionally, etch sub-categories make up a small

[8] TSD, p.4-30.

percentage of the total F-GHG usage; any less uncertainty derived by apportioning etch into sub-categories could very well be offset by the greater uncertainty of the usage estimate. Finally, based on F-GHG usage, different default emission factors on a per wafer size basis may not be necessary.

Figure 1 shows 2009 percentages of F-GHG usage in the three broad categories; CVD chamber cleans, etch, and wafer cleans.

With chamber cleans accounting for 75% of total semiconductor F-GHG usage and etch accounting for only 24%, the benefit of apportioning etch emissions into four separate process sub-categories for three different wafer sizes as required in the reproposed rule is not apparent.

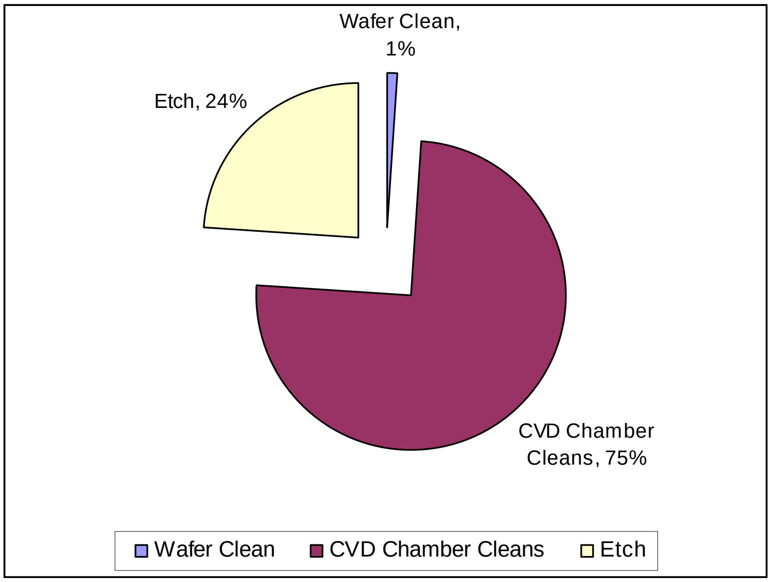


Figure 1 2009 F-Gas Usage Totals per Category

3.4.3 Conclusion: Industry F-GHG Usage Per Process Category

The ISMI survey collected estimated 2009 F-GHG usage data for Tier 2b process categories and the reproposed rule Refined Method sub-categories. Data were collected for ≤150 mm, 200 mm, and 300 mm fabs. While requiring more effort than Tier 2a (which estimates emissions per gas while not differentiating among process types), apportioning usage into the 3-IPCC Tier 2b categories simplifies the data collection compared to the Refined Method sub-categories and improves the accuracy of estimates. The survey showed that chamber cleans make up 75% of total F-GHG usage while etch accounts for ~24% of the total. Based on actual industry F-GHG usage, the need for in situ thermal, bevel clean, and ashing sub-categories is not apparent. Additionally, etch sub-categories make up a small percentage of the total F-GHG usage; any less uncertainty derived by apportioning etch into sub-categories could very well be offset by the increased uncertainty of the usage estimate. Finally, based on F-GHG usage patterns, establishing different default emission factors on a per wafer size basis may not be necessary.

3.5 Emission Factors versus F-GHG Usage for Refined and Tier 2b Process Categories

In a Notice of Data Availability (NODA), May 13, 2010, EPA issued “Draft Emission Factors for Refined Semiconductor Manufacturing Process Categories.” Table 4, Table 5, and Table 6 show emission factors for 150 mm, 200 mm and 300 mm fabs, respectively. A comparison of the NODA tables to reported gas usage by 150 mm, 200 mm and 300 mm fabs reveals that the EPA has not provided emission factors for many gases used in Refined Method process sub-categories.

Table 4 shows 150 mm refined method process sub-categories compared to industry F-GHG usage in the sub-categories. While EPA has provided default emission factors for thirteen 150 mm F-GHG uses, emission factors are not provided for nine F-GHG uses. All of the F-GHG uses without defaults are in etch processes where F-GHG usage per process sub-category is a small percentage of the industry's total usage. The 150 mm sub-categories without default emission factors account for ~2% of total industry F-GHG usage.

Table 4 150 mm Refined Method Process Sub-categories with Default Emission Factors Compared to Industry Uses

Process Gas	CVD Chamber Cleaning			Etch			
	In situ Plasma	Remote Plasma	In situ Thermal	Silicon Etch	Oxide Etch	Nitride Etch	Metal Etch
CF_4				0.3%			0.2%
C_2F_6						0.08%	
C_3F_8							
c-C_4F_8				0.004%		0.004%	
CHF_3				0.03%			
CH_3F							
SF_6				0.6%		0.2%	
NF_3					0.4%		
C_4F_6							
C_5F_8							
C_4F_8O							
CH_2F_2							

	F-Gas used in category and refined method emission factor provided
	Refined method default emission factor provided but gas not used
	F-Gas used in category and refined method emission factor NOT provided
%	Percent of 2009 Total F-Gas Used

Table 5 shows 200 mm Refined Method process sub-categories compared to industry F-GHG usage in the sub-categories. While the EPA has provided default emission factors for eighteen 200 mm F-GHG uses, it does not give factors for 27 F-GHG uses; thus, 60% of 200 mm uses do not have default emission factors. The 200 mm sub-categories without default emission factors account for ~ 3% of total industry F-GHG usage.

Table 6 compares 300 mm process sub-categories to industry F-GHG usage in these sub-categories. While EPA has provided default emission factors for 21 of the 300 mm F-GHG uses, emission factors are not provided for fifteen 300 mm F-GHG uses. Ninety-three percent of the missing default factors are for etch sub-processes with relatively minor F-GHG usage. The 300 mm sub-categories without default emission factors account for ~4% of total industry F-GHG usage.

Table 5 200 mm Refined Method Process Sub-categories with Default Emission Factors Compared to Industry Uses

Process Gas	CVD Chamber Cleaning			Etch				Wafer Cleaning	
	Plasma	Plasma	Thermal	Silicon Etch	Oxide Etch	Nitride Etch	Metal Etch	Cleaning	Ashing
CF_4		0.05%		0.4%			0.03%		0.1%
C_2F_6				0.4%		0.0002 %			1.0%
C_3F_8									
c-C_4F_8				0.02%		0.1%	0.0003 %		
CHF_3				0.06%					0.002%
CH_3F					0.01%	0.03%			
SF_6	0.06%			0.3%		0.4%		0.0001%	0.0003%
NF_3			0.02%		0.2%	0.1%			0.01%
C_4F_6						0.0002 %			
C_5F_8					0.05%				
C_4F_8O									
CH_2F_2				0.0002 %		0.001%			

(green)	F-Gas used in category and refined method emission factor provided
(red)	F-Gas used in category and refined method emission factor NOT provided
%	Percent of 2009 Total F-Gas Used

Table 6 300 mm Refined Method Process Sub-categories with Default Emission Factors Compared to Industry Uses

Process Gas	CVD Chamber Cleaning			Etch				Wafer Cleaning	
	Plasma	Plasma	Thermal	Silicon Etch	Oxide Etch	Nitride Etch	Metal Etch	Cleaning	Ashing
CF_4							0.2%		
C_2F_6	0.04%								
C_3F_8					0.01%				
c-C_4F_8						0.2%			
CHF_3									
CH_3F					0.01%	0.02%			
SF_6					0.2%	0.2%	0.1%		
NF_3					0.6%		2.0%		
C_4F_6						0.04%			
C_5F_8					0.1%	0.01%			
C_4F_8O									
CH_2F_2				0.06%					

(green)	F-Gas used in category and refined method emission factor provided
(yellow)	Refined method default emission factor provided but gas not used
(red)	F-Gas used in category and refined method emission factor NOT provided
%	Percent of 2009 Total F-Gas Used

The 2009 F-GHG usage was then compared to the IPCC Tier 2b default emission factors (see Table 7). Tier 2b provides default emission factors for 98% of industry F-GHG uses. While IPCC Tier 2b does not provide default emission factors for in situ thermal chamber cleans, bevel cleans, or ashing, F-GHG use in these process sub-categories is only 1.5% of the total industry usage. F-GHG use in in-situ plasma chamber clean and etch processes without Tier 2b defaults is ~0.4% of the total F-GHG used.

Table 7 Tier 2b Process Categories with Emission Factors Compared to Industry F-GHG Uses

Process Gas	In situ Plasma Total	Remote Plasma	In situ Thermal	Etch Total	Bevel Cleaning	Ashing
CF_4		0.05%			0.1%	0.3%
C_2F_6						0.6%
C_3F_8				0.007%		
$c\text{-}C_4F_8$						
CHF_3						0.01%
CH_3F				0.07%		
SF_6	0.06%				0.1%	0.0003%
NF_3			0.3%			0.007%
C_4F_6						
C_5F_8				0.2%		
C_4F_8O						
CH_2F_2						

3.5.1 Conclusion: Emission Factors versus F-GHG Usage for Refined and Tier 2b Process Categories

IPCC Tier 2b provides emission factors for 98% of processes in which F-GHGs are used while the Refined Method tables provide emission factors for only 91% of the GHGs used.

4 ISMI ANALYSIS OF TSD REFINED METHOD UNCERTAINTY ANALYSIS

ISMI reviewed Appendix B of the TSD to understand the basis for the EPA's conclusion that the Refined Method results in twice the certainty as the IPCC Tier 2b. Several issues were identified with its approach:

- EPA assumes uncertainties in usage are the same for each method (TSD, p.25); the survey data demonstrate this is not the case. Increasing the number of process categories beyond the IPCC Tier 2b categories introduces new sources of error associated with the engineering estimates to apportion gas usage among the additional process sub-categories.
- The gas usage distribution was based on data from a *PFC Reduction Climate Partnership for Semiconductors* audit of a single large semiconductor partner (TSD, p.27); survey data demonstrate that the gas distribution used by the EPA is not reflective of the industry.

- For the Monte Carlo analysis, output variables were simulated based on input parameters such as relative errors and distributions around emission factors. The TSD acknowledges that some case existed had only a single entry for developing a refined process category emission factor. For those cases, the EPA assumed either a zero relative error or 10% based on ISMI's *Guideline for Environmental Characterization of Semiconductor Process Equipment - Revision 2,* Technology Transfer #06124825A-ENG. ISMI believes that the relative errors used in the simulation model for the Refined Method are too low. The 10% relative error reported by ISMI is a measure of measurement repeatability when characterizing a single process recipe run on a single equipment set. The actual relative errors across multiple process recipes for multiple equipment types in multiple fabs will be much larger. The simulation results give a valid lower limit to the uncertainties, but do not capture the variability typically seen across process recipes and across the industry. Input was solicited from a company that conducts process emissions characterizations:

  Assuming an etch EF will not vary more than 10% is wrong. If we repeatedly test a single process step (with an unvarying recipe), then yes we get a high degree of repeatability. In fact, in that case the emission factor will vary by much less than 10% from test to test. However, EPA's groupings of process categories (nitride etch, silicon etch, etc.) are broad enough to capture a wide range of process recipes especially since they'll be coming from many different companies. When we look at different etch steps (for example) with different recipes we can see considerable variability in emission factors for a given compound. We have results from hundreds of different tool tests over the years, and while I didn't take time to review all of them a quick survey of EFs we're currently using in etch shows that emission factors for a given compound can vary 2 or 3X among different process recipes. In other words, SF6 for example may have an EF of 0.1 on one etch step and 0.25 on another. So emission factors on a given process recipe are highly repeatable, but they will vary considerably among different etch process recipes.

- Table B-1 of the TSD lists a Refined Process Category relative error for the CF_4 in situ chamber clean gas utilization factor of 46%; it is not clear that 46% is the appropriate value when Table 6.9 of the 2006 IPCC GL lists an uncertainty of 10%.

- In late 2009, the EPA asked device manufacturers and equipment suppliers to provide data on measured utilization rates and byproduct formation factors. On behalf of equipment suppliers and the industry, SEMI submitted sanitized data to the EPA. ISMI assumes those data are reflected in Table B-1 relative errors for chamber cleaning gases (8% vs. 30% for in situ C_2F_6 and C_3F_8, 9% vs. 70% for in-situ NF_3, and 5% vs. 400% for remote NF_3).

- EPA concluded in the uncertainty analysis that, "The most sensitive determinant of uncertainty is the emission factor for RPS because its usage exceeds all others by a large margin" (TSD, p.29). The survey demonstrates that in situ and remote CVD chamber cleans are the largest use categories for F-GHG; ISMI assumes the EPA's assessment applies to these two categories. Analysis of the SEMI sanitized data reports confirms current IPCC defaults for in situ and remote NF_3 chamber cleans. Because relative errors for CVD chamber clean gases decreased and the majority of emission factors were unchanged from Tier 2b, conducting a new Tier 2b uncertainty analysis might be more appropriate than relying on the 2006 IPCC uncertainty analysis as the basis for comparing the two methods.

4.1 Conclusion: ISMI Analysis of TSD Refined Method Uncertainty Analysis

The ISMI survey finds 75% of F-GHGs is used in chamber cleans. The TSD shows relative errors for chamber clean EFs have been significantly reduced while EFs have not substantively changed; it would be more appropriate for EPA to conduct a new Tier 2b uncertainty analysis using the improved chamber clean relative errors rather than relying on the 2006 IPCC uncertainty analysis as the basis for comparing the two methods.

The relative errors that EPA estimates for the refined method etch process sub-categories underestimates uncertainty because the EPA equates measurement repeatability with relative error associated with emission factors for varying process conditions. Erroneous assumptions used to perform the TSD Refined Method uncertainty analysis and industry gas usage patterns support continued use of Tier 2B defaults rather than an expansion to Refined Method.

5 COST ANALYSIS: BURDEN ESTIMATE FOR ESTIMATING AND REPORTING F-GHG EMISSIONS

In Part 6 of the survey, data were collected to complete a cost analysis of the impact of the reproposed rule. The EPA methodology for estimating labor costs was used.[9] Labor categories were Legal, Managerial, Technical and Clerical. While respondents indicated that wage rates for the highly technical semiconductor industry are considerably higher than those used in the EPA EIA, the EPA wage rates were used to make the data comparable. The EPA estimates the rule affects 91 facilities. Total industry labor burdens were calculated by taking the average of the survey responses for Part 6 and multiplying by 91 facilities. Industry total capital and O& M costs were calculated by taking the total reported by all respondents, dividing by the number of respondents, and then multiplying this result by 91. ISMI believes capital and O&M costs are underestimated because some respondents indicated they anticipated capital and O&M costs but were unable to prepare cost estimates at this time. Additionally, in a follow-up request for information from survey respondents, some respondents stated their reported O&M costs are low because they did not take into account requirements for calibrating GHG measurement devices (i.e., scales, pressure transducers, thermometers, etc.). Table 8 lists each activity associated with estimating F-GHG emissions according to the reproposed rule (excluding POU abatement testing) and the associated industry labor and monitoring instrumentation cost burdens. It also includes the EPA's estimate of industry cost burden.

An additional survey questionnaire was sent to the original survey participants to better assess facility-specific cost burden associated with a) recalculating gas/facility-specific heel factors when a trigger point changes by 1% and b) determining annual gas consumption using a different method from purchase records with heel factors applied. Since not all responses have yet been received, these additional costs are not included in Table 8.

---

[9] U.S. Environmental Protection Agency (EPA), 2010. Economic Impact Analysis for the Mandatory Reporting of Greenhouse Gas Emissions F-Gases: Subparts I, L, QQ, SS. Available at http://www.epa.gov/climatechange/emissions/downloads10/F-gas_EIA.pdf.

Table 8 Industry Burden Estimate and EPA Estimate

Activity	Labor Burden for Collecting Data					Instrumentation Burden for Monitoring Data		
	Industry Legal Cost	Industry Managerial Costs	Industry Technical Costs	Industry Clerical Costs	Total Industry Labor Costs	Total Industry Capital Cost	Total Industry O&M Cost	Total Industry, Capital, and O&M Costs
Industry cost to develop F-Gas heel factor and track data	$4,596	$19,824	$513,295	$127	$537,841	$2,290,167	$3,254,767	$5,544,934
Industry cost to develop and track F-Gas apportionment by nine "Refined Method" process categories	$7,996	$41,820	$8,029,035	$16,792	$8,095,643	$13,839,583	$2,645,067	$16,484,650
Estimating emissions and by-products by specific process type – EPA refined process categories	$8,915	$53,455	$3,411,899	$180,236	$3,654,506	$22,514,917	$3,130,400	$25,645,317
Collecting all data required to be reported/retained for POU abatement devices	$303	$36,197	$386,481	$134,557	$557,538	$1,304,333	$333,667	$1,638,000
Total industry burden for estimating F-GHG emissions per refined process categories and collecting data to be reported/retained for POU abatement	$21,810	$151,297	$12,340,709	$331,711	$12,845,528	$39,949,000	$9,363,901	$49,312,901
EPA estimate of industry burden to collect activity data for F-GHG emission estimate and to report	$2,757	$116,347	$2,411,981	$22,664	$2,663,750	$0	$0	$0

5.1 Conclusion: Burden Estimate for Estimating and Reporting F-GHG Emissions

The EPA has greatly underestimated the cost for the semiconductor industry to comply with the reproposed rule. ISMI estimates the industry labor burden to collect and report F-GHG activity data is 5X what the EPA estimates. The EPA assumes the industry will incur no O&M costs (this cannot be true if measurement device calibrations are required); a conservative industry estimate is $9.4M. The EPA assumes that no capital costs are incurred, yet an estimated $40M of capital will be required to meet the requirements to develop facility- and gas-specific heel factors and to apportion F-GHG usage into the nine Refined Method process sub-categories using an engineering model based on wafer passes.

6 POU ABATEMENT

6.1 Survey Results

Twenty-one responses from 31 fabs were received to questions on POU abatement of F-GHGs and N_2O. Of these 31 fabs, 17 or 55% currently have installed or plan to install POU systems to abate F-GHG or N_2O. The fabs intend to claim destruction removal efficiency (DRE) for 2114 abatement systems. Twenty fabs are large (>10,500 m^2 silicon) and account for 2076 or 99% of the total POU abatement devices reported. Three have 250 or more POU devices; on average, each large fab has 122 POU devices. This is more than twice the 50 POU abatement systems the EPA estimates are installed in large fabs.

6.1.1 Design of Device

The reproposed rule requires documentation that the abatement systems are specifically designed to abate F-GHG or N_2O abatement and that performance is verified according to the EPA's Protocol for Measuring Destruction or Removal Efficiency of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing (EPA DRE protocol).

Based on the survey responses, the companies depend on the equipment manufacturer to design the unit and the manufacturer to certify the DRE. Some sample responses are as follows (see Appendix C.1 for all comments):

- *"The only documentation available is equipment specification provided at time of purchase."*
- *"We intend to place this requirement on the equipment manufacturer."*
- *"PFC DRE has been a major part of the procurement selection process, that process and the manufacturer's data can be stored for documentation purposes."*

6.1.2 Installation of the Abatement System

The reproposed rule requires documentation that the abatement equipment is installed according to the equipment manufacturer's specifications.

Based on the survey responses, fabs use the manufacturer's installation and operation specifications to develop a design packages for the units. The units are installed according to the requirements in the detailed design packages (gas hook-ups, valves, exhaust, materials of construction, power, water, etc.). At one fab, the supplier that designed the abatement systems also installs and operates the devices. Most companies keep installation records as part of their in-house installation protocols. If the fab outsources the installation and operation to a contractor, the contractor provides this documentation for the fab owner. According to one respondent,

- *"At a minimum, install per the manufacturer's instructions and/or have the manufacturer install the unit. We would have the manufacturer or contractor certify the proper installation."*
- To certify proper installation, will use *"standard documents related to tool installation and the start-up report from abatement supplier."*

See Appendix C.2 for all comments.

6.1.3 Operation and Maintenance of the Device

The reproposed rule requires documentation that the abatement systems are operated and maintained according to the equipment manufacturer's specification. This includes documentation that the equipment is used within the manufacturer's specified equipment lifetime and limits of gas mix and exhaust flow rates. The rule requires annual certification with evidence of recent on-site measurements of DRE.

Based on the survey responses, the fabs generally use the equipment manufacturer's protocols in combination with their own in-house O&M procedures to ensure that the devices are properly operated and maintained. However, the fabs have different ways to track and document the operation and maintenance of the device. Some use bi-weekly reports from their maintenance contractor, some use existing O&M tracking systems, and others use their supervisory control and data acquisition (SCADA) system to monitor the operation of the device. One response indicated that the fab currently uses a time-based preventive maintenance procedure, but would like to move to a more performance-based protocol. Some responses are as follows (see Appendix C.3 for all comments):

- *"Use existing maintenance documentation and tracking systems to document that the unit is properly maintained and operated according the manufacturer's specifications at a minimum."*
- *"SCADA is used to monitor process conditions for POUs. Also, we have a robust preventive maintenance program which documents all PMs."*

6.1.4 Tracking POU Abatement System Uptime

The reproposed rule requires documentation of the abatement system uptime (i.e., continuous operation of the system).

The fabs plan to use a variety ways to track abatement device uptime, including manual as well as automated systems such as SCADAs or another equipment management system (EMS). At one fab, a malfunction of the abatement device shuts down the tool and tracking of the tool uptime serves as a surrogate for the abatement device. Some fabs plan to use their maintenance records to track abatement device uptime. Only six fabs or about 20% of all fabs currently track uptime. According to one respondent,

> *"Through a mix of automated and manual methods. Routine maintenance requiring downtime is tracked through technician records. Other parameters that indicate the equipment is operating can be tracked through facility monitoring systems. Scheduled maintenance is tracked through mostly manual methods, but upset conditions are not."*

See Appendix C.4 for all comments.

6.1.5 Testing Using EPA Protocol

Only three respondents out of 21 (i.e., 15%) have used the EPA DRE protocol in testing since the draft protocol was published. Previous testing used a Fourier transform infrared (FTIR) method as described in ISMI's *Guideline for Environmental Characterization of Semiconductor Process Equipment – Revision 2*, Technology Transfer #06124825B-ENG and earlier versions. Some survey participants expressed concerns with the EPA test protocol, finding it too complex, costly, labor-intensive, and burdensome from a recordkeeping point of view. These companies are consequently considering using the 60% DRE default value, although they believe that the default greatly underestimates the capability of the abatement devices they are using.

In the EIA, the EPA acknowledges that fabs will likely outsource DRE measurements at a cost of $35,000 per week (EIA, p.4-33). Very few third parties in the U.S. have experience characterizing semiconductor process emissions or testing semiconductor POU abatement devices; still fewer have experience testing in an operating manufacturing fab. Some sample responses are as follows (see Appendix D for all comments):

- *"New ruling is very complex and was not used to verify performance of tools. We would probably choose to use the default values, although it significantly under-reports our abatement efficiency."*
- *"Site does not measure DRE due to cost and time burden. Site does not plan on developing measured DRE values."*

6.1.6 Cost Analysis: POU Abatement Testing

The EPA estimates there are 29 "large" fabs in the U.S. (see preamble to reproposed Rule); however, in the EIA, EPA assumes that only the 23 "large" semiconductor facilities that participate in EPA's PFC Partnership use abatement devices and incur the cost of testing (EIA, p.4-27). The EPA also assumes those 23 fabs have an average 50 abatement systems for a total of 1150, of which 20% require testing annually (EIA, p.4-33). The EPA's estimate of $35,000 per week for third-party testing agrees with industry experience; however, the EPA assumes that five units per week can be tested while industry experience is three. The EPA estimates that each fab will annually spend $70,000 for testing POU devices for a total annual industry cost of $1,610,000.

The survey identified that large fabs, which are not members of the PFC Partnership, have POU abatement systems installed; thus, the EPA's assumption (that only the 23 large fabs operated by partners have abatement) is incorrect. The 20 large fab respondents have installed or plan to install 2076 POU units. According to the EPA's 20% testing rule, the 20 fabs will have to test on average 415 units annually, averaging out to 21 units per fab, more than twice the 10 units the EPA estimates per "large" facility.

At $35,000 per week, assuming three units are tested per week, the 20 survey respondents with large facilities will spend $4,844,000 annually or $242,200 per fab. If the average number of POU abatement devices for the 20 large fabs respondents is extrapolated to the 29 "large" facilities identified by the EPA, then the total annual cost to the U.S. industry will rise to $7.024 million or 4.4X the burden estimated by EPA. ISMI believes this is an appropriate yet conservative estimate of total industry costs; the number will likely further increase in the future if some of the 61 fabs currently not in the "large" category decide to install POU abatement. For the large fabs that reported 250 installed POU abatement devices, the annual cost to test 50 units (20% of the total) would be approximately $600,000 and take 17 weeks.

6.2 Conclusion: POU Abatement

The reproposed rule requires that semiconductor fabs test 20% of the installed POU abatement devices annually or use a default DRE of 60%. Device manufacturers would not install F-GHG POU abatement devices if they believed the DREs they achieved were as low as the reproposed rule default of 60%; thus, fabs will most likely test their abatement devices so they can claim a higher DRE. The EPA has greatly underestimated the number of POU abatement devices installed in large semiconductor facilities. A conservative estimate of the annual industry cost to test POU abatement devices is $7 million, more than 4.4X EPA's estimate and does not consider lost production time.

7 RECORDKEEPING AND REPORTING

The reproposed rule establishes data reporting requirements for semiconductor facilities that could be made available to the public. Additionally, it requires that the industry retain specific data. Survey respondents were asked to indicate whether listed data elements are currently collected for each facility and to identify those elements they consider CBI. Table 9 lists the required data reporting elements and the percentage of compiled survey responses.

Table 9 Availability and CBI Status of Data to Be Reported

Data Element to be Reported	Currently Collected?			CBI		
	Yes	No	N/A	Yes	No	N/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.	46%	54%	—	92%	8%	—
The method of emissions calculation used.	86%	14%	—	—	100%	—
Emission factors used for process utilization and by-product formation rates and the source for each factor for each fluorinated GHG and N_2O.	75%	25%	—	64%	36%	—
Where process categories for semiconductor facilities are not used, descriptions of individual processes or process categories used to estimate emissions.	64%	32%	4%	48%	48%	4%
For each fluorinated GHG and N_2O, annual gas consumed during the reporting year and facility-wide gas-specific heel-factors used.	57%	43%	—	48%	52%	—
The apportioning factors for each process category and a description of the engineering model used for apportioning gas usage. 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 Eq. 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 estimates for each fluorinated GHG and N_2O.	61%	36%	4%	84%	12%	4%
Fraction of each gas fed into each process type that is fed into tools with abatement systems.	68%	21%	11%	48%	32%	20%
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 measurement 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.	46%	43%	11%	48%	36%	16%
For each abatement system through which fluorinated GHGs or N_2O flow at your facility, for which you are reporting controlled emissions, the following:						
Certification that each abatement system used at your facility is installed, maintained, and operating in accordance with manufacturers' specifications.	11%	68%	21%	—	88%	12%
The uptime and the calculations to determine uptime for that reporting year.	18%	64%	18%	12%	76%	12%
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.	57%	18%	25%	8%	80%	12%
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 N1O abatement.	7%	64%	29%	—	88%	12%
Where properly measured destruction or removal efficiencies or class averages of destruction or removal efficiencies are used to report controlled emissions, the following:						
A description of the class including the abatement system manufacturer and model number, and the fluorinated GHG and N2O in the process effluent stream.	57%	11%	32%	8%	68%	24%
The total number of systems in that class for the reporting year.	57%	11%	32%	4%	72%	24%
The total number of systems for which destruction or removal efficiency was measured in that class for the reporting year.	21%	46%	32%	4%	72%	23%
A description of the calculation used to determine the class average,	32%	36%	32%	4%	72%	24%

Data Element to be Reported	Currently Collected?			CBI		
	Yes	No	N/A	Yes	No	N/A
including all inputs of the calculation.						
For heat transfer fluid emissions, inputs in the mass-balance equation, Eq. I-12 of this subpart for each fluorinated GHG.	14%	75%	11%	8%	88%	4%
Example calculations for fluorinated GHG, N_2O, and heat transfer fluid emissions.	68%	25%	7%	36%	60%	4%

Table 10 lists the records required to be retained under the reproposed rule. Survey results for whether or not required records are currently available have not yet been obtained.

Table 10 Availability of Records to be Retained

Data Element to be Reported	Currently Available?		
	Yes	No	N/A
Data and copies of calculations used to estimate emissions including all spreadsheets	93%	7%	—
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:			
Documentation that these were measured using the International SEMATECH Manufacturing Initiative's Guideline for Environmental Characterization of Semiconductor Process Equipment (December 2006).	32%	46%	21%
Documentation that the measurements made are representative of fluorinated GHG and N2O emitting processes at your facility.	—	79%	21%
The date and results of the initial and any subsequent tests to determine process tool gas utilization and by-product formation rates.	29%	54%	18%
For each abatement system through which fluorinated GHGs or N_2O flows at your facility, for which you are reporting controlled emissions, the following:			
Documentation to certify that each abatement system used at your facility is installed, maintained, and operated in accordance with manufacturer's specifications.	18%	68%	14%
Records of the uptime and the calculations to determine how the uptime was accounted for at your facility.	18%	68%	14%
Abatement system calibration and maintenance records.	61%	25%	14%
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.	18%	64%	18%
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).,	—	64%	36%
Purchase records for gas purchased.	93%	7%	—
Invoice for gas purchases and sales.	57%	43%	—

7.1 Conclusion: Data Reporting, Retention, and CBI

The reproposed rule requirement that emissions be reported by process, process category or process type is considered CBI by 92% of respondents. Much of the POU abatement data that must be reported is not currently collected, and the majority of data required to be retained is currently not collected. The EPA's assumptions about the availability of required data likely underestimates the industry cost burden.

8 SUMMARY

The reproposed rule attempts to improve the accuracy of F-GHG emissions estimates by improving F-GHG consumption estimates through development of facility-wide, gas-specific heel factors based on "the residual weight or pressure of a gas cylinder/container." These facility-specific heel factors are to be used instead of the 10% default heel factor currently used by 81% of respondents to the 2009 ISMI survey. In addition to an estimated $0.5 million for the industry to develop facility- and gas-specific heel factors, 26% of the industry can be expected to incur capital costs that are not comprehended in the EPA's EIA. If measurement devices must be calibrated annually, all of the industry will incur annual O&M costs that are not accounted for in the EIA.

All survey respondents indicate they are not meeting the reproposed rule apportioning requirements with their current gas tracking systems. Existing fab infrastructure does not capture usage data in the nine sub-categories of the Refined Method. Apportioning usage into these sub-categories is more challenging than the EPA estimates and will increase labor burdens, require infrastructure changes, and result in significant capital and O&M expenditures. This burden is not reflected in the EPA EIA.

The 2009 ISMI survey found 66% of fabs estimate F-GHG emissions using a method less rigorous than Tier 2b while 27% use some form of Tier 2b, typically with 10% heel factors; requiring facilities to estimate emissions using Tier 2b and facility-specific heel factors would improved accuracy for most semiconductor facilities. Apportioning F-GHG usage into the three IPCC Tier 2b categories is simpler than using Refined Method sub-categories because a majority of F-GHGs are used in a single Tier 2b process category. The 2010 survey showed that plasma CVD chamber cleans use 75% of the total F-GHG, while etch accounts for ~24%. Based on actual industry F-GHG usage, the need for in situ thermal, bevel clean, and ashing default sub-categories is not apparent. Additionally, etch sub-categories make up a small percentage of the total F-GHG usage; any less uncertainty derived from apportioning etch into sub-categories could very well be offset by the greater uncertainty of the usage estimate. Finally, based on F-GHG usage patterns, establishing different default emission factors on a per wafer size basis may not be necessary.

The EPA states that the Refined Method results in emissions estimates that are twice as certain as the IPCC Tier2b approach; however, ISMI's review of the EPA's uncertainty analysis shows that assumptions were made that underestimate the relative error of Refined Method etch process sub-category defaults. On the other hand, the relative error of Tier 2b chamber clean defaults appears to be overestimated. These errors (coupled with industry F-GHG usage patterns and improvements in gas consumption estimates based on facility- and gas-specific heel factors) support the continued use of Tier 2b default emission factors.

The EPA has also underestimated the semiconductor industry burden to comply with the reproposed rule, largely due to their assumption that estimating emissions using Tier 2b imposes the same burden on the industry as the Refined Method. ISMI estimates the industry labor burden to collect and report F-GHG activity data is 5X the EPA estimate. The EPA assumes the industry will incur no capital or O&M costs, while ISMI conservatively estimates the cost to be $40 million and $9.4 million, respectively. Use of Tier 2b with facility- and gas-specific heel factors will improve the accuracy of F-GHG emissions estimates for at least 81% of fabs while not imposing the substantial cost burden associated with the Refined Method.

Similarly, the EPA has underestimated the number of POU abatement devices installed in large semiconductor facilities. A conservative estimate of the annual industry cost to test POU abatement devices is $7 million, more than 4.4X the EPA estimate, and does not consider lost production.

The reproposed rule requiring that emissions be reported by process, process category, or process type is considered CBI by 92% of the respondents. Also, much of the POU abatement data that must be reported is not currently collected or being retained. Consequently, the EPA is underestimating the cost burden of semiconductor F-GHG reporting requirements.

Appendix A – 2010 Semiconductor Industry Process Greenhouse Gas Survey

The 2010 survey questionnaire was formatted as an Excel workbook with multiple sheets.

Sheet 1: Background

2010 Semiconductor Industry Process Greenhouse Gas Survey

Background:

The U.S. EPA has published a proposed Mandatory Greenhouse Gas Reporting Rule for the Electronics Industry in March, 2010. Once published in the Federal Register, the industry has 60 days to submit comments. ISMI and SIA are partnering to gather and analyze data to respond to requirements in the proposed rule.

Impact and Reporting Requirements

We anticipate EPA's proposed rule will impact semiconductor manufacturing facilities with annual production capacity >1,080 m^2 of silicon. Semiconductor facilities must report the following:

- Fluorinated GHGs from plasma etching.
- Fluorinated GHGs from chamber cleaning.
- Fluorinated GHGs from wafer cleaning.
- N_2O emissions from chemical vapor deposition and other manufacturing processes.
- Fluorinated GHGs from heat transfer fluid use.
- CO_2, CH_4 and N_2O emissions from stationary combustion units.

Estimating Emissions

EPA proposes developing facility specific heel factors for each cylinder/container size of each process GHG used. EPA further proposes allocation of gas per process using a facility-specific engineering model based on wafer passes. EPA is proposing use of default emission factors for fluorinated GHG based on wafer size being processed in a fab and process categories.

Definitions:

Fab: A single semiconductor device manufacturing line.

Fluorinated greenhouse gas: Sulfur hexafluoride (SF6), nitrogen trifluoride (NF3), and any fluorocarbon gas except for controlled substances as defined at 40 CFR Part 82 Subpart A. In addition to SF6 and NF3, "fluorinated GHG" includes but is not limited to any hydrofluorocarbon, any perfluorocarbon, any fully fluorinated linear, branched or cyclic alkane, ether, tertiary amine or aminoether, any perfluoropolyether, and any hydrofluoropolyether (typical fluorinated GHGs used: CF4, C2F6, C3F8, c-C4F8, c-C4F8O, C4F6, C5F8,CHF3, CH2F2, NF3, SF6, and heat transfer fluids (HTFs) (CF3-(OCF(CF3)-CF2)n-(O-CF2)m-O-CF3, CnF2n+2, CnF2n+1(O)CmF2m+1, CnF2nO, (CnF2n+1)3N)).

Heel: 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).

Process Sub-categories:

Oxide etch means any process using fluorinated GHG reagents to selectively remove SiO2, SiOx-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, Si3N4, SiC, SiCO, SiCN, etc. 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.

Sheet 2: Instructions, Part 1: General Information and Part 2: Determination of facility-specific gas-specific heel factors and gas utilization by process

Instructions: Please complete the following survey by responding to the grey boxes. Do not report any data considered to be company confidential/proprietary. Survey is to be returned by April 26th, 2010 to Laurie.Beu@ismi.sematech.org. A separate survey must be completed for each fab. If more than one fab is located at a facility, separate surveys should be completed for each fab. Please respond to every question. It is likely you will need to meet with facilities/chemical distribution and process engineers to develop responses. ISMI will compile and analyze the results by May 19, 2010.

Survey data handling, analysis, and reporting: Completed surveys will be reviewed, analyzed, and compiled by ISMI personnel (member company assignees will not have access to the individual responses). All survey results will be scrubbed of any company identifying information and reported anonymously. NO data will be shown when fewer than five responses were received for a question. Average and trend data not specific to any company may be shared with the industry and others. Upon agreement of both SIA and ISMI, ISMI may provide written technical reports documenting survey results.

Part 1: General Information

Name of Person Completing Survey:		
Email Address:		
Phone Number:		
Company:		
Location:		List city, state and/or country.
Site Location Name:		
How many fabs are located at this site?		
Name of Fab being reported:		
Diameter of wafers processed in fab:		Choose appropriate response from list.
Fab manufacturing capacity currently:		Choose appropriate response from list.
Do you expect to exceed the 25,000 metric ton CO2eq per year emission threshold (includes process and combustion GHG emissions)?		

Manufacturing capacity: The proposed rule requires that a facility calculate process emissions to determine applicability of the rule with an equation that includes manufacturing capacity (m2).

How will you determine "100% manufacturing capacity" for this fab? Please describe:		Check with fab business planners.

Part 2: Determination of facility-specific gas-specific heel factors and gas utilization by process - The IPCC Tier 2 methodology utilizes defaults to estimate process greenhouse gas emissions. To estimate process gas usage, the IPCC takes the amount of gas utilized and subtracts a default value of 10% for the fraction of gas remaining in the cylinder (heel factor) which is un-used and sent back to the supplier. Default emission factors are then used to determine emissions from etch and CVD. In the 2009 proposed rule, EPA proposed that facilities track gas consumption utilizing MFCs or scales with ±1% accuracy. The 2010 re-proposed rule calls for development of facility-wide gas-specific heel factors based on residual weight or pressure of a gas cylinder/container that the facility uses to change out the cylinder for each cylinder type for each gas used

Facility-wide gas-specific heel factors: The weight of the gas in the incoming cylinder is very consistent for each gas container type. A cylinder change-out is triggered by either the weight of the gas measured by scale or the measured pressure, depending on the gas. The gas remaining in the cylinder is determined either by the measured weight or the calculated weight based on the measured pressure using the Ideal Gas Law (PV=ZnRT) with the appropriate compressibility factor (Z) for the gas. The total usage is the difference in the weight of the cylinder when installed and when changed. Using this known residual weight of the container, a gas specific heel factor for each container type used (cylinder or bulk) for each type of gas used is determined (residual amount percentage of the total amount). This gas-specific heel factor is then applied to each of the cylinders or bulk containers for each gas used to determine the net amount of each gas used by the facility.

Describe how this fab plans to develop facility-wide gas-specific, container-specific heel factors for the fab:	

The proposed rule requires that all flowmeters, weigh scales, pressure gauges and thermometers used to measure quantities shall have an accuracy and precision of 1% of full scale or better.

Do the measuring devices you currently use meet the 1% of full scale accuracy requirement? Please explain:		
Please describe how you currently calibrate flowmeters, weigh scales, pressure gauges and thermometers.		
If you do not have accuracy and precision of 1% of full scale, what is the accuracy and precision of the meters you use?		
If you do not have accuracy and precision of 1% of full scale, what is the cost of replacing each type of device with devices that meet the proposed rule?		
Please provide estimate of man-hours and equipment costs to comply with requirements to develop gas-specific, container-specific heel factors by fab using measuring devices with 1% full scale accuracy by responding to Question 1 in Part 6.		

2010 Proposed Rule Apportioning of Gas to Processes: The proposed rule requires apportioning fluorinated GHG consumption by process category or individual process using a facility-specific engineering model based on wafer passes.

Please describe how your fab plans to apportion process gas usage by process category or individual process:	
How do you plan to determine gas consumption per wafer pass?	
Will additional monitoring, software, re-distribution of gas cylinders, etc. be required for your fab to apportion gases by process category based on wafer passes?	
Please provide estimate of man-hour and equipment cost to comply with gas apportioning using a model based on wafer passes by responding to Question 2 in Part 6.	

SIA Proposed Method to determine gas utilization per process type: Once the total amount of each gas used by the facility is determined, the amount of each gas used in each process type (etch and chamber cleans) can be reasonably approximated using engineering estimates where gas distribution systems feed multiple tools and processes. First all of the tools that use a particular gas are determined and sorted by process type (etch and chamber cleans). The total usage of a particular gas is then apportioned between etch and chamber clean processes by using knowledge of factors such as process recipes, typical flow rates and times, groups of similar tools running similar processes, and the average utilization or throughput of individual tools or groups of similar tools.

Please describe how your facility would determine process gas usage by process category or individual process if you could use a method not based on wafer passes:	

Part 3: Applying Default Emission Factors for Various Process Sub-categories - The IPCC method Tier 2b provides default emission factors for fluorinated process greenhouse gases commonly used in CVD chamber clean and etch around the 2005 timeframe. Since the defaults were developed, the basket of process greenhouse gases has expanded and gases are being used in additional processes. In the re-proposed rule, EPA plans to develop additional default emission factors for additional processes and process sub-categories. To prioritize development of new default emission factors, please estimate 2009 gas usage in your fab using each of the following sub-categorization methods. If a gas is not used for a process sub-category, list "N/A". Please use the apportioning methodologies described previously to provide fab-wide estimates of gas usage.

Table 1: Estimate of Process Greenhouse Gas Utilization per 2006 IPCC Tier 2b - IPCC method Tier 2b provides default emission factors for CVD and etch. EPA's proposed rule expands the categories of processes using F-GHG and N2O into process sub-categories. Please provide an estimate of the amount of each gas used in calendar year 2009 in each process sub-category shown in grey. The blacked out spaces do not currently have IPCC default emission factors. If you are using a gas in one of these categories, please list 2009 annual consumption in kg. If you use F-GHG in bevel cleaning or ashing, please include in etch. If bulk gas distribution is utilized and gas consumption tracking data is not available for CVD and etch, contact fab process engineers and develop an engineering estimate to apportion gas usage between the different process types.

	Process Gas	*Chamber Cleaning*		*Etch*
		In situ plasma	Remote plasma	
List estimated amount of each gas used annually (kg) in each process type.	CF4			
	C2F6			
	C3F8			
	c-C4F8			
	CHF3			
	SF6			
	CH3F			
	NF3			
	C4F6			
	C5F8			
	C4F8O			
	CH2F2			
	F2			
	COF2			
	N2O			

Please describe how you collected Table 1 data and any deficiencies you noted with using Tier 2b:	

Please provide estimate of man-hours and equipment costs to develop emissions estimates using IPCC Tier 2b by responding to Question 3 in Part 6.

Table 2: Estimate of Process Greenhouse Gas Utilization using Updated IPCC Emission Sub-categories - Since the IPCC Tier 2b factors were developed, additional process gases and GHG using processes have been identified. This method is an update of the IPCC emissions defaults to reflect in-situ thermal chamber cleans, wafer cleaning, and additional GHGs. Please provide an estimate of the amount of each gas used annually in each process sub-category. If bulk or centralized gas distribution is utilized and gas consumption tracking data is not available for CVD and etch, contact fab process engineers and develop an engineering estimate to apportion gas usage between different process types.

	Process Gas	*CVD*			*Etch*	*Wafer Cleaning*
		In situ plasma	Remote plasma	In-situ thermal		
List estimated amount of each gas used annually (kg) in each process type.	CF4					
	C2F6					
	C3F8					
	c-C4F8					
	CHF3					
	CH3F					
	SF6					
	NF3					
	C4F6					
	C5F8					
	C4F8O					
	CH2F2					
	COF2					
		CVD (plasma processes)			Other (non-plasma	
	N2O					

Please describe how you collected Table 2 usage for updated IPCC emission categories and the barriers you noted to data collection:	

Please provide estimate of man-hours and equipment costs to develop emissions estimates using updated IPCC Tier 2b by responding to Question 4 in Part 6.

Table 3: EPA Refined Process Category Method: Estimate of Process Greenhouse Gas Utilization adding wafer cleaning and additional process sub-categories - In the proposed rule, EPA provides tables with yet to be developed default GHG emission factors for process sub-categories. This method divides chamber cleaning into three sub-categories, etch processes into four sub-categories based on the film being etched and adds two wafer cleaning categories. Please provide an estimate of the amount of each gas used annually in each process sub-category. If bulk gas distribution is utilized and gas consumption tracking data is not available for CVD, etch and wafer clean subcategories, contact fab process engineers and develop an engineering estimate to apportion usage among different process categories.

		Chamber Cleaning			*Film Etch*				*Wafer Cleaning*	
	Process Gas	In situ plasma	Remote plasma	In-situ thermal	Silicon	Oxide	Nitride	Metal	bevel cleaning	ashing
List estimated amount of each gas used annually (kg) in each process type.	CF4									
	C2F6									
	C3F8									
	c-C4F8									
	CHF3									
	CH3F									
	SF6									
	NF3									
	C4F6									
	C5F8									
	C4F8O									
	CH2F2									
	COF2									
		CVD (plasma processes)			Other (non-plasma)					
	N2O									

Please describe how you collected Table 3 usage data using EPA's refined process categories and the barriers to collecting the data:	

Please provide estimate of man-hours and equipment costs to develop emissions estimates using EPA's refined process categories by responding to Question 5 in Part 6.

Part 4: POU Abatement Requirements: If you wish to reflect emissions reductions due to F-GHG or N2O POU abatement systems, the proposed rule allows for use of a default 60% DRE or a measured DRE if specific criteria are met.

Question	Response	Please explain:
Do you currently have or have plans to install POU abatement to abate F-GHG or N2O in your fab?		If No, go to next sheet.
How many POU abatement systems do you plan to claim DRE for F-GHG or N2O?		
The proposed rule requires the following documentation for POU abatement devices:		
Documentation that the abatement systems are specifically designed for F-GHG or N2O. How do you plan to document that systems are designed specifically for F-GHG or N2O?		
Documentation to certify that the abatement systems are properly installed according to manufacturer's specifications. How do you plan to document that systems are properly installed?		
Documentation to certify that the abatement systems are properly operated and maintained according to manufacturer's specifications. How do you plan to document that systems are properly maintained and operated?		
Documentation of abatement system uptime. How do you plan to document abatement system uptime,(i.e., SCADA or manufacturing tracking systems)?		
Do you currently continuously track abatement system uptime?		
Please provide estimate of man-hour and equipment cost to comply with POU abatement reporting/recordkeeping requirements by responding to Question 6 in Part 6.		
Testing is required if you wish to claim emissions reductions due to abatement but do not plan to use the default DRE of 60%; If this is the case for your fab, please answer the following:		
Have you measured DRE in accordance with the EPA Protocol?		
The rule requires random sampling of 3 abatement devices or 20% of installed abatement systems, whichever is greater. How many abatement devices are you required to test annually?		
Please provide estimate of man-hour and equipment cost to comply with POU abatement testing requirements by responding to Question 7 in Part 6.		

Part 5: Recordkeeping and Reporting Requirements: The proposed rule lists several data reporting requirements for the facility that could be made available to the public under this reporting rule. Please indicate if each piece of data is currently available for the fab. Please indicate if your company considers each data item to be Confidential Business Information (CBI). If CBI, provide a detailed explanation as to why this data is considered sensitive from a business and/or competitive aspect. It is important to describe why certain data is CBI and why it would be damaging to your company if made public.

Data Element to be Reported	Currently Collected?	CBI?	If considered CBI, please explain why:
Annual emissions of each fluorinated GHG and N2O emitted from each individual process, process category, or process type as applicable and from all heat transfer fluid use as applicable.			
The method of emissions calculation used.			
Emission factors used for process utilization and by-product formation rates and the source for each factor for each fluorinated GHG and N2O.			
Where process categories for semiconductor facilities are not used, descriptions of individual processes or process categories used to estimate emissions.			
For each fluorinated GHG and N2O, annual gas consumed during the reporting year and facility-wide gas-specific heel-factors used.			
The apportioning factors for each process category and a description of the engineering model used for apportioning gas usage. 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 N2O.			
Fraction of each gas fed into each process type that is fed into tools with abatement systems.			
Description of all abatement systems through which fluorinated GHGs or N2O 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.			
For each abatement system through which fluorinated GHGs or N2O flow at your facility, for which you are reporting controlled emissions, the following:			
Certification that each abatement system used at your facility is installed, maintained, and operated in accordance with manufacturers' specifications.			
The uptime and the calculations to determine uptime for that reporting year.			
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.			
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 N2O abatement.			
Where properly measured destruction or removal efficiencies or class averages of destruction or removal efficiencies are used to report controlled emissions, the following:			
A description of the class including the abatement system manufacturer and model number, and the fluorinated GHG and N2O in the process effluent stream;			
The total number of systems in that class for the reporting year.			
The total number of systems for which destruction or removal efficiency was measured in that class for the reporting year.			
A description of the calculation used to determine the class average, including all inputs of the calculation.			
For heat transfer fluid emissions, inputs in the mass-balance equation, Equation I-12 of this subpart for each fluorinated GHG.			
Example calculations for fluorinated GHG, N2O, and heat transfer fluid emissions.			

The proposed rule calls for the retention of significant amounts of data. Please indicate if each piece of data is currently available for the fab. If not currently being collected and retained, please explain what will be involved in collecting and retaining this data.

Required Record	Currently Available?	If you anticipate problems with collecting or retaining this data, please explain.
Data and copies of calculations used to estimate emissions including all spreadsheets.		

Part 6: Estimated Burden for Estimating Process Greenhouse Gas Emissions Using Proposed Alternatives - **EPA has proposed methods for** estimating process greenhouse gas heel factors, apportioning gas usage between process categories, and estimating emissions that are more stringent than required by the IPCC. Reporting and recording keeping requirements are also significant. An accurate assessment of the manpower and monitoring impacts is required to determine overall cost to the industry.

	Labor Burden For Collecting Data				Instrumentation Burden For Monitoring Data				
Please estimate the Facility-Specific Burden associated with the following:	Legal (hours)	Manager (hours)	Technical (hours)	Clerical (hours)	Capital Costs ($K)	Equipment Lifetime (years)	Annual O&M Costs ($K)	Other Annual Costs (please specify) ($K)	Comments (e.g., is measurement already performed in ordinary course of business? If not, what specific instrumentation will be required?)
1. Developing facility-wide gas-specific, container-specific heel factors per fab using measuring devices with 1% full scale accuracy and precision.									
2. Apportioning process GHG usage by process category or individual process using EPA proposed method based on wafer passes.									
3. Apportioning PFC usage and estimating emissions and by-products by process type (CVD, etch) using 2006 IPCC Tier 2b Method defaults (Table 1).									
4. Apportioning PFC usage and estimating emissions and by-products by specific process type - Updated IPCC Method defaults (Table 2).									
5. Estimating emissions and by-products by specific process type - EPA refined process categories (Table 3).									
6. Collecting all data required to be reported/retained for POU abatement devices.									
7. Conducting emissions testing and providing all data required to comply with POU abatement testing requirements if not using abatement defaults.									
8. Collecting all data required to be reported/retained for heat transfer fluid estimate.									

Thank you for completing the survey!
Please send completed survey to: Laurie.Beu@ismi.sematech.org

Appendix B – Full Comments for Part 3: Apportioning Gas Usage into Tier 2b and EPA Refined Method categories

B.1 Tier 2b Method

Responses to "Please describe how you collected Table 1 usage data and any deficiencies you noted with using the Tier 2b Method."

B.1.1 Estimation of Gas Consumption

- *We used "a combination of purchase data, tool information, and cylinder data."*
- *"We have Purchasing (department) supply us with the amount of full cylinders used per year to start the data collection process. The heel and amount of gas used is based on the full cylinder weight/pressure. We are using 98% of the product but are required to measure each cylinder for less than 20 lbs of being left in the cylinder. This rule penalizes companies, when their use approaches 100%, which minimizes emissions. As usage approaches 100%, companies will have to weigh the empty cylinders."*
- *"When a cylinder is received in gas management system (GMS) it is assigned the full cylinder volume (psi or lbs) programmed based on what each supplier has stated the fill volume is for that product. When the cylinder is installed in a cabinet it is moved in GMS to the appropriate panel. When the cylinder is removed from the panel as empty, it is moved in GMS and the empty cylinder volume (either psi or lbs) is entered in GMS. GMS itself converts everything to SCF."*
- *"Data is collected from Air Liquide cylinder usage report based on facility-specific heel factors."*
- *"This is based upon delivery records for the various materials to the Fab."*
- *We use "amount of gas purchased and heel factor (10%)."*

B.1.2 Apportioning of Gas Usage Between Tools

- *"CF4 was apportioned between CVD and etch based on the number of tools performing each process. C2F6 was apportioned between etch and CVD based on engineering judgment considering process tool gas valve and wafer passes data. The CVD portion of C2F6 was only used with In Situ Plasma cleaning. C3F8 is used only for In Situ Plasma cleans. C4F8, CHF3, and SF6 are used only for etch processes. NF3 was apportioned between etch and CVD based on engineering judgment considering process tool gas valve and wafer pass data. NF3 was only used for In Situ Plasma cleaning. N2O is used only as a CVD process gas."*
- *"We used the 100 most frequently run GHG-utilizing recipes to develop an engineering model to apportion gas consumption between the 3 categories. Gas consumption was apportioned using nominal recipe gas flow and time for 2009. The only gas for which apportioning came into play was CF4. All other gases are uniquely used in either CVD or etch."*
- *We used "a combination of purchase data, tool information, and cylinder data."*

- *"Data (was) first modeled using tool-recipe specific data and converted into monthly and annual usage.*
- *"If a gas goes from a cabinet to a VMB or VMP, the total usage is divided by the number of active tools which can be anywhere from 1 tool to 8 tools. Based on the tool ID it is determined if this is etch or CVD. Further description explains remote plasma system (RPS) or in-situ. There are some instances where in-situ and RPS tools share the same VMB. The reported usage is sometimes estimated based on usage of other (i.e., RPS) tools that do not share VMB with in-situ tools."*
- *"Air Products provides gas usage by tool. Most tools have a dedicated cylinder/cabinet so usage is, by default, determined as CVD or etch based on the tool. In the few instances where a cylinder/cabinet feeds multiple tools from a common VMB, the tools that share the cylinder are of the same type (CVD or etch) - but may run different recipes within that CVD or etch category.*
- *"Each gas cabinet is tied to a specific tool which allows gas usage apportioning by tool and process type. Knowledge of each tool allows us to distinguish between remote and in situ plasma."*
- *We use "engineering estimates to split gas purchases into separate categories."*
- *"CF4, C4F8, CHF3, CH3F, SF6, and C5F8 are used only for etch processes. NF3 was apportioned between etch and CVD based on engineering judgment considering process tool gas valve and wafer pass data. NF3 was apportioned between In Situ Plasma and Remote Plasma cleaning based on the number of tools using each technology. N2O is used only as a CVD process gas."*
- *"Data was collected based on purchasing records and apportioned by cost center usage. Engineering estimates were used to apportion NF3 between In-situ and Remote plasma cleans."*
- *"The values presented here are the result of a calculation using actual 2009 data of gases taken from inventory and an apportioning scheme based on design flow of gases to each category. Once the apportioning is done, the percentage of the gas per category is multiplied times the gas usage."*

B.2 EPA Refined Method

Responses to "Please describe how you collected Table 3 usage data using EPA's Refined Method and the barriers to collecting the data."

B.2.1 Apportioning of Gas Usage Between Tools

- *"Used engineering estimate. There is likely ~50% error in this estimate."*
- *"The silicon, oxide and nitride usage for tools that have multiple process are added and then each tool set given 1/3 of the usage that is not attributed to a single process type."*
- *"CF4 was apportioned between CVD and etch based on the number of tools performing each process. The etch portion of CF4 was apportioned between individual etch and wafer cleaning processes based on the number of tools performing each process. C2F6 was apportioned between etch and CVD based on engineering judgment considering process*

tool gas valve and wafer passes data. The CVD portion of C2F6 was only used with In Situ Plasma cleaning. The etch portion of C2F6 was apportioned to individual etch processes based on the number of tools performing each process. C3F8 is used only for In Situ Plasma cleans. C4F8, CHF3, and SF6 are used only for etch processes and were apportioned to individual etch processes based on the number of tools performing each process. NF3 was apportioned between etch and CVD based on engineering judgment considering process tool gas valve and wafer pass data. The CVD portion of NF3 was only used for In Situ Plasma cleaning. The etch portion of NF3 was only used for oxide etch. N2O is used only as a CVD process gas.

- *"We used the 100 most frequently run GHG-utilizing recipes to develop an engineering model to apportion gas consumption between the 5 categories. Gas consumption was apportioned using nominal recipe gas flow and time for 2009. There is some CF4 used for ashing; however, the amount is believed to be relatively small compared to CVD chamber cleaning and etch. In addition, there is some SF6 used for metal etch which is not included here but believed to be a small fraction of total usage. The primary barrier to data collection is resources required to manually extract information from recipes."*
- *"Note that the poly and nitride etch processes are run on the same tools, and the separation between the two processes was not available at this time; would need to work with fab engineers to determine going forward. All usage for 2009 was indicated as nitride, even though there is a split between the two processes."*
- *"Can not accurately separate some etch processes due to complexity of processes in multi-stack films. Does not include some film stacks that we etch (e.g., silicon carbide)."*
- *Same as for Tier 2b (Table 1) "plus had to obtain more process specific info from etch engineering as of which film is etched by which tool and clarification on gases used by each tool. This is not based on wafer passes. That info is not currently available. Data based on last quarter 2009 actual usage per cylinder."*
- *"CVD is straightforward…….gas usage per tool, one kind of clean. I spent significant time creating a complete list of Etch tools. I then took a 1st stab at filling in the columns for %ash/%bevel/%poly/%oxide/%nitride/%aluminum based on some educated guesses and looking at some recipes/film stacks. This part is what took the longest. Note that this is not a comprehensive determination -- just engineering judgment. The % for each kind of film was then applied to each gas usage -- but in a linear fashion. No accounting for actual flow or time variations for the individual gases."*
- *"Each system's lot history was examined over a 4 month period for 140 etch process systems and chambers by stage, equipment integration program, and capability in order to estimate a percentage of wafers processed per film type. A 4 month period was chosen due to data manageability. Factory wafers processed fluctuations, technology introductions, technology changes, system idling, or system maintenance "hard-down" situations can not be forecasted. Choosing the correct film type for each gas is dependent on the engineer's knowledge about the specific technology flows, stages, equipment integration programs, capabilities, and processes encountered on each system. Film types can not be automatically filtered or determined solely based on etch parameters. Idle systems are not included in usage data due to insufficient lot history data. Lot histories do not include processing that may bypass normal track-in procedures and/or do not utilize production wafers such as "quals" (etch rate, particle, MFC calibration, endpoint testing), engineering experiments,*

engineering lots, special work requests, new product and new test development, chamber conditioning, chamber in-situ cleans, chamber warm-up processes, engineering recovery procedures, etc. Gas usage per wafer could not be determined in these situations. Gas usage per wafer also could not be determined due to the amount of process recipes used on each system, chamber unique gas flow correction factors, end pointed processes (which introduce variable wafer-to-wafer times per lot), process stabilization steps, automated system process routines (ESC chucking/de-chucking), process faults/lot aborts, variable chamber sequencing (multiple chambers utilized on a system), and wafer count variation from lot to lot."

- *Used the following methodology to estimate gas usage: 1. Used heel factors for each cylinder type based on change out triggers. 2. Applied heel factors to gas disbursement data to obtain total usage of each gas for the year. 3. Assigned each tool/gas combination to a process group. 4. Where multiple processes are performed by the same gas on the same tool: a. Chose the predominant one, or b. If judged to be equal, distributed gas for that tool/process equally across categories. 3. Matched tool/gas process groups with gas distribution system information to assign process group(s) to each cylinder station. 4. Where >1 process group on a cylinder station, prorated gas usage per cylinder across groups based on number of tools in that group, without regard to process recipe nominal flows (due to) time constraint. 5. Multiplied by actual cylinder changes for the year, and summed up gas consumption by process groups.*
  NOTE: Some older tools, not served by the centralized gas rooms and core farms, log cylinder changes locally, not in the central database. We did not attempt to obtain these records for the survey, but used the centralized data to estimate the gas allocation for these tools."
- *"C4F8, CHF3, CH3F, SF6, and C5F8 were apportioned between individual etch processes based on the number of tools performing each process. CF4 was apportioned between individual etch and wafer cleaning processes based on the number of tools performing each process. NF3 was apportioned between etch and CVD based on engineering judgment considering process tool gas valve and wafer pass data. NF3 was apportioned between In Situ Plasma and Remote Plasma cleaning based on the number of tools using each technology. NF3 used for etch was apportioned between individual etch processes based on the number of tools performing each process. N2O is used only as a CVD process gas."*
- *"We have apportioned the actual usage of each tool chamber by using a ratio of the authorized tool usage / the total authorized usage of the Fab x the actual usage / total number of tool chambers."*
- *"This data is based on purchasing records and apportioned by cost center billing. Engineering estimates were used to apportion gases between different processes. Gas use by refined process category is currently not tracked."*
- *"The values presented here are the result of a calculation using actual 2009 data of gases received and an apportioning scheme based on design flow of gases to each category. Once the apportioning is done, the percentage of the gas per category is multiplied times the gas usage.*

B.3 Barriers to Accurate Data Collection

The respondents identified a number of barriers to accurate data collection:

- *“Can not accurately separate some etch processes due to complexity of processes in multi-stack films”*
- *“Gas usage per wafer also could not be determined due to the amount of process recipes used on each system, chamber unique gas flow correction factors, end pointed processes (which introduce variable wafer-to-wafer times per lot), process stabilization steps, automated system process routines (ESC chucking/de-chucking), process faults/lot aborts, variable chamber sequencing (multiple chambers utilized on a system), and wafer count variation from lot to lot.”*
- *“Lot histories do not include processing that may bypass normal track-in procedures and/or do not utilize production wafers such as “quals” (etch rate, particle, MFC calibration, endpoint testing), engineering experiments, engineering lots, special work requests, new product and new test development, chamber conditioning, chamber in-situ cleans, chamber warm-up processes, engineering recovery procedures, etc.”*
- *“Some older tools, not served by the centralized gas rooms and core farms, log cylinder changes locally, not in the central database.”*
- *“Our cylinder stations can serve up to 8 tools. Many of these stations are NOT segregated by the process groups proposed by EPA. Using an engineering model based on wafer passes and nominal gas flows to allocate gas usage would be very complex in our fab due to large numbers of recipes per tool and constantly changing product mix. Data from ~ 1000 recipes would have to be assessed and maintained on an ongoing basis. Customized software tied to our logistics system would be required to collect and aggregate the data for reporting.”*
- *“Gas use by Refined Method process categories is currently not tracked.”*

Appendix C – Full Comments for Part 4: POU Abatement

Responses to POU abatement questions.

C.1 Design of Device

- *“The only documentation available is equipment specification provided at time of purchase.”*
- *“We intend to place this requirement on the equipment manufacturer.”*
- *“Require the manufacturer to provide documentation.”*
- *“For abatement units installed (though not specifically for PFCs), the manufacturer provides a manual - or specifications - with each POU abatement unit. It indicates that the unit is designed to abate and their rated DRE. These specifications become part of the facilities design and installation package.”*
- *“The manufacturer designed, installed and operates the POU devices. Upon installation, the manufacturer has written a commissioning document which includes that the system was designed, installed and is operated properly to abate specific F-gases. At each annual PM the commissioning document is updated to certify proper operation of the POU.”*
- *“PFC DRE has been a major part of the procurement selection process, that process and the manufacturer's data can be stored for documentation purposes.”*
- *“We will rely on manufacturers to provide that certification for specific gases. We are assuming they will be able to provide this because they currently provide published DRE numbers for some of the specific gases listed in the rule. We have 3 different abatement systems, and will have to obtain manufacturer certification for all three types.”*

C.2 Installation of the Abatement System

- *“We have employed the services of company that maintains the systems. We would request statement from them, along with statement from our current facilities and maintenance owners.”*
- *“By developing check lists or other appropriate paperwork documenting what the manufacturer's specs are and that our installation procedures have complied with them.”*
- *“At a minimum, install per the manufacturer's instructions and/or have the manufacturer install the unit. We would have the manufacturer or contractor certify the proper installation.”*
- *“Facilities (department) uses the manufacturers installation and operation specifications to develop the design package for the unit. The units are installed per the requirements in the detailed design package (gas hook ups, valves, exhaust, materials of construction, power, water, etc). The manufacturer specifications are retained as part of the design/installation records.”*
- *“We have reviewed the manufacturer's installation manuals and developed what we call "typicals"--standard install instructions. We also install each unit under the guidance of a supplier representative. We would have the manufacturer or contractor certify the proper installation.”*

- *”The manufacturer designed, installed and operates the POU devices. Upon installation, the manufacturer has written a commissioning document which includes that the system was designed, installed and is operated properly to abate specific F-gases. At each annual PM the commissioning document is updated to certify proper operation of the POU.”*
- *To certify proper installation, will use “standard documents related to tool installation and the start-up report from abatement supplier.”*
- *“We have documentation sign-offs from actual install process. Prints are developed and published by site engineers, and tools are installed according to prints. Trades groups install according to prints and sign-off work as it's completed. The prints are designed according to the manufacturer's specifications for flow, pressure, etc. We do maintain as-built files of our equipment installs.”*
- *“Our tool install process included the documentation of proper installation practices.”*

C.3 Operation and Maintenance of the Device

- *“A combination of maintenance records for equipment and training records for personnel could probably satisfy this requirement.”*
- *“We have biweekly reports from our contracted service supplier to demonstrate on-going maintenance and operation. We also maintain the tools on our in-house monitoring system.”*
- *”By developing check lists or other appropriate paperwork documenting what the manufacturer's specs are and that our O&M procedures have complied with them. Operation and maintenance procedures on the systems are currently documented but have not been routinely compared against manufacturer’s specs.”*
- *“Use existing maintenance documentation and tracking systems to document that the unit is properly maintained and operated according the manufacturer's specifications at a minimum.”*
- *“Preventive maintenance procedures (cleaning & repair) are determined by the equipment engineers - typically per the manufacturers recommendations but they can be modified based on field operation (e.g., frequency may be increased or decreased based on unit performance and other factors). The PM procedures are maintained on-line in the equipment system. Note that for GHG abatement units that would be installed, the on-line PM procedures would not deviate from the manufacturers specifications if required by the Rule.”*
- *“The manufacturer designed, installed and operates the POU devices. Upon installation, the manufacturer has written a commissioning document which includes that the system was designed, installed and is operated properly to abate specific F-gases. At each annual PM the commissioning document is updated to certify proper operation of the POU.*
- *“We may use the abatement supplier for contracted on site service; documentation of maintenance plan and activities is part of the contracted work; also, monitoring maintenance activity type and frequency type is standard.”*

- *"This would require a site-wide procedural change as O&M is currently based off system performance. We would prefer to follow the manufacturer's recommendations for performance metrics (temperatures, pressures, throughput), as opposed to time-based PMs. Specifically, replacing parts on a time basis rather than use or performance basis."*
- *"SCADA is used to monitor process conditions for POUs. Also, we have a robust preventive maintenance program which documents all PMs."*

C.4 Tracking of Uptime

- *"SCADA and monthly report from contract supplier."*
- *"Through a mix of automated and manual methods. Routine maintenance requiring downtime is tracked through technician records. Other parameters that indicate the equipment is operating can be tracked through facility monitoring systems. Scheduled maintenance is tracked through mostly manual methods, but upset conditions are not."*
- *"These abatement systems have facility system SCADA monitoring added."*
- *"No current requirement"*
- *"POU abatement uptime is not currently tracked in the Equipment Management System (EMS). Rather, the chamber/tool that the unit is tied to has uptime tracked in our EMS. When a tool is "down," the equipment engineer can select an option that the abatement unit is "down" therefore the tool is down. If the abatement unit is down, the tool is not allowed to operate. Any GHG abatement units added could be given a unique ID (identification) in EMS and then the "uptime" would be tracked separately -- though the system would be configured such that the tool could not operate if the abatement unit is off-line."*
- *"Install facility systems monitoring to track uptime, i.e. SCADA. We have a few POU hooked into SCADA because of LSS (Life Safety System) requirements to shut down the tool if the POU goes offline."*
- *"The tools are designed to prevent F-gases from flowing if the abatement system has malfunctioned. The tool is allowed to finish the process run if and when a scrubber malfunction occurs. All subsequent runs are prevented from running until the POU fault is corrected. Therefore the (company's) EFK (system) needs only to track individual malfunctions of each POU. Co./Vendor track uptime on POUs as part of the vendor contract.*
- *"Online monitoring system tracking and documenting uptime of all abatement units."*
- *"We use SCADA on site, but adding all POU abatement equipment to the system will require IS configuration and software updates. Queries would also have to be developed to pull down-time. The site typically configures the POU systems so that if they are not operating it will shutdown the tool or divert to a redundant POU system. We would prefer the option to use a process tool shutdown ability (or redundant POU) as opposed to tracking POU uptime. (Currently) site does not track POU uptime."*
- *We use "SCADA"*

C.5 Testing Using EPA Protocol

- *"New ruling is very complex and was not used to verify performance of tools. We would probably choose to use the default values, although it significantly under-reports our abatement efficiency."*
- *Have you used the EPA testing protocol? "On recent testing, yes, but some testing was done prior to the protocol."*
- *"New protocol requires gas flow from the process equipment during abatement device testing. Cost of production and other manufacturing impacts are being evaluated."*
- *"No current requirement."*
- *"Any newly installed GHG abatement unit would either be tested upon installation or the default DRE would be claimed, although 60% seems unreasonably low."*
- *Have not tested DRE using EPA protocol due to "the cost of rental/purchase of QMS."*
- *"We measured DRE, but (tests) have not yet been performed following the new EPA protocol; FTIR method has been used."*
- *"Site does not measure DRE due to cost and time burden. Site does not plan on developing measured DRE values."*

International SEMATECH Manufacturing Initiative
Technology Transfer
2706 Montopolis Drive
Austin, TX 78741

http://ismi.sematech.org
e-mail: info@sematech.org

ATTACHMENT B3:
2010 ISMI SUPPLEMENTAL SURVEY REPORT

Supplemental Greenhouse Gas (GHG) Reporting Rule Survey Results

International SEMATECH Manufacturing Initiative
Technology Transfer #10065098A-TR

Supplemental Greenhouse Gas (GHG) Reporting Rule Survey Results

Technology Transfer #10065098A-TR
International SEMATECH Manufacturing Initiative

Abstract: This report from the ESHI004M project presents the responses to a supplemental survey of Semiconductor Industry Association (SIA) and International SEMATECH Manufacturing Initiative (ISMI) members asking for comments about and cost information associated with data collection and annual data reporting under the U.S. Environmental Protection Agency's Mandatory Reporting of Greenhouse Gases (GHG): Additional Sources of Fluorinated GHGs reproposed rule. Results and analysis of ISMI's initial 2010 Semiconductor Industry Process Greenhouse Gas (GHG) Survey, the Technical Support Document (TSD,) and Economic Impact Assessment (EIA), which support the reproposed rule, are in Technology Transfer #10065097A-ENG.

Keywords: Cost Analysis, Government Regulations, Greenhouse Effect

Authors: Walter Worth

Approvals: Walter Worth, Author
Steve Trammell, Project Manager
Ron Remke, Program Manager
Joe Draina, Director
Laurie Modrey, Technology Transfer Team Leader

Table of Contents

List of Tables

Acknowledgments

The author wishes to acknowledge the members of the ISMI Greenhouse Gas Leadership Working Group and SIA PFC Committee for their participation in the survey.

1 EXECUTIVE SUMMARY

The International SEMATECH Manufacturing (ISMI) Environment, Safety, and Health Technology Center conducted a major survey in support of ISMI and Semiconductor Industry Association (SIA) members' response to the Environmental Protection Agency's (EPA's) reproposed rule for estimating greenhouse gas emissions. This report documents the results of a supplemental survey, comprised of five questions, which dealt with recalculating gas cylinder heel factors and determining gas usage by means other than gas purchase records. Six companies participated in the survey, providing data for 13 fabs.

The survey shows that only a few fabs currently collect the data required to recalculate gas/facility specific heel factors when the trigger point for cylinder replacement is changed by 1% or 20%. Most indicated that they need additional scales, pressure transducers, network capability, and software upgrades to meet this requirement.

Only one fab currently collects the data that would allow it to calculate gas usage without using purchase records and heel factors. One fab commented that calculating gas usage based on process recipes using real-time flow meters would be very costly in terms of new capital equipment.

For the annual reporting of gas usage, the fabs would have to formalize their recordkeeping with the addition of hardware and software upgrades as well as database programming to minimize calculations.

Based on the survey, it is estimated that the industry cost for labor (legal, managerial, technical, and clerical) to collect the data would be on the order of $1.4 million annually. Similarly, the costs for equipment capital and operation and maintenance of the equipment would be ~ $2.8 million, for a combined industry cost burden of $4.2 million in the first year.

2 INTRODUCTION

The U.S. Environmental Protection Agency's Proposed Mandatory Reporting of Greenhouse Gases (GHG): Additional Sources of Fluorinated GHGs (reproposed rule) was published in the Federal Register (FR) on April 12, 2010, beginning the 60-day comment period. To develop a response to the reproposed rule, the Semiconductor industry Association (SIA) asked the International SEMATECH Manufacturing Initiative (ISMI) Environment, Safety, and Health Technology Center to conduct a survey of SIA and ISMI members to determine its impact. The survey results are documented in ISMI's *2010 ISMI Semiconductor Greenhouse Gas (GHG) Reporting Rule Survey Report*, Technology Transfer #10065097A-TR.

To answer a few supplemental questions about the reproposed rule, SIA and ISMI members were subsequently asked to complete another shorter survey. ISMI sent a questionnaire to SIA and ISMI members asking for comments and cost information associated with data collection and annual data reporting. Two of the questions dealt with the impacts of changes to the gas cylinder heel factor, changes of 1% and 20%, respectively. Another question looked at the impact of the reproposed rule requirement that a facility take two annual inventories of cylinders in service (at the beginning and end of year). The fourth question asked for comments on determining gas consumption using a technique other than purchase records. The last question assessed the effort involved to maintain the records required for annual gas consumption reporting to the EPA.

The survey participants were also asked to estimate the impact on labor, capital and annual operating and manufacturing (O&M) costs for each of their fabs to meet the reproposed rule requirements for the following tasks:

1. Recalculating gas/facility specific heel factor when a trigger point changes by 1%
2. Tracking cylinders (separate from purchase records) changed out at a point that differs by more than 20% of its trigger point
3. Determining annual inventory of all cylinders in service (beginning and end of year)
4. Determining annual gas consumption using a different method from purchase records with heel factors applied
5. Maintaining records required to determine annual gas consumption

ISMI's ESH Technology Center developed the survey questionnaire, collected the survey responses, and compiled and analyzed the data for ISMI and SIA members. Survey data were analyzed independent of the SIA to preserve respondent confidentiality.

3 SURVEY RESULTS

Six companies, representing a total of 13 fabs, responded to the five questions in the Supplemental GHG Survey. Due to time and man-power constraints, respondents could provide data for only 13 fabs, representing a 14% response for the 91 fabs that the EPA estimates must report under the reproposed rule. Despite the few responses, the amount of data is significant and representative of the industry as a whole.

***Question 1** – What is the impact of recalculating gas/facility specific heel factor when the trigger point changes by 1%?*

***Response*:** Three of the 13 fabs already record the required data. One fab pointed out that additional scales, pressure transducers, network capability, and software upgrades would be required. Another stated that it is not clear how this would be done and further study would be required.

***Question 2** – What is the impact of tracking cylinders (separate from purchase records) changed out at a point that differs by greater than 20% of its trigger point?*

***Response*:** Only one of the fabs currently records this data. The other fabs stated that they either have no clear idea of how to meet this requirement or would need to calculate gas usage cylinder by cylinder based on data currently collected. Others indicated that they would need additional scales, pressure transducers, network capability, and software upgrades to meet this requirement.

***Question 3** – What is the impact of determining annual inventory of all cylinders in service (beginning and end of year)?*

***Response*:** Two respondents stated that they would calculate annual consumption based on data that is currently being collected. Another company with six fabs responded that they would use contractors to weigh and track all incoming and outgoing fluorinated greenhouse gas (F-GHG) cylinders by fab. Another fab questioned the need for performing this task twice, since the data at the end of one year would be the same as that at the beginning of the following year.

***Question 4** – What is the impact of determining annual gas consumption using a different method from purchase records with heel factors applied?*

***Response*:** Only one fab is equipped to calculate annual consumption with a different method using data that is currently being collected. Another fab indicated that it would ask the gas supplier to weigh each cylinder after it is returned. Two fabs stated that they would need additional scales, pressure transducers, network capability, software upgrades and database programming (to minimize calculations). One fab commented that calculating gas usage based on process recipes using real-time flow meters would be very costly in terms of new capital equipment.

***Question 5** – What is the impact of maintaining records required for annual gas consumption determination?*

***Response*:** Currently, because most companies rely on purchase records for annual gas consumption data, they would need to formalize their recordkeeping process to meet this requirement. In addition to the hardware and software upgrades (mentioned above), database programming would be required to minimize calculations.

4 ESTIMATED BURDEN FOR ESTIMATING PROCESS GREENHOUSE GAS EMISSIONS USING EPA REPROPOSED ALTERNATIVES

The six companies that responded to the survey estimated the number of man-hours that would be required by the 13 fabs in the various labor categories—legal, managerial, technical, and clerical—to accomplish each task covered by the five questions. Table 1 shows that the tasks require a significant number of additional man-hours for the 13 fabs. As expected, the greatest number of man-hours falls into the technical and clerical categories.

Table 1 Labor (Man-Hours) for Data Collection for 13 Fabs

Question	Legal	Managerial	Technical	Clerical
1	1	54	330	48
2	11	68	638	48
3	10	45	502	116
4	32	80	820	58
5	10	58	427	306
Total	**64**	**305**	**2717**	**576**

Table 2 shows the labor costs ($K) in the four labor categories for data collection for the 13 fabs. To convert the man-hours in Table 1 to dollars in Table 2, the following average industry labor costs were used:

Labor Category	$/hr
Legal	101.00
Manager	71.03
Technician	55.30
Cleric	29.65

Table 2 shows that the additional labor cost burden for the 13 fabs is ~ $195,500 annually. All costs in the tables are given in thousands of dollars.

Table 2 Labor Cost ($K) for Data Collection for 13 Fabs

Question	Legal	Managerial	Technical	Clerical	Total
1	0	3.8	18.3	1.4	23.7
2	1.1	4.8	35.3	1.4	42.6
3	1.0	3.2	27.8	3.4	35.4
4	3.2	5.7	45.3	1.7	55.9
5	1.0	4.1	23.6	9.1	37.8
Total	**6.4**	**21.7**	**150.3**	**17.1**	**195.5**

Similarly, the capital, annual O&M, and other annual costs were estimated by the six companies for the 13 fabs (see Table 3). Again, the cost related to each of the tasks in the five questions was estimated by category (i.e., capital, O&M, and other). The data show that recalculating the specific heel factor and determining gas consumption without using purchase records result in the highest capital and O&M expenditures. Total expenditures for the 13 fabs are estimated to be $335,000 for capital and $60,000 for annual O&M.

Table 3 Capital and O&M Costs ($K) for Data Collection for 13 Fabs

Question	Capital Costs	Annual O & M Costs	Other Annual Costs
1	150	15	0
2	3	0	0
3	0	0	0
4	182	45	10
5	0	0	0
Total	**335**	**60**	**10**

Average costs per fab were calculated by dividing the values in Table 2 and Table 3 by 13 (the number of responding fabs). To arrive at a total industry cost, the costs per fab were then extended to the 91 fabs that the EPA estimated will have to report under the reproposed rule. Table 4 shows that the total industry cost burden for additional labor is approximately $1,368,000 annually.

Table 4 Industry Labor Cost ($K) for Data Collection for 91 Fabs

Question	Legal	Managerial	Technical	Clerical	Total
1	1	27	128	10	165
2	8	34	247	10	299
3	7	22	194	24	247
4	23	40	317	12	392
5	7	29	165	64	265
Total	**46**	**151**	**1,052**	**120**	**1,368**

Similarly, industry capital and annual O&M costs were calculated by extrapolating the data from the survey to the 91 fabs (see Table 5). The total cost burden to the industry for capital and annual O&M is estimated to be approximately $2,835,000 for the first year.

Table 5 Industry Capital & O & M Costs ($K) for Data Collection for 91 Fabs

Question	Capital	O & M	Other	Total
1	1,050	105	0	1,155
2	21	0	0	21
3	0	0	0	0
4	1,274	315	70	1,659
5	0	0	0	0
Total	**2,345**	**420**	**70**	**2,835**

When labor, capital, and O&M costs are combined, the total burden to the semiconductor industry to comply with the requirements of EPA's reproposed rule is on the order of $4.2 million for the first year. For the second and consequent years, the total cost burden would decrease by about a half, assuming the equipment has a 5-year lifetime (as estimated by some of the respondents).

5 SUMMARY

The reproposed rule attempts to improve the accuracy of F-GHG emissions estimates by improving F-GHG consumption estimates through the development of facility-wide gas-specific heel factors based on "the residual weight or pressure of a gas cylinder/container." The first two questions of this survey addressed the impact on fab capital and O&M costs when the trigger point for changing out the cylinders is altered by 1% or 20%, respectively. Only a few fabs currently collect the data required to recalculate gas/facility specific heel factors. Others indicated that they need additional scales, pressure transducers, network capability, and software upgrades to meet this requirement.

A few fabs currently collect enough data to calculate gas inventory at the beginning and end of each year. Some will use contractors to weigh and track all incoming and outgoing cylinders. Others questioned the need for two inventories since the inventory at the end of one year would be the same as the inventory at the beginning of the next year.

Only one fab currently collects the data that would allow it to calculate gas usage without using purchase records and heel factors. Most fabs would have to either rely on contractors or install significant new hardware and software to collect the necessary data. One fab commented that calculating gas usage based on process recipes using real-time flow meters would be very costly in terms of new capital equipment. For the annual reporting of gas usage, the fabs would have to formalize their recordkeeping with the addition of hardware and software upgrades as well as database programming to minimize calculations.

The cost to the industry (i.e., 91 fabs) in terms of labor and capital expenditures to meet the specific requirements of the reproposed rule would be significant. It is estimated that the labor (legal, managerial, technical, and clerical) for collecting the data would cost on the order of $1.4 million annually. Similarly, the costs for equipment capital and operation and maintenance of the equipment would be approximately \$2.8 million. The grand total industry cost burden for labor, capital, and O&M would be on the order of \$4.2 million in the first year.

International SEMATECH Manufacturing Initiative
Technology Transfer
2706 Montopolis Drive
Austin, TX 78741

http://ismi.sematech.org
e-mail: info@sematech.org

ATTACHMENT B4:
2010 ISMI EPA PROTOCOL

Consolidated Comments from ISMI GHG Working Group: March 2010 EPA Draft DRE Measurement Protocol

General Comments:

1. Need to integrate JEITA alternative method for measuring dilution through the system. (Comment from last draft not addressed). We anticipate that this will be resolved during EPA witness testing planned for this year.
2. Why is it acceptable to use a tracer approach to determine tool effluent flow but not acceptable for abatement system effluent flow? Agree with the consideration for a properly mixed sample which the tool pump provides at the tool effluent as well as the concern when dealing with non-ideal ducts (ones which may not contain laminar flow) as often at the abatement system effluents. The missing piece is the demonstration that the injected tracer is homogeneously mixed with the abatement system effluent flow. Propose to add a stratification test to the protocol in support of the post-abatement flow tracer method. This stratification test can be easily performed by stepping the FTIR sample probe across the abatement system effluent duct at depths of 25%, 50% and 75% (or more if desired) while measuring the tracer gas concentrations by FTIR. Should the concentrations be consistent at each depth into the abatement system effluent duct the tracer/effluent can be considered homogenously mixed and the flow determination can continue with the probe centered in the duct. Furthermore, the gases incorporated for tracers are also the same pfcs commonly monitored at these facilities, albeit absent of the particular process for flow determinations. Therefore, if the FTIR data is acceptable for concentration measurements used for DRE determinations it should be acceptable for flow determination by the process described above. Previous results have displayed very repeatable results at various tracer injection rates. Two other experiments comparing FTIR and QMS tracer studies for flow determination are planned for the next few months. One will be at a laboratory using a 4" mixing duct and a second in late June at a semi-conductor facility. Another issue of concern is the stability of the QMS measurements during these tests. Previous testing results demonstrated very tight deviations using FTIR concentration results over multiple tracer release flow rates. With the inherent drift, ambient pressure inlet and calibration issues associated with the QMS (and alluded to in the protocol Section 2.2.4) it is a concern that the QMS will not be able to produce data quality equal to the FTIR approach. We anticipate that this will be resolved during EPA witness testing planned for this year.

Real life issues not addressed in the protocol:

1. What it takes to construct the "calibration curve", reference library should bracket concentrations seen in the field. (Comment from last draft not addressed, see further comments on 2.2.5 comment 2)
2. Reference conditions should be reasonably close to sample conditions

(temp, press, path length) and will impact data. (Comment from last draft not addressed)
3. Analysis method will take significant work to determine optimal regions for analysis to minimize interfererants. (Comment from last draft not addressed)
4. Heated versus unheated sample lines? (Comment from last draft not addressed)
5. Optics integrity, fouling due to particulates. (Comment from last draft not addressed)
6. Signal to noise and resulting detection limits. (Comment from last draft not addressed)
7. Detector saturation. (Comment from last draft not addressed)
8. Moisture issues, spectra interference. (Comment from last draft not addressed)

Section
1.1 Protocol Purpose
1.2 Protocol Objectives

1.3 Protocol Scope
1. References ISMI 2006 guideline. Please note that ISMI Guideline is currently being revised in a coordinated effort with ISMI's international membership. Here and throughout the document, should reference the 2009 SEMATECH Guideline, which will be finalized soon. (Comment from last draft not addressed) Still 2006
2. The method stipulates that the relative error must achieve plus or minus 5 %. Presumably they mean < 5% relative error. (Comment from last draft not addressed)
3. Footnotes 3 and 4: Selection of fraction emitted as the benchmark/performance metric seems predicated on low DRE. For a well functioning abatement unit with DRE approaching 1, all the same issues will occur with using the relative error of fraction emitted as are identified with using the relative error of DRE as DRE approaches 0. The benchmark metric and performance standard defined for this protocol should not be so sensitive to the DRE itself. Should the acceptable error be defined as a percentage of the unabated emission value instead? While footnote 4 argues that the proposed 5% relative error performance standard is achievable, it is not clear that this is true across the full range of DREs. (Comment from last draft not addressed)
4. Typo in Section 1.3, paragraph 3, 4th sentence should have the "the" removed between standard and relative.

1.4 History of the Protocol
1. We question the cost-benefit of the ban on the detuning (bypass) method. Given the short duration of the test protocol, and in recognition that the method is for a single tool with relatively low emissions; we question whether the ban on the de-tuning method is justifiable....i.e., "prevents a

significant quantity of PFC emissions." (Comment from last draft not addressed)

2.1.1 Description of Experimental System
In Figure 1 consideration needs to be taken when low purge-flow pumps are employed. If the sample exhaust is not returned to the tool effluent downstream of the extraction location it will impact the DRE as the inlet mass loading will be lower than normal operation. This is only applicable when the extracted flow is not negligible compared to the tool effluent flow.

2.1.3 Required Resources
1. Figure 1 - Will MFCs function in this configuration, the schematic locates them on the suction side of the pump? They would be at negative pressure, typical MFCs need pressure (i.e. 20-50psi) to function properly.
(Comment from last draft not addressed)
2. Figure 1 - What is a "calibration system"? Is this gas delivery via MFC? Need more info, if it is MFCs then same comment as above.
(Comment from last draft not addressed)
3. Figure 1 - Need to specify minimum distance between pump exhaust and FTIR2 inlet to avoid recirculation issues. (Comment from last draft not addressed)

2.1.5 Safety
1. Mentions "integrated circuit fabrication environment." Don't forget this is supposed to apply to flat panel and solar facilities. (Comment from last draft not addressed)

2.2 Measurement Methodology
2. Include JEITA alternative for measuring dilution. (Comment from last draft not addressed). We anticipate that this will be resolved during EPA witness testing planned for this year.

2.2.1 Method 1 – Dilution Adjusted Concentration Measurement
1). In section 2.2.1 (DRE determination with plasma off) a specified flow of 120% of the process flow is stipulated to ensure the abatement system is tested under conditions that may occur during processing. The pfc concentrations will be much greater than normal as is (not being disassociated by a plasma).

2.2.2 Method 2 – Total Volume Adjustment.
1). Typo in 2.2.2, 2nd paragraph, 3rd sentence "…all operating chambers that are"

2.2.3 Equipment Needed
1. Is NDIR an appropriate method for abatement effluent characterization? Should it be included? If it is included, what is needed to obtain good results? (Comment from last draft not addressed)
2. Table 1 – What is a metal bellows sample pump? Do we mean flex foreline fitting bellows? Do we mean metal diaphragm? If so what type of metal? Might not hold up to corrosives. (Comment from last draft not addressed)

3. Table 1 - Sample filter, pore size spec? Material spec? Could impact pressure drop/data significantly over time for dirty processes and unheated lines. (Comment from last draft not addressed)
3. The suggestion of using a pfc that passes through the abatement system with DRE<5% to determine abatement system effluent flow forms a circular argument. Per the protocol, one must demonstrate that the abatement system DRE for the compound is <5% by QMS and tracer studies before using the pfc tracer approach.

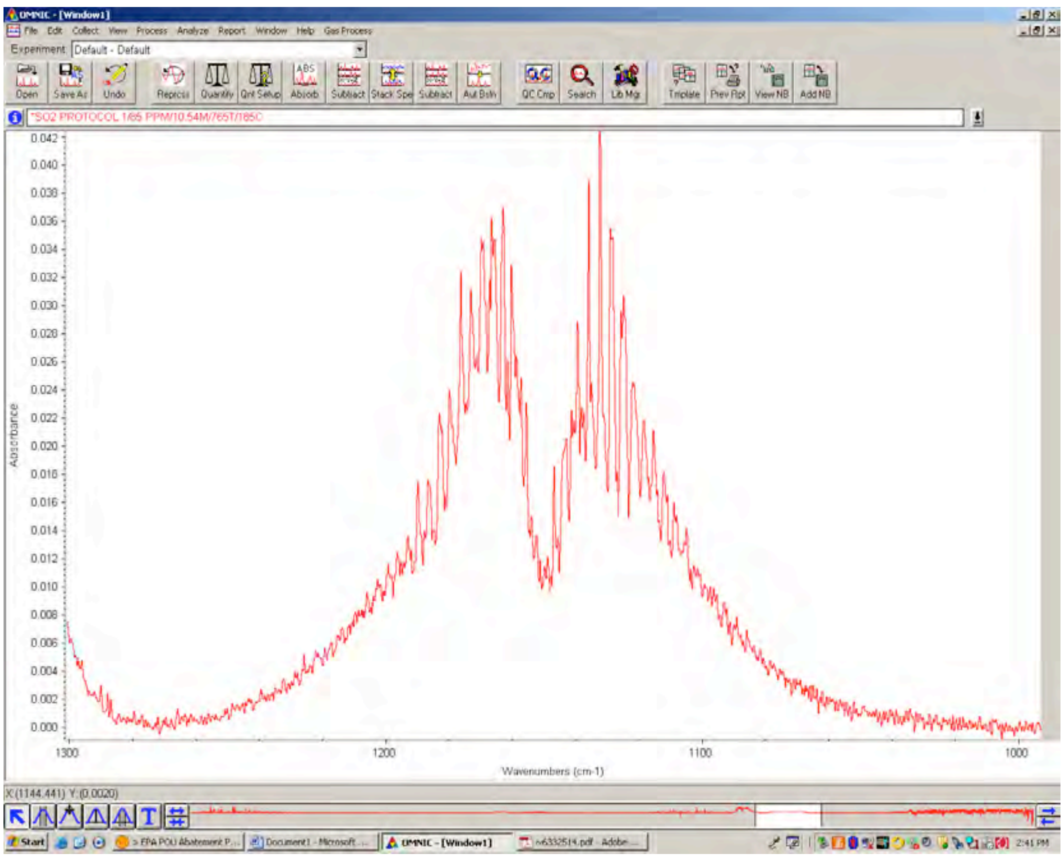
2.2.4 FTIR and QMS Protocols
1. FTIR absorbance range of "0.1 to 1" is somewhat arbitrary and detector specific. (Comment from last draft not addressed)
2. Current version states scan times should be on the order of 3 seconds. Not all FTIRs can scan so quickly. One of the systems we have collects 1 scan/1.7 seconds plus you have factor in the processing time. Also short scans will increase MDLs at the abatement system effluents.

2.2.5 Calibration Curve
1. Why is a 6 point calibration curve required for QMS, but apparently only a 2 point calibration curve required for FTIR? (Comment from last draft not addressed)
2. Current version states the necessity to bracket (within the FTIR reference set for the particular compound) the observed concentration ranges and only considers absorption features between 0.1 and 1.0 absorbance units (a.u.). Although it is good practice, it is not always practical or necessary. Since most pfcs have broad absorption features they are linear over large concentration ranges. It is a fair assumption that the linear behavior can be extrapolated to concentrations ~50% greater than the largest reference should the compound exhibit linear behavior. In the last sentence of 2 paragraph of 2.2.5 it alludes to this by stating that all non-linear curves must bracket the observed concentration range. Alternating cells at the tool effluent FTIR can eliminate the ability to observe byproducts. It is also cumbersome to switch between plasma off/on experiments to ensure that concentrations are bracketed or the 0.1-1.0 a.u. range is conserved.

3. The suggestion to only quantify over FTIR absorbance features between 0.1-1.0 absorbance units (a.u.) is rather restricting (Sections 2.2.4, 2.2.5 & 2.2.7). There are often plenty of usable features outside this 0.1-1.0 range.

The lower bound of this range would be better represented by a factor offset based on the FTIR system noise, say absorbance features at a minimum of 1.5 times the system noise are acceptable for use. Common system noise levels are on the order of 10-3 and most of the time much better. Using 0.1 a.u. as the lower bound is requiring that absorbance features be 100 times (or more) your system noise to be usable. An illustration of this is depicted below in the FTIR reference for SO2. This SO2 feature displayed is the band most often quantified. The peak absorbance is less than 0.1 a.u. (0.04 a.u.), but remains well above the system noise. The FTIR cell path length of 10.5m is common for semi-conductor sampling, therefore normalizing the SO2 concentration to fall within the 0.1-1.0 range yields approximately 136 ppm required to quantify SO2 using this absorbance feature.

Similarly, there is a lot of usable information to be gathered from absorbance features greater than 1.0 a.u. I feel a better representation of the upper bound would be features that are not opaque (totally absorbing) and quantify at no more 50% of the concentration of the largest reference in the particular compounds' set. Of course this only applies to linear absorbing compounds which the pfcs are. A skilled spectroscopist (meteorologist) would know when this is appropriate. Furthermore, when determining the tool effluent flow, this is often the case as it is necessary to run the process recipe (per the protocol Section 2.2.1) with the tool plasma off. This is the case when determining tool utilization as well.



FTIR Reference for 85 ppm SO2 collected at 10.54m

Granted SO2 is not a GHG but it is a by-product of SF6 processes. The protocol also does state that it is acceptable to go outside of this range so long as the reference set bracket it which is easy to do on the lower bound by adding a zero (or noise spectrum) to your reference set. However, looking forward, if this protocol is to be applied for other compounds this restrictive range may provoke an issue where good data could be non-acceptable.

2.2.6 Flow and Dilution Measurement

1. Is the stipulation of a minimum of 3 flow rates with an average derived from a minimum of 40 distinct analytical measurements, for each flow rate, appropriate? How was this number selected? (Comment from last draft not addressed)
2. Same as 2.2.3 comment - The suggestion of using a pfc that passes through the abatement system with DRE<5% to determine abatement system effluent flow forms a circular argument. Per the protocol, one must demonstrate that the abatement system DRE for the compound is <5% by QMS and tracer studies before using the pfc tracer approach.

2.3.1.1 Total Volume Flow

1. We are confused why different minimum measurement data collection quantities of 640, 40, and 60 are alternately applied here. What is the basis for selecting these numbers? (Comment from last draft not addressed)
2. Why must there be a minimum of 180 TVF data points? What is the physical or mathematical basis for selecting this number? (Comment from last draft not addressed)
3. The statistical methods and equations, along with any specific sample number requirements they may have should be referenced to standard textbooks or similar reference material. (Comment from last draft not addressed).
4. Using a Non-reactive Gas at POU Abatement Device Outlet (Comment from last draft not addressed). We anticipate that this will be resolved during EPA witness testing planned for this year.

Discussion: the below described added methodology can be proven at a company's fab and utilized for that same POU abatement device make and model at that company's fab. It would need to be proven again at a same company's different fab. This logic is the same as above less than 5% tracer gas testing methodology, as it also needs to be proven.

Suggested Added Language: Another methodology is to accurately flow a non-reactive gas (e.g. CF_4) into POU abatement device outlet and measure the concentration downstream (usually by FTIR). This methodology requires the use of all of the following criteria:

The non-reactive gas used must be sampled at POU abatement device outlet to determine that this gas is not present.

The non-reactive gas must be injected across the POU abatement device outlet duct. This should be accomplished by using an injection probe with equally spaced holes to uniformly distribute gas.

The location selected for downstream non-reactive gas analysis must be at least eight duct diameters downstream from non-reactive gas injection location.

The location selected for downstream non-reactive gas analysis must be used for POU abatement device outlet sampling. This will ensure that any dilution that occurs from POU abatement device outlet to this sampling location will be accounted for.

The downstream non-reactive gas analysis location must be traversed with the sampling probe at a few locations to ensure the non-reactive gas is well mixed. For example, if the duct is 10 centimeters, the duct can be traversed every 2 centimeters to prove each probe location has nearly the same non-reactive gas concentration. The concentrations measured for each of these probe locations must agree within +/-10%. The average of the measured concentrations would then be used to calculate the POU abatement device outlet flow.

The distance from the downstream non-reactive location to the next downstream air addition (e.g. exhaust lateral connection) is at least two duct diameters.

If any of the six above criteria cannot be met, then this methodology cannot be utilized.

To ensure that this methodology can be utilized, it should be compared directly to the QMS and noble gas methodology for a specific POU abatement device make and model at a fab. The calculated dilution factor for both the QMS and noble gas methodology and this POU abatement device outlet methodology must be within +/-10% of each other. Thereafter, this POU abatement outlet methodology can be utilized for the all of the same POU abatement device make and model for this company's fab only, if each POU abatement device make model can meet the six criteria listed above.

3 BENCHMARK RELATIVE ERROR

1. "These formulas may not be applicable when using alterative methodologies to those presented in this protocol are used..." Does this mean that alternative methods are ok? It implies that way. Also note typo in quotes. (Comment from last draft not addressed)

W-5

Caudill, Neil (ECY)

From:	Chris Lyle [ctlyle@hotmail.com]
Sent:	Thursday, October 14, 2010 8:54 AM
To:	Caudill, Neil (ECY)
Subject:	Chapter 173-441 WAC- Reporting of Emissions of Greenhouse Gases - New Rule
Attachments:	EcologyReportingRule10142010.doc

Mr. Neil Caudill
Washington State Department of Ecology

Attached are my written comments regarding: Chapter 173-441 WAC- Reporting of Emissions of Greenhouse Gases - New Rule

Please include them in the public record.

Chris Lyle

Written Testimony regarding proposed Chapter 173-441 WAC
Reporting of Emissions of Greenhouse Gases
October 14, 2010

By Chris Lyle

Anthropogenic Global Warming (AGW) is named for the hypothesis that human activity related to burning fossil fuel causes an increase in atmospheric CO_2 concentration leading to a general increase in earth's temperature since the beginning of the industrial age around 1850. This hypothesis leads to the perception that civilization needs to reduce our carbon footprint in order to save the world according to CO_2 alarmists.

What percent of the earth's atmosphere consists of carbon dioxide (CO_2)? This question is important because burning fossil fuel releases CO_2 into the atmosphere. This is the focal point of blame for global warming. The concentration of CO_2 in the atmosphere today is a miniscule point zero three eight percent (.038%), also stated as 380ppmv. How can such an infinitesimally small fraction of earth's atmosphere be the cause of so much alarm? This is where the great global warming debate begins.

The foundation of this debate is based on complex algorithmic computer models written to forecast future climate scenarios. These models attempt to extrapolate historical temperature records going back hundreds and thousands of years based on various temperature proxies. Two primary types of temperature proxies are tree rings and ice cores. Some scientists think they can determine temperature history based on tree ring width.

This begs the following question. How do you unravel and extract verifiable temperature data from a tree ring or ice core? Tree ring characteristics are determined by sunlight; rainfall moisture; soil nutrients: N-P-K; plus a little CO_2. These elemental factors are combined through the process of photosynthesis into wood cells that form tree rings. Temperature plays a part, but is it really possible to ferret out a temperature measurement from all these other factors playing such a key role in the construction of tree ring growth?

The width of a tree ring has more to do with the function of rainfall moisture and soil nutrients. Growing conditions can range from warm-wet to warm-dry, from cool-wet to cool-dry. Soil nutrient characteristics can range from rich to poor. You have different possible environmental combinations and none of them reveal a temperature standard that can be objectively measured. Extracting a temperature reading is simply impossible because you have no way of knowing whether growing conditions were wet or dry in relation to nutrient rich or poor soil conditions during the growing season. It is simply impossible to ferret out a temperature reading once the cellular structure of wood has been created.

Science does not know whether there was an above or below average number of sunny days during the growing season. A narrow tree ring could have been created by a high number of cold cloudy days with below average rainfall as it could have been created by warm dry clear sunny days. A cold dry growing season could easily create the same type of tree ring characteristics as a warm dry growing season. Tree rings do not maintain a uniform width around their circumference. How do you tell which part of the uneven cross section of a tree represents an accurate temperature proxy? It is simply impossible to sort the constituent factors back out into their original characteristics in such a way that a temperature reference could accurately be determined. There really is no way to unravel the yarn once a tree ring is created.

The same line of questioning applies to ice cores.
The Vostock ice core in Antarctica and the Greenland ice cores are the two primary sources of ice core data used to measure earth's early atmospheric CO_2 content. Generally two data source points are not a large enough sample size to be considered 'statistically significant'.

There are other problems with the ice core record. It takes years for air to be trapped in ice so the question must be asked, "What is actually being contained and measured"? How can researchers be sure that when the snow fell and was subsequently compressed into ice that an accurate representative sample of CO_2 was stored in the ice? It is simply impossible to rule out the possibility of contamination from melt water and bacteria. Given such a small sample population, ice core studies don't meet standard requirements for statistical significance. Converting a CO_2 sample stored inside a tiny bubble held within an ice crystal into a representative temperature measurement that is accurate seems highly problematic?

Suggested reading for further information on the subject of ice core records:

1.
Measurement of Pre-Industrial CO_2 Levels
By Dr Timothy Ball
11/2008
http://friendsofscience.org/assets/documents/FoS%20Pre-industrial%20CO2.pdf

2.
Climate Change: Incorrect information on pre-industrial CO_2
Statement written for the Hearing before the US Senate Committee
on Commerce, Science, and Transportation
March 19, 2004
Statement of Prof. Zbigniew Jaworowski
Chairman, Scientific Council of Central Laboratory for Radiological Protection
http://www.mitosyfraudes.org/Calen5/JawoCO2-Eng.html

3.
Ancient Ice
Sean D. Pitman M.D.
© December, 2006
http://naturalselection.0catch.com/Files/ancientice.html

The next question I have deals with nomenclature. Why is CO_2 called a "greenhouse gas"? Aren't greenhouses a human invention intended for good purposes like growing warm season plant life in cold climates? The fact is greenhouses are enclosed atmospheric systems intended to trap heat generated from sunlight passing through a glass pane. On the other hand the earth's atmosphere is an open system. The vast majority of the heat created as sunlight passes through the atmosphere, warms the earth's surface and is reflected back out into space.

The rate of heat lost back into space varies throughout day and night. The rate of heat loss back into space is affected primarily by the amount of water vapor in the atmosphere. The rate of heat loss is affected by the degree to which water vapor has condensed and formed clouds. During the day clouds reflect heat back out into space and cool the surface. During the night clouds reflect heat back to the earth's surface causing a warming affect. Using the words "greenhouse gas" as a metaphor describing the affect that CO_2 has on earth's atmosphere is simply an inaccurate paradigm for characterizing climate change.

Another major point of contention among climate modelers is the question of how to accurately characterize the role played by clouds, water vapor, humidity and precipitation. Measuring thermodynamic affects these factors have and converting the results into computer models remains a complex guessing game. Perceptions for modeling dynamic relationships boil down to a debate over "climate sensitivity". This is described by Wikipedia's characterization reached in the IPCC Fourth Assessment Report: "In Intergovernmental Panel on Climate Change (IPCC) reports, equilibrium climate sensitivity refers to the equilibrium change in global mean near surface air temperature that would result from a sustained doubling of the atmospheric (equivalent) CO_2 concentration ($\Delta Tx2$). This value is estimated, by the IPCC Fourth Assessment Report (AR4) as likely to be in the range 2°C to 4.5°C with a best estimate of about 3°C, and is very unlikely to be less than 1.5°C." (Search Wikipedia: climate sensitivity)

Translation: If atmospheric concentration of CO_2 doubles from present day 380 ppmv to 760 ppmv then mean climate temperature will increase by a best guess estimate of 3°C (equal to 5.4°F). The potential time period for this increase is uncertain, but can be estimated based on the most recent rate of CO_2 increase which is 2 ppmv per year (http://www.esrl.noaa.gov/gmd/ccgg/trends/co2_data_mlo.html). At this rate of increase it would take one hundred ninety years for CO_2 to double to 760 ppmv. In other words it will take approximately 190 years for the mean global near surface air temperature to increase by 5.4°F. This figure is well within the parameters of the Medieval Warming Period around a thousand years ago.

Climate science is not 'settled'. Revelations from the November 2009 'climategate' e-mail scandal show us that politics has infected science. Climate Research Unit proponents of AGW theory created a computer model rigged to support their hypothesis then try to hide the fact that the model they created doesn't work when back tested on historical temperature records.

The IPCC is exposed for publishing anecdotal forecasts about receding Himalayan glaciers. Indian glaciologist Syed Hasnain was originally interviewed by New Science Magazine. In 1999 New Science Magazine published his claim that Himalayan glaciers are set to disappear by 2035. Later in 2005, World Wildlife Federation published a reference to Mr. Hasnain's comments from his New Science Magazine interview without scrutinizing the facts. The IPCC then published the bogus WWF reference in their Fourth Assessment Report without bothering to conduct a verifiable peer review of the information.

Manipulation of NASA – GISS (Goddard Institute for Space Studies) and NASA – NCDC (National Climate Data Center) data sets reveal that cold climate reporting sites have been compromised. NASA – GISS and NASA – NCDC deleted actual temperature records from thousands of locations throughout the world as it changed to a system of global grid points. Each grid point is now determined by averaging the temperatures of two or more adjacent weather observation stations. Now the NCDC grid map contains only averaged, not real temperatures, leading to significant doubt that the result is a valid representation of Earth temperatures. The number of actual weather observation points used as a starting point for world average temperatures was reduced from about 6,000 in the 1970s to about 1,000 now leaving much of the world unaccounted for. There was a clear bias toward removing higher-latitude, high-altitude and rural locations. The sad fact is that the public can no longer take scientists at their own word.

During 2003, under President George W. Bush's administration, the EPA made two determinations with respect to the Clean Air Act:
1. The EPA lacked authority under the Clean Air Act to regulate carbon dioxide and other greenhouse gases (GHGs).
2. Even if the EPA did have such authority, it would decline to exercise it.
http://en.wikipedia.org/wiki/Massachusetts_v._Environmental_Protection_Agency
EPA reasoned that carbon dioxide did not constitute an "air pollutant" within the meaning of the federal Clean Air Act.

Soon after, a laundry list of plaintiffs, beginning with the Commonwealth of Massachusetts, filed suit against EPA pressing to reverse EPA's determination. Eventually the case made it to the U.S. Supreme Court.

The U.S. Supreme Court ruled against EPA on April 2, 2007. The Court found that greenhouse gases are air pollutants covered by the Clean Air Act. The Court found that the EPA has the authority to regulate carbon dioxide (CO_2) and other greenhouse gases. The Court held that the EPA Administrator must determine whether or not emissions of greenhouse gases from new motor vehicles cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. In making these decisions, the EPA Administrator is required to follow the language of section 202(a) of the Clean Air Act.

Massachusetts v. Environmental Protection Agency
http://www.supremecourtus.gov/opinions/06pdf/05-1120.pdf

As a result of this ruling on December 7, 2009, the EPA Administrator signed two distinct findings regarding greenhouse gases under section 202(a) of the Clean Air Act:

>Endangerment Finding: The Administrator finds that the current and projected concentrations of the six key well-mixed greenhouse gases--carbon dioxide (CO_2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6)--in the atmosphere threaten the public health and welfare of current and future generations.

>Cause or Contribute Finding: The Administrator finds that the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle engines contribute to the greenhouse gas pollution which threatens public health and welfare.

These findings do not themselves impose any requirements on industry or other entities. However, this action is a prerequisite to finalizing the EPA's proposed greenhouse gas emission standards for light-duty vehicles, which were jointly proposed by EPA and the Department of Transportation's National Highway Safety Administration on September 15, 2009.

These findings were signed by the Administrator on December 7, 2009. On December 15, 2009, the final findings were published in the Federal Register (www.regulations.gov) under Docket ID No. EPA-HQ-OAR-2009-0171. The final rule is effective January 14, 2010.

Source:
Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Clean Air Act http://www.epa.gov/climatechange/endangerment.html

The major error in judgment of this Supreme Court ruling and in the subsequent finding by the current EPA Administrator lies in the fatally flawed perception that the science is settled. If the Supreme Court and EPA had known everything we know today about 'climategate' they might have reached a different conclusion. The Supreme Court and the EPA relied heavily on the corrupt analysis published by the IPCC and the Hadley Climate Research Unit. These studies were generated through a peer review process by related scientists with preconceived intentions friendly to the philosophy of AGW.

If the Court and EPA had done the math they might have understood that the amount of CO_2 resulting from human activity is statistically insignificant compared to natural sources. The fact that CO_2 plays a vital role in the respiration of plant life and that CO_2 resulting from combustion of fossil fuel is indistinguishable from naturally occurring CO_2 should have weighed heavily against ruling that CO_2 is a pollutant.

If the Supreme Court had examined some of the alternative hypothesis regarding climate change mentioned above they might have given more deference towards EPA's decision making authority. Instead they bought in to the scare tactics. CO_2 is not a pollutant that directly endangers human health. The Court set the bar way too low in terms of determining 'toxicity' of CO_2. The idea that CO_2 is an indirect danger to human health via global warming is unreasonable given the miniscule percent of total CO_2 in the atmosphere and the even smaller percent of CO_2 added to the atmosphere on annual basis from human activity. The idea that reducing the human quotient of CO_2 output will result in less global warming is absurd.

The Court needs to consider reversing it's ruling based on the revelation that what was once considered 'sound science' has now been revealed as scientific malpractice and malfeasance. The science used to justify this ruling was contaminated as evidenced by the emails released via a whistleblower at the Hadley CRU. Arbitrary and capricious studies by scientists holding personal political agendas as evidenced by the 'climategate' emails should not stand as the basis for Supreme Court decisions.

EPA needs to reconsider their endangerment determination. The list of reasons for reconsideration is long. The EPA suppressed an internal report that was skeptical of claims about global warming, including whether carbon dioxide must be strictly regulated by the federal government. The clearest explanation is for readers to go to these websites in the following order.

EPA Endangerment Finding for CO_2
http://www.heartland.org/suites/environment/endangerment.html

Suppressed Text of EPA Staffer's Skeptical Assessment of 'Endangerment' Finding
Alan Carlin - June 29, 2009
http://www.heartland.org/full/25560/Suppressed_Text_of_EPA_Staffers_Skeptical_Assessment_of_Endangerment_Finding.html

CEI re Alan Carlan EPA skeptic
http://cei.org/cei_files/fm/active/0/Endangerment%20Comments%206-23-09.pdf

Alan Carlan
Comments on Draft TED for Endangerment Analysis for GHG Emissions under CAA
http://www.heartland.org/custom/semod_policybot/pdf/25560.pdf

The fact that EPA ignored skeptics within their own ranks serves as evidence that EPA needs to reconsider their endangerment determination. This argument is fully supported by the written testimony of Steve McIntyre.
http://scienceandpublicpolicy.org/images/stories/papers/reprint/sub_on_epa.pdf

Regulating human output of carbon dioxide is a total waste of taxpayer revenue. Rulemaking regarding reporting of greenhouse gases by Washington state businesses is unnecessary. Further rulemaking efforts by Ecology should be put on hold pending Legislative review.

W-6

October 14, 2010

Ted Sturdevant
Washington State Department of Ecology

Dear Director Sturdevant,

Please accept this letter as comment to the Department of Ecology regarding the Proposed Rule Text, Reporting Emissions of Greenhouse Gases, Chapter 173-441 WAC. The organizations listed below appreciate the opportunity to comment on the proposed rule text. **We oppose the proposed three-year delay of the reporting program and strongly urge the Department of Ecology to revisit this issue before the rule is finalized.**

Rule text inconsistent with legislative intent

Delaying the start of greenhouse gas (GHG) reporting until 2013 is inconsistent with Washington's two laws that establish a reporting program. 2008 HB 2815 states that Ecology must write rules that "require persons report 2009 emissions starting in 2010." SB 6373 affirms this, stating that: "the rules must require...reporting will start in 2010 for 2009 emissions." A three-year delay in the start of the program is inconsistent with the direction given to Ecology by the Legislature and such a significant change in the law would require legislative action.

Delay in implementation is unnecessary

The three-year delay in the proposed rule is unnecessary. While there have been changes from the GHG reporting program Ecology originally planned to use due to the start of federal reporting requirements, there is still a foundation in place to start reporting in 2010. In May of 2010, the Western Climate Initiative (WCI) released its report "Proposed Harmonization of Essential Requirements for Mandatory Reporting in U.S. Jurisdictions with EPA Mandatory Reporting Rule." This report demonstrates how WCI partner states that were preparing GHG reporting programs can harmonize their state programs with the federal EPA rule. Washington has been an active participant in the WCI and its reporting subcommittee and should be able to implement the suggestions contained in the report.

Oregon can also provide a model for our state. Like Washington, Oregon passed a law directing mandatory reporting of 2009 GHG emissions beginning in 2010. Even with the changes in federal law, Oregon is still on schedule to implement its reporting program; 2009 emissions will be reported this year and transportation fuel providers will start reporting next year. Washington should seek input from Oregon on how we can start our reporting program on time.

Delay in implementation threatens the state's climate program

Any program to reduce GHG emissions must start with a solid understanding of where emissions come from, which is why GHG reporting is the foundation of the Washington's climate program. Delaying reporting until 2013 suggests that the state will not move forward with GHG reduction measures until after 2013, significantly decreasing the time the state has to reduce emissions consistent with the 2020 GHG limit in RCW 70.235.050. This delay poses a real threat to the state's entire climate program and could suggest to major emitters that the state is backing off on its commitment to reduce emissions.

We strongly urge Ecology to reconsider this proposed rule text and restore the start date to 2010 reporting of 2009 emissions, per legislative direction.

Thank you for your attention to these comments. We look forward to continue to work with the Department of Ecology as it develops its important GHG Reporting program.

Sincerely,

Gregg Small
Climate Solutions

Joan Crooks
Washington Environmental Council

Nancy Hirsh
NW Energy Coalition

Brendon Cechovic
Washington Conservation Voters

Alan Durning
Sightline Institute

Aaron Ostrom
Fuse

Carrie Dolwick
Sierra Club

April Putney
Futurewise

Rob Johnson
Transportation Choices Coalition

Mike Petersen
The Lands Council

Gerry Pollet
Heart of American Northwest

LeeAnne Beres
Earth Ministry

W-7

Caudill, Neil (ECY)

From:	Muehlethaler, Eveleen T. [eveleenm@ptpc.com]
Sent:	Thursday, October 14, 2010 3:31 PM
To:	Caudill, Neil (ECY)
Cc:	Hodges, Charlie; Loney, Roger A.; Wallendahl, Annika S.; DeLeo, Val
Subject:	GHG Reporting Rule Comments
Attachments:	2010 10 14 PTPC GHG Reporting Comments.pdf

Neil-

Thank you for all the work Ecology has put into the proposed GHG Reporting Rules.
Please accept the attached comments from PTPC.

Thank you-

Eveleen Muehlethaler
Port Townsend Paper Corp.
eveleenm@ptpc.com
(360)379-2112

PORT TOWNSEND PAPER FAMILY OF COMPANIES

CROWN PACKAGING
CROWN • CREATIVE • GROUP

BOXmaster

October 14, 2010

Neil Caudill
Air Quality Program
Washington Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600
Sent via e-mail: neil.caudill@ecy.wa.gov

Subject: GHG Reporting Rule Comments

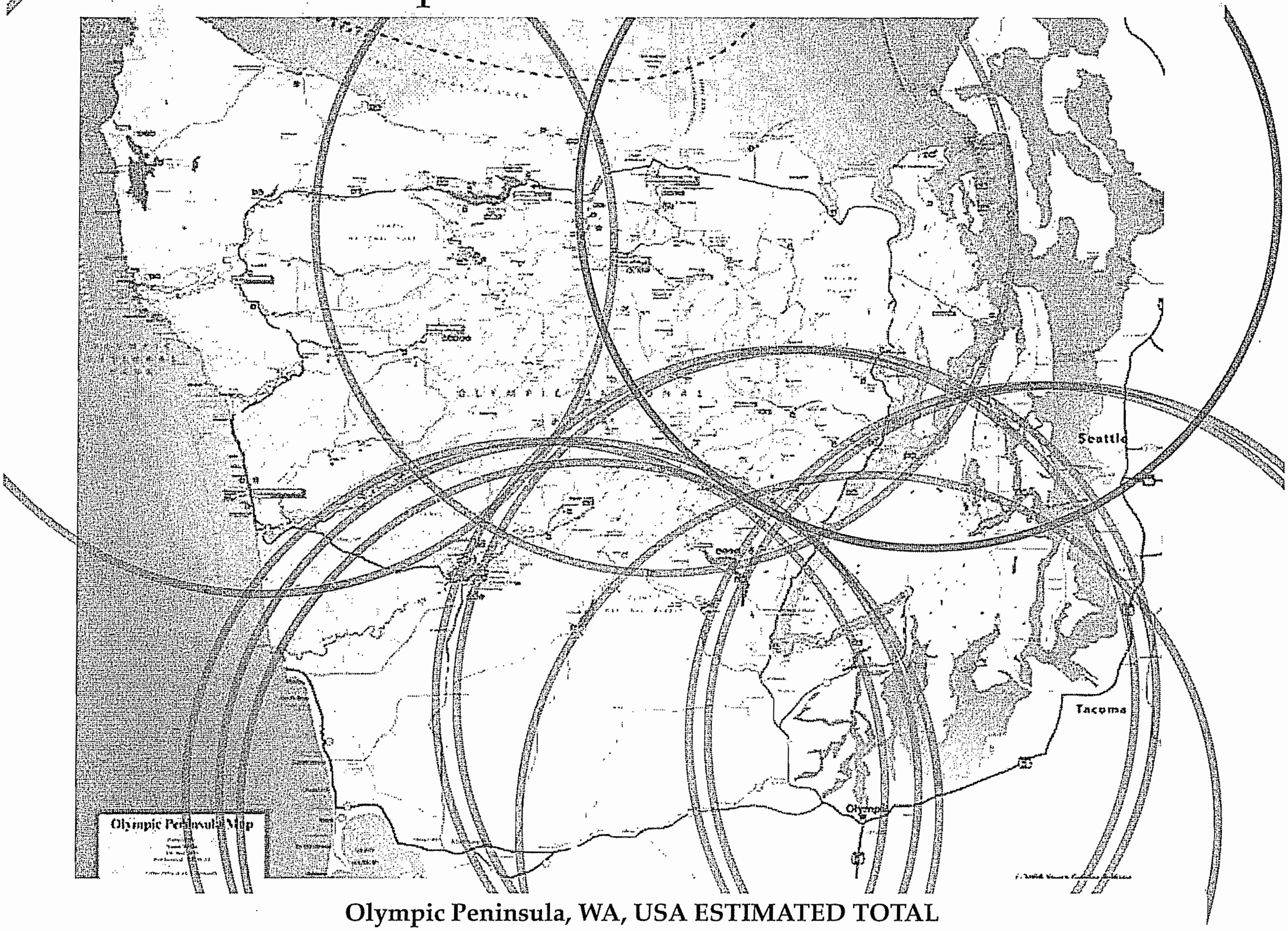
Thank you for the opportunity to comment on the proposed GHG Reporting Rules. Port Townsend Paper Corporation will be subject to these requirements and sincerely appreciates Ecology's efforts to coordinate with EPA on reporting mechanisms. Multiple reporting systems with a variety of differences would create confusion and waste limited resources while trying to track GHG. We also appreciate the phased approach to reporting. This is a complex system with lots of data. Your approach should help allow for the development of a robust data collection.

Our greatest concern with this proposed rule is in the protection of Confidential Business Information. Some of the requested data has long been considered sensitive information in sourcing fuel and remaining competitive. My understanding is that EPA is working on a system that would allow for CBI information to be entered into the e-GGRT system and remain confidential. I have been told that WA State would expect to receive all the information (including CBI) from EPA. Furthermore, I have been told that at the state level all the information would be available to the public. This situation defeats all the work being done at the Federal level to address legitimate CBI concerns. We request that Ecology address the issue of CBI in a manner that preserves the safeguards put into place at the federal level.

Sincerely-

Eveleen Muehlethaler
Vice President – Environmental Affairs
100 Mill Road
Port Townsend, WA 98368
(360) 379-2112
E-mail : eveleenm@ptpc.com

Biomass Burning a first estimate map
Competition for Forest Resources



Olympic Peninsula, WA, USA ESTIMATED TOTAL
275MW = 2,750,000 Tons forest wood/yr. = 2,750,000 Tons CO_2/yr

PLUS proportional loss in Oxygen-generating capacity of our forests

Red circles represent 50 mile maximum "cost effective" harvest radius around all existing and proposed biomass incinerators / burners (ao Sept 2010) around the Olympic Peninsula, WA, USA.

After quickly using up "waste" wood within circle, facilities forage for other sources -- outside the area, standing wood, other materials including construction & demolition debris ("urban wood") or sludge.

On map: PT Holdings/Port Townsend, Nippon/Port Angeles, Quilayeute School/Forks, Sierra Pacific/ Aberdeen, Gores Group/Cosmopolis, Grays Harbor/Hoquiam, Evergreen College/Olympia, Simpson/ Shelton, Adage/Shelton, City of Tacoma/Tacoma, Simpson/Tacoma

At least 3 existing facilities already forage outside of their circle.
At least 26 similar burners exist or are proposed for WA State.

ESTIMATED TOTAL

275MW = 2,750,000 Tons of forest wood/yr. = 2,750,000 Ton of CO2/yr

PLUS proportional loss in Oxygen-generating capacity of our forests

Woody biomass burners* represented on the first page are:

Port Townsend	PT Holdings/Port Townsend Paper	28.5 or 36 MW	8x expansion from 3.5 MW
Port Angeles	Nippon Paper	20MW	expansion
Forks	Quilayeute School	?	under construction
Aberdeen	Sierra Pacific Sawmill	18MW	existing
Cosmopolis	Gores Group/Smurfit	14MW	newly repurchased, to be restarted
Hoquiam	Grays Harbor Paper	18.5MW	existing
Olympia	Evergreen College	?	feasibility study
Shelton	Simpson	31	expand from 14 MW
Shelton	Adage	60	proposed
Tacoma	Simpson	55	existing
Tacoma	City of Tacoma Steam Plant	50/13MW	existing

Megawatts are estimates based on figures found to date. If anything, they are low. Figures are variously nominal for a given burner, nomimal total for the facility, or gross (total).

*biomass burners are variously known as co-generators, burners or incinerators. Each term carries particular regulatory implications, but they all do the same thing: burn biomass. They operate the same, and have the same effect on the substances being burned and environment.

Updates may be available as we get more accurate information.

Information As of September 30, 2010

W-9

Caudill, Neil (ECY)

From: Beam, Thomas G [Thomas_G_Beam@RL.gov]
Sent: Thursday, October 14, 2010 4:17 PM
To: Caudill, Neil (ECY)
Cc: Jackson, Dale E.; Beam, Thomas G; Peterson, Kirk A
Subject: Comments on Proposed New WAC 173-441 "Reporting Emissions of Greenhouse Gases"
Attachments: final Hanford comment package-2nd proposed WAC 173-441 rule.pdf

Mr. Neil Caudill
Air Quality Program
State of Washington
Department of Ecology

Dear Neil,

Attached for your consideration, in accordance with Washington State Register (WSR) Item 10-18-047 (dated 9/15/2010), are comments on the proposed new Ecology rule establishing a greenhouse gas (GHG) emissions reporting program for the State of Washington. Mission Support Alliance, LLC (MSA), in consultation with the Department of Energy (DOE) and other Hanford Site contractors, is submitting these comments as DOE's integrating contractor on the Hanford Site. If it is determined the Hanford Site is subject to the proposed rule, MSA will have overall responsibility for developing and managing the Site's greenhouse gas reporting program.

We commend Ecology staff for their extensive efforts in developing a comprehensive proposal that addresses numerous and varied interests. This draft rule is a significant improvement over the previous proposal issued for public comment last year. Placement of mobile source reporting requirements on suppliers will greatly simplify the reporting burden, and movement of the first reporting year to 2012 will allow for adequate preparation of reporting systems. The incremental changes suggested by our comments should provide additional clarification and streamlining to help the regulated community maintain compliance with this rule.

You will note from our comments, however, that we are concerned that Ecology's desire to exactly "harmonize" its reporting rule with the EPA regulations in 40 CFR 98 results in certain rigorous and prescriptive requirements that may not be congruent with Ecology's desire to regulate facilities with GHG emissions that exceed a lower threshold. We believe there is room to remain consistent with the EPA reporting rule (a desirable outcome), while relaxing certain compliance burdens for those smaller sources that will only be subject to Ecology's GHG reporting rule and may not have sufficient resources to support this reporting program.

We look forward to receiving Ecology's responses to our comments. If you have questions or would like to discuss any of them further, please give me a call at the number below. Thanks.

Sincerely,

Tom Beam, Manager
Environmental Mission Integration
Mission Support Alliance, LLC
509-376-4876

PS. Reply confirmation of your receipt of these comments would be much appreciated. Thanks.

Hanford Site Comments—Proposed New WAC 173-441 Rule

Comment Number	Proposed Rule Section/Citation	Comment	Recommended Action(s)/ Requested Change(s) *(Proposed text additions; proposed text ~~deletions~~)*
Hanford-01	WAC 173-441-020(b)	The proposed definition of "carbon dioxide equivalents" differs from that included in 40 CFR 98.6 for the same term. It does not appear that the proposed alternate definition provides sufficient benefit to justify creating potential confusion by having two different definitions for the same term within related regulatory programs.	Revise the definition of "carbon dioxide equivalents" to match that included in 40 CFR 98.6 for the same term. Alternatively, if Ecology believes there is a benefit to using the proposed different definition, please explain why.
Hanford-02	WAC 173-441-020(f)	The definition of "Facility" includes a provision for operators of military installations to classify such installations as multiple sites for greenhouse gas emissions reporting purposes based on "distinct and independent functional groupings" within the installation. In response to informal questions previously posed to Ecology staff, it has been suggested that this provision may also be potentially applicable to other federal facilities, such as the Hanford Site.	Provide clarification and guidance concerning whether the provision for military installations is potentially applicable to other federal facilities (such as the Hanford Site). Such guidance should include specific criteria to be considered when determining if an installation or facility can be divided into multiple sites for purposes of greenhouse gas emissions reporting.
Hanford-03	WAC 173-441-040 Table A-1	This proposed table includes broad, undefined entries for "All other HFCs" and "All other PFCs" with no established global warming potential (GWP) values for purposes of converting emissions into CO_2e. The table indicates that Ecology should be contacted to obtain GWP values for any HFCs/PFCs that are not listed. If Ecology is aware of additional appropriate GHGs that have defined GWP values, then they should be specifically listed in the table individually. If Ecology later becomes aware of other HFCs/PFCs that warrant inclusion on the table, they can be added via a future rulemaking.	Revise Table A-1 to delete the rows for "All other HFCs" and "All other PFCs".
Hanford-04	WAC 173-441-050 (8) General	Although it is recognized the proposed rule language pertaining to calibration and accuracy requirements is taken directly from corresponding federal regulations in 40 CFR	Revise the proposed rule language so that facilities/reporters whose GHG emissions exceed 10,000 metric tons CO_2e, but fall below the EPA reporting threshold of 25,000 metric tons

rds or icy.
mis innual
revise
ous orters , but tons that 173-

Comment Number	Proposed Rule Section/Citation	Comment	Recommended Action(s)/ Requested Change(s) *(Proposed text additions; proposed text ~~deletions~~)*
		establish graded reporting and certification requirements that are more easily satisfied by smaller sources.	
Hanford-08	WAC 173-441-060(5)	The proposed rule language includes the text "as published on July 1, 2009" with respect to the requirements in 40 CFR 3.10. Review of the referenced federal regulations does not indicate any significance to the July 1, 2009 date that is relevant to this proposed Ecology rule. In addition, the July 1, 2009 date does not match the August 1, 2010 date used throughout the proposed rule with respect to incorporating federal regulations by reference.	Verify that the July 1, 2009 "incorporation by reference" dated reflected in the proposed text is accurate, and revise the proposed rule language, as appropriate.
Hanford-09	WAC 173-441-110(6)	The proposed rule language specifies that fee payment must be made within 30 days of receiving Ecology's billing statement. This timeframe is unreasonably short and the rule includes no provisions for a grace period before late fees may be invoked. The fee payment requirement should be more consistent with that imposed under the air operating permit program in WAC 173-401, which provides approximately 120 days for payment (invoice billing by October 31 with payment due by February 28) and a 90 day grace period before penalties begin accruing.	Revise the proposed rule language to specify a more reasonable timeframe for required payment of fees under the greenhouse gas reporting program and to provide for an established grace period before being subject to potential late fees.

W-10

Caudill, Neil (ECY)

From:	Cohen, Matthew [MCOHEN@stoel.com]
Sent:	Thursday, October 14, 2010 5:31 PM
To:	Caudill, Neil (ECY)
Cc:	Adair, Janice (ECY); bart.kale@nucor-seattle.com; Cohen, Matthew; Holmes, Frank; petewh@comcast.net; Curtis Lesslie; Gerald Brown
Subject:	Comments on WAC 173-441, GHG Reporting Rules
Attachments:	scan.pdf; Ecology September 2010 public comment draft of GHG reporting rules, with MC redline.DOCX

Neil, enclosed please find a short cover letter and proposed revisions to WAC ch. 173-441, submitted on behalf of Ash Grove Cement Company, Nucor Steel Seattle, Inc. and the Western States Petroleum Association.
Please call with any questions.

Matthew Cohen
STOEL RIVES LLP | 600 University Street, Suite 3600 | Seattle, WA 98101-4109
Direct: (206) 386-7569 | Mobile: (206) 714-1671 mcohen@stoel.com | www.stoel.com

<<scan.pdf>> <<Ecology September 2010 public comment draft of GHG reporting rules, with MC redline.DOCX>>

STOEL RIVES LLP
ATTORNEYS AT LAW

600 University Street, Suite 3600
Seattle, Washington 98101
main 206.624.0900
fax 206.386.7500
www.stoel.com

October 14, 2010

MATTHEW COHEN
Direct (206) 386-7569
mcohen@stoel.com

Mr. Neil Caudill
Air Quality Program
Washington Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600

Re: WAC ch. 173-441, Greenhouse Gas Reporting

Dear Mr. Caudill:

I am writing on behalf of Ash Grove Cement Company, Nucor Steel Seattle, Inc. and the Western States Petroleum Association (collectively, "the Coalition") to comment on the public comment draft of WAC ch. 173-441, Reporting of Emissions of Greenhouse Gases. With minor caveats the Coalition supports Ecology's proposal. We very much appreciate Ecology's efforts to structure Washington's reporting rule and deadlines to maintain consistency with EPA's GHG reporting rule. Your efforts will minimize the burden of having to report GHG emissions under two independent reporting schemes.

With this letter we enclose a redline of the proposed ch. 173-441. It includes suggested edits and footnotes that explain the need for each edit. Please call if I can provide any additional information in support of the changes proposed in the attached redline.

Very truly yours,

Matt Cohen

Matthew Cohen

Cc: Janice Adair

70334098.1 0009551-00001

Chapter 173-441 WAC

REPORTING OF EMISSIONS OF GREENHOUSE GASES

NEW SECTION

WAC 173-441-010 Scope. This rule establishes mandatory GHG reporting requirements for owners and operators of certain facilities that directly emit GHG as well as for certain suppliers of liquid motor vehicle fuel, special fuel, or aircraft fuel. For suppliers, the GHGs reported are the quantity that would be emitted from the complete combustion or oxidation of the products supplied.

[]

NEW SECTION

WAC 173-441-020 Definitions. The definitions in this section apply throughout this chapter unless the context clearly requires otherwise.

(1) **Definitions specific to this chapter:**

(a) "Biomass" means nonfossilized and biodegradable organic material originating from plants, animals, or microorganisms, including products, by-products, residues, and waste from agriculture, forestry, and related industries as well as the nonfossilized and biodegradable organic fractions of industrial and municipal wastes, including gases and liquids recovered from the decomposition of nonfossilized and biodegradable organic material.

(b) "Carbon dioxide equivalents" or "CO_2e" means a metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential.

(c) "Department of licensing" or "DOL" means the Washington state department of licensing.

(d) "Director" means the director of the department of ecology.

(e) "Ecology" means the Washington state department of ecology.

(f) "Facility" unless otherwise specified in any subpart of 40 C.F.R. Part 98 as effective on or proposed by August 1, 2010, 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.

(g) "Greenhouse gas," "greenhouse gases," "GHG," and "GHGs" includes carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Beginning on January 1, 2012, "greenhouse gas" also includes any other gas or gases designated by ecology by rule in Table A-1 in WAC 173-441-040.

(h) "Person" includes:

(i) An owner or operator, as those terms are defined by the United States Environmental Protection Agency in its mandatory greenhouse gas reporting regulation in 40 C.F.R. Part 98, as effective on August 1, 2010; and

(ii) A supplier.

(i) "Supplier" means any person who is:

(i) A motor vehicle fuel supplier or a motor vehicle fuel importer, as those terms are defined in RCW 82.36.010;

(ii) A special fuel supplier or a special fuel importer, as those terms are defined in RCW 82.38.020; or

(iii) A distributor of aircraft fuel, as the term is defined in RCW 82.42.010.

(2) **Definitions specific to suppliers.** Suppliers must use the definitions found in the following regulations unless the definition is in conflict with a definition found in subsection (1) of this section. These definitions do not apply to facilities.

(a) WAC 308-72-800;

(b) WAC 308-77-005; and

(c) WAC 308-78-010.

(3) **Definitions from 40 C.F.R. Part 98.** For those terms not listed in subsection (1) or (2) of this section, the definitions found in 40 C.F.R. ~~Part~~ 98.6, as effective on or proposed by August 1, 2010, are adopted by reference as modified in WAC 173-441-120(2).

(4) **Definitions from chapter 173-400 WAC.** If no definition is

provided in subsections (1) through (3) in this section, use the definition found in chapter 173-400 WAC.

[]

NEW SECTION

WAC 173-441-030 Applicability. The GHG reporting requirements and related monitoring, recordkeeping, and reporting requirements of this chapter apply to the owners and operators of any facility that meets the requirements of subsection (1) of this section; and any supplier that meets the requirements of subsection (2) of this section. In determining whether reporting is required, the requirements of subsection (1) must be applied independently of the requirements of subsection (2).

(1) **Facility reporting.** Reporting is mandatory for an owner or operator of any facility located in Washington state that emits ten thousand metric tons CO_2e or more per calendar year from all applicable source categories listed in WAC 173-441-120.[1] ~~with total GHG emissions that exceeds the reporting threshold. GHG emissions from all applicable source categories listed in WAC 173-441-120 at the facility must be included when determining whether emissions from the facility meet the reporting threshold.~~

[1] The edits proposed here are just "wordsmithing," but the redline offers two advantages. First, our proposed language more clearly states that only emissions from listed source categories count toward the reporting threshold. Second, the key sentence of the section no longer uses a term ("the reporting threshold") that is first defined in the following subsection.

~~(a) **Reporting threshold.** Any facility that emits ten thousand metric tons CO_2e or more per calendar year in total GHG emissions from all applicable source categories listed in WAC 173-441-120 exceeds the reporting threshold.~~

(~~b~~2) **Calculating facility emissions for comparison to the threshold.** To calculate GHG emissions for comparison to the reporting threshold, the owner or operator must:

(~~i~~a) Calculate the total annual emissions of each GHG in metric tons from all applicable source categories that are listed and defined in WAC 173-441-120. The GHG emissions must be calculated using the calculation methodologies specified in WAC 173-441-120 and available company records.

(~~ii~~b) Include emissions of all GHGs that are listed in Table A-1 of WAC 173-441-040, including all GHG emissions from the combustion of biomass and all fugitive releases of GHG emissions from biomass, calculated as provided in the calculation methods referenced in Table 120-1.

(~~iii~~c) Sum the emissions estimates for each GHG and calculate metric tons of CO_2e using Equation A-1 of this subsection.

$$CO_2e = \sum_{i=1}^{n} GHG_i \times GWP_i \quad (Eq. A-1)$$

Where:

CO_2e	=	Carbon dioxide equivalent, metric tons/year.
GHG_i	=	Mass emissions of each greenhouse gas listed in Table A-1 of WAC 173-441-040, metric tons/year.
GWP_i	=	Global warming potential for each greenhouse gas from Table A-1 of WAC 173-441-040.

n = The number of greenhouse gases emitted.

(~~iv~~d) Include in the emissions calculation any CO_2 that is captured for transfer off-site.

(~~v~~e) Research and development activities are not considered to be part of any source category defined in this chapter.

(~~2~~3) **Suppliers.** Reporting is mandatory for any supplier required to file periodic tax reports to DOL ~~and~~ that reports the sale in Washington state of one or more applicable fuels listed in WAC 173-441-130(1), the complete combustion or oxidation of which would result in aggregate calendar year emissions of carbon dioxide exceeding ten thousand metric tons.[2] ~~has total carbon dioxide emissions that exceed the reporting threshold.~~

~~(a) **Reporting threshold.** Any supplier that supplies applicable fuels that are reported to DOL as sold in Washington state of which the complete combustion or oxidation would result in total calendar year emissions of ten thousand metric tons or more of carbon dioxide exceeds the reporting threshold.~~

(~~b~~4) **Calculating supplier emissions for comparison to the threshold.** To calculate ~~GHG~~ CO_2 emissions for comparison to the reporting threshold, a supplier must:

(~~i~~a) Base its emissions on the applicable fuel quantities as established in WAC 173-441-130(1) and reported to DOL. A supplier must apply the mass in metric tons per year of CO_2 that would result from the complete combustion or oxidation of these fuels towards the reporting threshold.

[2] The edits proposed here have the same goal as those suggested in subsection (1).

(~~ii~~b) Calculate the total annual carbon dioxide emissions in metric tons from all applicable fuel quantities and fuel types as established in WAC 173-441-130(1) and reported to DOL. The ~~GHG~~ CO_2 emissions must be calculated using the calculation methodologies specified in WAC 173-441-130 and data reported to DOL.

(~~iii~~c) Only include emissions of carbon dioxide associated with the complete combustion or oxidation of the applicable fuels. Include all CO_2 emissions from the combustion of biomass fuels.

(~~iv~~d) Include in the emissions calculation any CO_2 that is captured for transfer off-site.

(~~v~~e) Research and development activities are not considered to be part of any source category defined in this chapter.

(~~3~~5) **Applicability over time.** A person that does not meet the applicability requirements of either subsection (1) or (~~2~~3) of this section is not subject to this rule. Such a person would become subject to the rule and the reporting requirements of this chapter if they exceed the applicability requirements of subsection (1) or (~~2~~3) of this section at a later time. Thus, persons should reevaluate the applicability ~~to~~of this chapter (including the revising of any relevant emissions calculations or other calculations) whenever there is any change that could cause a facility or supplier to meet the applicability requirements of subsection (1) or (~~2~~3) of this section. Such changes include, but are not limited to, process modifications, increases in operating hours, increases in production, changes in fuel or raw material use, addition of equipment, facility expansion, and changes to this chapter.

(~~4~~6) **Voluntary reporting.** A person may choose to voluntarily report to ecology GHG emissions that are not required to be reported under subsection (1) or (~~2~~3) of this section. Persons voluntarily reporting GHG emissions must use the methods established in WAC 173-441-120(3) and 173-441-130 to calculate any voluntarily reported GHG emissions.

(~~5~~7) **Reporting requirements when emissions of greenhouse gases fall below reporting thresholds.** Except as provided in this subsection, once a facility or supplier is subject to the requirements of this chapter, the person must continue for each year thereafter to comply with all requirements of this chapter, including the requirement to submit annual GHG reports, even if the facility or supplier does not meet the applicability requirements in subsection (1) or (~~2~~3) of this section in a future year.

(a) If reported emissions are less than the reporting thresholds in subsection (1) or (3)[3]~~ten thousand metric tons CO_2e per year~~ for five consecutive years, then the person may discontinue reporting under~~complying with~~ this chapter provided that the person submits a notification to ecology that announces the cessation of reporting and explains the reasons for the reduction in emissions. The notification shall be submitted no later than March 31st of the year immediately following the fifth consecutive year of emissions less than the applicable reporting threshold~~ten thousand tons CO_2e per year~~. The person must maintain the corresponding records required under WAC 173-441-050(6) for each of the five consecutive years and

[3] The reporting thresholds are different for suppliers and facilities, in that only CO2 emissions count for suppliers. The proposed edits to paragraphs (a) and (b) apply the requirements of this subsection to both suppliers and facilities.

retain such records for three years following the year that reporting was discontinued. The person must resume reporting if annual emissions in any future calendar year increase above the thresholds in subsection (1) or (~~2~~3) of this section.

(b) If reported emissions are less than 50 percent of the reporting thresholds in subsections (1) or (3) ~~five thousand metric tons CO_2e per year~~ for three consecutive years, then the person may discontinue complying with this chapter provided that the person submits a notification to ecology that announces the cessation of reporting and explains the reasons for the reduction in emissions. The notification shall be submitted no later than March 31st of the year immediately following the third consecutive year of emissions less than 50 percent of the applicable reporting threshold~~five thousand tons CO_2e per year~~. The person must maintain the corresponding records required under WAC 173-441-050(6) for each of the three consecutive years and retain such records for three years following the year that reporting was discontinued. The person must resume reporting if annual emissions in any future calendar year increase above the thresholds in subsection (1) or (~~2~~3) of this section.

(c) If the operations of a facility or supplier are changed such that all applicable GHG-emitting processes and operations listed in WAC 173-441-120 and 173-441-130 cease to operate, then the person is exempt from reporting in the years following the year in which cessation of such operations occurs, provided that the person submits a notification to ecology that announces the cessation of reporting and certifies to the closure of all GHG-emitting processes and operations. This provision does not apply to seasonal or other temporary cessation of operations. This provision does not apply to facilities with municipal solid waste landfills. The person must resume reporting for any future calendar year during which any of the GHG-emitting processes or operations resume operation.

[]

NEW SECTION

WAC 173-441-040 Greenhouse gases. (1) **Greenhouse gases.** Table A-1 of this section lists the GHGs regulated under this chapter and their global warming potentials.

(2) **CO_2e conversion.** Use Equation A-1 of WAC 173-441-030 (1)(b)(iii) and the global warming potentials listed in Table A-1 of this section to convert emissions into CO_2e.

Table A-1:

Global Warming Potentials (100-Year Time Horizon)

Name	CAS No.	Chemical Formula	Global Warming Potential (100 yr.)
Carbon dioxide	124-38-9	CO_2	1
Methane	74-82-8	CH_4	21
Nitrous oxide	10024-97-2	N_2O	310
HFC-23	75-46-7	CHF_3	11,700
HFC-32	75-10-5	CH_2F_2	650
HFC-41	593-53-3	CH_3F	150

HFC-125	354-33-6	C_2HF_5	2,800
HFC-134	359-35-3	$C_2H_2F_4$	1,000
HFC-134a	811-97-2	CH_2FCF_3	1,300
HFC-143	430-66-0	$C_2H_3F_3$	300
HFC-143a	420-46-2	$C_2H_3F_3$	3,800
HFC-152	624-72-6	CH_2FCH_2F	53
HFC-152a	75-37-6	CH_3CHF_2	140
HFC-161	353-36-6	CH_3CH_2F	12
HFC-227ea	431-89-0	C_3HF_7	2,900
HFC-236cb	677-56-5	$CH_2FCF_2CF_3$	1,340
HFC-236ea	431-63-0	CHF_2CHFCF_3	1,370
HFC-236fa	690-39-1	$C_3H_2F_6$	6,300
HFC-245ca	679-86-7	$C_3H_3F_5$	560
HFC-245fa	460-73-1	$CHF_2CH_2CF_3$	1,030
HFC-365mfc	406-58-6	$CH_3CF_2CH_2CF_3$	794
HFC-43-10mee	138495-42-8	$CF_3CFHCFHCF_2CF_3$	1,300
All other HFCs	NA	NA	Contact ecology
Sulfur hexafluoride	2551-62-4	SF_6	23,900
Trifluoromethyl sulphur pentafluoride	373-80-8	SF_5CF_3	17,700
Nitrogen trifluoride	7783-54-2	NF_3	17,200
PFC-14 (Perfluoromethane)	75-73-0	CF_4	6,500
PFC-116 (Perfluoroethane)	76-16-4	C_2F_6	9,200
PFC-218 (Perfluoropropane)	76-19-7	C_3F_8	7,000
Perfluorocyclopropane	931-91-9	$C\text{-}C_3F_6$	17,340
PFC-3-1-10 (Perfluorobutane)	355-25-9	C_4F_{10}	7,000
Perfluorocyclobutane	115-25-3	$C\text{-}C_4F_8$	8,700
PFC-4-1-12 (Perfluoropentane)	678-26-2	C_5F_{12}	7,500
PFC-5-1-14 (Perfluorohexane)	355-42-0	C_6F_{14}	7,400
PFC-9-1-18	306-94-5	$C_{10}F_{18}$	7,500
All other PFCs	NA	NA	Contact ecology
HCFE-235da2 (Isoflurane)	26675-46-7	$CHF_2OCHClCF_3$	350

HFE-43-10pccc (H-Galden 1040x)	E1730133	$CHF_2OCF_2OC_2F_4OCHF_2$	1,870
HFE-125	3822-68-2	CHF_2OCF_3	14,900
HFE-134	1691-17-4	CHF_2OCHF_2	6,320
HFE-143a	421-14-7	CH_3OCF_3	756
HFE-227ea	2356-62-9	$CF_3CHFOCF_3$	1,540
HFE-236ca12 (HG-10)	78522-47-1	$CHF_2OCF_2OCHF_2$	2,800
HFE-236ea2 (Desflurane)	57041-67-5	$CHF_2OCHFCF_3$	989
HFE-236fa	20193-67-3	$CF_3CH_2OCF_3$	487
HFE-245cb2	22410-44-2	$CH_3OCF_2CF_3$	708
HFE-245fa1	84011-15-4	$CHF_2CH_2OCF_3$	286
HFE-245fa2	1885-48-9	$CHF_2OCH_2CF_3$	659
HFE-254cb2	425-88-7	$CH_3OCF_2CHF_2$	359
HFE-263fb2	460-43-5	$CF_3CH_2OCH_3$	11
HFE-329mcc2	67490-36-2	$CF_3CF_2OCF_2CHF_2$	919
HFE-338mcf2	156053-88-2	$CF_3CF_2OCH_2CF_3$	552
HFE-338pcc13 (HG-01)	188690-78-0	$CHF_2OCF_2CF_2OCHF_2$	1,500
HFE-347mcc3	28523-86-6	$CH_3OCF_2CF_2CF_3$	575
HFE-347mcf2	E1730135	$CF_3CF_2OCH_2CHF_2$	374
HFE-347pcf2	406-78-0	$CHF_2CF_2OCH_2CF_3$	580
HFE-356mec3	382-34-3	$CH_3OCF_2CHFCF_3$	101
HFE-356pcc3	160620-20-2	$CH_3OCF_2CF_2CHF_2$	110
HFE-356pcf2	E1730137	$CHF_2CH_2OCF_2CHF_2$	265
HFE-356pcf3	35042-99-0	$CHF_2OCH_2CF_2CHF_2$	502
HFE-365mcf3	378-16-5	$CF_3CF_2CH_2OCH_3$	11
HFE-374pc2	512-51-6	$CH_3CH_2OCF_2CHF_2$	557
HFE-449sl (HFE-7100) Chemical blend	163702-07-6 163702-08-7	$C_4F_9OCH_3$ $(CF_3)_2CFCF_2OCH_3$	297
HFE-569sf2 (HFE-7200) Chemical blend	163702-05-4 163702-06-5	$C_4F_9OC_2H_5$ $(CF_3)_2CFCF_2OC_2H_5$	59
Sevoflurane	28523-86-6	$CH_2FOCH(CF_3)_2$	345
HFE-356mm1	13171-18-1	$(CF_3)_2CHOCH_3$	27
HFE-338mmz1	26103-08-2	$CHF_2OCH(CF_3)_2$	380
(Octafluorotetramethy-lene) hydroxymethyl group	NA	$X-(CF_2)_4CH(OH)-X$	73

HFE-347mmy1	22052-84-2	$CH_3OCF(CF_3)_2$	343
Bis(trifluoromethyl)-methanol	920-66-1	$(CF_3)_2CHOH$	195
2,2,3,3,3-pentafluoropropanol	422-05-9	$CF_3CF_2CH_2OH$	42
PFPMIE	NA	$CF_3OCF(CF_3)CF_2OCF_2OCF_3$	10,300

NA = not available.

[]

NEW SECTION

WAC 173-441-050 General monitoring, reporting, recordkeeping and verification requirements. Persons subject to the requirements of this chapter must submit GHG reports to ecology, as specified in this section.

(1) **General.** Follow the procedures for emission calculation, monitoring, quality assurance, missing data, recordkeeping, and reporting that are specified in each relevant section of this chapter.

(2) **Schedule.** The annual GHG report must be submitted as follows:

(a) Report submission due date:

(i) A person required to report GHG emissions to the United States Environmental Protection Agency under 40 C.F.R. Part 98 must submit the report required under this chapter to ecology no later than March 31st of each calendar year for GHG emissions in the previous calendar year.

(ii) A person not required to report GHG emissions to the United States Environmental Protection Agency under 40 C.F.R. Part 98 must submit the report required under this chapter to ecology no later than October 31st of each calendar year for GHG emissions in the previous calendar year.

(b) Reporting requirements begin:

(i) For an existing facility or supplier that began operation before January 1, 2012, report emissions for calendar year 2012 and each subsequent calendar year.

(ii) For a new facility or supplier that begins operation on or after January 1, 2012, report emissions beginning with the first operating month and ending on December 31st of that year. Each subsequent annual report must cover emissions for the calendar year, beginning on January 1st and ending on December 31st.

(iii) For any facility or supplier that becomes subject to this rule because of a physical or operational change that is made after January 1, 2012, report emissions for the first calendar year in which the change occurs.

(A) Facilities begin reporting with the first month of the change and ending on December 31st of that year. For a facility that becomes subject to this rule solely because of an increase in hours of operation or level of production, the first month of the change is the month in which the increased hours of operation or level of production, if maintained for the remainder of the year, would cause the facility or supplier to exceed the applicable threshold.

(B) Suppliers begin reporting January 1st and ending on December

31st the year of the change.

(C) For both facilities and suppliers, each subsequent annual report must cover emissions for the calendar year, beginning on January 1st and ending on December 31st.

(3) **Content of the annual report.** Each annual GHG report shall contain the following information:

(a) Facility name or supplier name (as appropriate), facility or supplier ID number, and physical street address of the facility or supplier, including the city, state, and zip code.

(b) Year and months covered by the report.

(c) Date of submittal.

(d) For facilities,[4] report annual emissions of each GHG (as defined in WAC 173-441-020) as follows:

(i) Annual emissions (including biogenic CO_2) aggregated for all GHGs from all applicable source categories in WAC 173-441-120 and expressed in metric tons of CO_2e calculated using Equation A-1 of WAC 173-441-030 (1)(b)(iii).

(ii) Annual emissions of biogenic CO_2 aggregated for all applicable source categories in WAC 173-441-120 in metric tons. Units that use the methodologies in 40 C.F.R. Part 75 to calculate CO_2 mass emissions are not required to separately report biogenic CO_2 emissions, but may do so as an option.

(iii) Annual emissions from each applicable source category in WAC 173-441-120, expressed in metric tons of each applicable GHG listed in subsections (3)(d)(iii)(A) through (E) of this section.

[4] It would be a good idea to first list all requirements that apply to every reporting entity, then list the special reporting requirements for suppliers and facilities. It is not clear that subsections (f), (g) etc. apply to all reporters, and not just suppliers.

(A) Biogenic CO_2. Units that use the methodologies in 40 C.F.R. Part 75 to calculate CO_2 mass emissions are not required to separately report biogenic CO_2 emissions, but may do so as an option.

(B) CO_2 (including biogenic CO_2).

(C) CH_4.

(D) N_2O.

(E) Each fluorinated GHG.

(iv) Emissions and other data for individual units, processes, activities, and operations as specified in the "data reporting requirements" section of each applicable source category referenced in WAC 173-441-120.

(v) Indicate whether reported emissions from the facility include emissions from a cogeneration unit (yes or no).

(e) For suppliers, report the following information:

(i) Annual emissions of CO_2, expressed in metric tons of CO_2, as required in subsections (3)(e)(i)(A) and (B) of this section that would be emitted from the complete combustion or oxidation of the fuels reported to DOL as sold in Washington state during the calendar year.

(A) ~~Aggregate b~~Biogenic CO_2.

(B) Aggregate CO_2 (including nonbiogenic and biogenic CO_2).

(ii) All contact information reported to DOL not included in (a) of this subsection.

(f) A written explanation, as required under subsection (4) of this section, if you change emission calculation methodologies during the reporting period.

(g) Each data element for which a missing data procedure was used according to the procedures of an applicable subpart referenced in WAC 173-441-120 and the total number of hours in the year that a missing data procedure was used for each data element.

(h) A signed and dated certification statement provided by the designated representative of the owner or operator, according to the requirements of WAC 173-441-060 (5)(a).

(i) NAICS code(s) that apply to the facility or supplier.[5]

(i) Primary NAICS code. Report the NAICS code(s) that most accurately describe the reporting entity's ~~the~~ primary product/activity/service ~~at the facility, based on revenue~~. The primary product/activity/service ~~at the facility provides economic profit and~~ is the principal source of revenue for the reporting entity. A reporting entity that has two distinct products/activities/services providing comparable revenues may report a second primary NAICS code.

(ii) Additional NAICS code(s). Report all additional NAICS codes that describe all product(s)/activity(s)/service(s) at the reporting entity ~~correspond to product(s)/activity(s)/service(s) at the facility that provide economic profit, but~~ that are not related to the principal source of revenue. ~~If more than one additional NAICS code applies, list the additional NAICS codes in the order of the largest revenue to the smallest.~~

(j) Legal name(s) and physical address(es) of the highest-level United States parent company(s) of the reporting entity and the

[5] Subsections (i) and (j) include a series of deviations from the text of 40 CFR 98.3(10) and (11), as published in the 9/22/10 Federal Register, that change the meaning of the reporting requirements. For instance, paragraph (i)(i) of Ecology's proposed rule states that the primary product/activity/service at a facility "provides economic profit." This language does not come from the EPA rule, changes the meaning of the EPA rule, and is not based on SSB 6373. The Coalition urges Ecology to incorporate the language from 40 CFR 98.3(10) exactly as adopted by EPA.

percentage of ownership interest for each listed parent company as of December 31st of the year for which data are being reported according to the following instructions:~~reporting year.~~

~~(i) For reporting the United States parent company(s) and their percentage(s) of ownership interest, follow these instructions:~~

(A) If the reporting entity is entirely owned by a single United States company that is not owned by another company, provide that company's legal name and physical address as the United States parent company and report one hundred percent ownership.

(B) If the reporting entity is entirely owned by a single United States company that is, itself, owned by another company (e.g., it is a division or subsidiary of a higher-level company), provide the legal name and physical address of the highest-level company in the ownership hierarchy as the United States parent company and report one hundred percent ownership.

(C) If the reporting entity is owned by more than one United States company (e.g., company A owns forty percent, company B owns thirty-five percent, and company C owns twenty-five percent), provide the legal names and physical addresses of all the highest level companies with an ownership interest as the United States parent companies and report the percent ownership of each company.

(D) If the reporting entity is owned by a joint venture or a cooperative, the joint venture or cooperative is its own United States parent company. Provide the legal name and physical address of the joint venture or cooperative as the United States parent company, and report one hundred percent ownership by the joint venture or cooperative.

(E) If the reporting entity is entirely owned by a foreign company, provide the legal name and physical address of the foreign company's highest-level company based in the United States as the United States parent company, and report one hundred percent ownership.

(F) If the reporting entity is partially owned by a foreign company and partially owned by one or more U.S. companies, provide the legal name and physical address of the foreign company's highest-level company based in the United States, along with the legal names and physical addresses of the other U.S. parent companies~~all the other companies with an ownership interest, as United States parent companies~~, and report the percent ownership of each of these companies.

(G) If the reporting entity is~~you are reporting for~~ a federally owned facility, report "U.S. Government" and do not report physical address or percent ownership.

~~(ii) Reserved.~~

(4) **Emission calculations.** In preparing the GHG report, you must use the calculation methodologies specified in the relevant sections of this chapter. For each source category, you must use the same calculation methodology throughout a reporting period unless you provide a written explanation of why a change in methodology was required.

(5) **Verification.** To verify the completeness and accuracy of reported GHG emissions, ecology may review the certification statements described in subsection (3)(h) of this section and any other credible evidence, in conjunction with a comprehensive review

of the GHG reports and periodic audits of selected reporting facilities. Nothing in this section prohibits ecology from using additional information to verify the completeness and accuracy of the reports.

(6) **Recordkeeping.** A person that reports GHGs under this chapter must keep records as specified in this subsection. For suppliers, substitute CO_2 for every reference in this subsection to GHGs. Retain all required records for at least three years. The records shall be kept in an electronic or hard copy format (as appropriate) and recorded in a form that is suitable for expeditious inspection and review. Upon request by ecology, the records required under this section must be made available to ecology. Records may be retained off-site if the records are readily available for expeditious inspection and review. For records that are electronically generated or maintained, the equipment or software necessary to read the records shall be made available, or, if requested by ecology, electronic records shall be converted to paper documents. You must retain the following records, in addition to those records prescribed in each applicable section of this chapter:

(a) A list of all units, operations, processes, and activities for which GHG emissions were calculated.

(b) The data used to calculate the GHG emissions for each unit, operation, process, and activity, categorized by fuel or material type. These data include, but are not limited to, the following information:

(i) The GHG emissions calculations and methods used.

(ii) Analytical results for the development of site-specific

Formatted: Subscript

emissions factors.

(iii) The results of all required analyses for high heat value, carbon content, and other required fuel or feedstock parameters.

(iv) Any facility operating data or process information used for the GHG emission calculations.

(c) The annual GHG reports.

(d) Missing data computations. For each missing data event, also retain a record of the cause of the event and the corrective actions taken to restore malfunctioning monitoring equipment.

(e) Owners or operators required to report under WAC 173-441-030(1) must keep a written GHG monitoring plan.

(i) At a minimum, the GHG monitoring plan shall include the following elements:

(A) Identification of positions of responsibility (i.e., job titles) for collection of the emissions data.

(B) Explanation of the processes and methods used to collect the necessary data for the GHG calculations.

(C) Description of the procedures and methods that are used for quality assurance, maintenance, and repair of all continuous monitoring systems, flow meters, and other instrumentation used to provide data for the GHGs reported under this chapter.

(ii) The GHG monitoring plan may rely on references to existing corporate documents (e.g., standard operating procedures, quality assurance programs under appendix F to 40 C.F.R. Part 60 or appendix B to 40 C.F.R. Part 75, and other documents) provided that the elements required by (e)(i) of this subsection are easily recognizable.

(iii) The owner or operator shall revise the GHG monitoring plan as needed to reflect changes in production processes, monitoring instrumentation, and quality assurance procedures; or to improve procedures for the maintenance and repair of monitoring systems to reduce the frequency of monitoring equipment downtime.

(iv) Upon request by ecology, the owner or operator shall make all information that is collected in conformance with the GHG monitoring plan available for review during an audit. Electronic storage of the information in the plan is permissible, provided that the information can be made available in hard copy upon request during an audit.

(f) The results of all required certification and quality assurance tests of continuous monitoring systems, fuel flow meters, and other instrumentation used to provide data for the GHGs reported under this chapter.

(g) Maintenance records for all continuous monitoring systems, flow meters, and other instrumentation used to provide data for the GHGs reported under this chapter.

(h) Suppliers must retain any other data specified in WAC 173-441-130(5).

(7) **Annual GHG report revisions.**

(a) A person shall submit a revised annual GHG report within forty-five days of discovering that an annual GHG report that the person previously submitted contains one or more substantive errors. The revised report must correct all substantive errors.

(b) Ecology may notify the person in writing that an annual GHG report previously submitted by the person contains one or more substantive errors. Such notification will identify each such substantive error. The person shall, within forty-five days of receipt of the notification, either resubmit the report that, for each identified substantive error, corrects the identified substantive error (in accordance with the applicable requirements of this chapter) or provide information demonstrating that the previously submitted report does not contain the identified substantive error or that the identified error is not a substantive error.

(c) A substantive error is an error that impacts the quantity of GHG emissions reported or otherwise prevents the reported data from being validated or verified.

(d) Notwithstanding (a) and (b) of this subsection, upon request by a person, ecology may provide reasonable extensions of the forty-five day period for submission of the revised report or information under (a) and (b) of this subsection. If ecology receives a request for extension of the forty-five day period, by e-mail to an address prescribed by ecology, at least two business days prior to the expiration of the forty-five day period, and ecology does not respond to the request by the end of such period, the extension request is deemed to be automatically granted for thirty more days. During the automatic thirty-day extension, ecology will determine what extension, if any, beyond the automatic extension is reasonable and will provide any such additional extension.

(e) The owner or operator shall retain documentation for three years to support any revision made to an annual GHG report.

(8) **Calibration and accuracy requirements.** The owner or

operator of a facility that is subject to the requirements of this chapter must meet the applicable flow meter calibration and accuracy requirements of this subsection. The accuracy specifications in this subsection do not apply where either the use of company records (as defined in WAC 173-441-020(3)) or the use of "best available information" is specified in an applicable subsection of this chapter to quantify fuel usage and/or other parameters. Further, the provisions of this subsection do not apply to stationary fuel combustion units that use the methodologies in 40 C.F.R. Part 75 to calculate CO_2 mass emissions. Suppliers subject to the requirements of this chapter must meet the calibration accuracy requirements in chapters 308-72, 308-77, and 308-78 WAC.

(a) Except as otherwise provided in (d) through (f) of this subsection, flow meters that measure liquid and gaseous fuel feed rates, process stream flow rates, or feedstock flow rates and provide data for the GHG emissions calculations, shall be calibrated prior to January 1, 2012, using the procedures specified in this subsection when such calibration is specified in a relevant section of this chapter. Each of these flow meters shall meet the applicable accuracy specification in (b) or (c) of this subsection. All other measurement devices (e.g., weighing devices) that are required by a relevant subsection of this chapter, and that are used to provide data for the GHG emissions calculations, shall also be calibrated prior to January 1, 2012; however, the accuracy specifications in (b) and (c) of this subsection do not apply to these devices. Rather, each of these measurement devices shall be calibrated to meet the accuracy requirement specified for the device in the applicable subsection of this chapter, or, in the absence of such accuracy requirement, the device must be calibrated to an accuracy within the appropriate error range for the specific measurement technology, based on an applicable operating standard including, but not limited to, industry standards and manufacturer's specifications. The procedures and methods used to quality-assure the data from each measurement device shall be documented in the written monitoring plan, pursuant to subsection (6)(e)(i)(C) of this section.

(i) All flow meters and other measurement devices that are subject to the provisions of this subsection must be calibrated according to one of the following: You may use the manufacturer's recommended procedures; an appropriate industry consensus standard method; or a method specified in a relevant section of this chapter. The calibration method(s) used shall be documented in the monitoring plan required under subsection (6)(e) of this section.

(ii) For facilities and suppliers that become subject to this chapter after January 1, 2012, all flow meters and other measurement devices (if any) that are required by the relevant subsection(s) of this chapter to provide data for the GHG emissions calculations shall be installed no later than the date on which data collection is required to begin using the measurement device, and the initial calibration(s) required by this subsection (if any) shall be performed no later than that date.

(iii) Except as otherwise provided in (d) through (f) of this subsection, subsequent recalibrations of the flow meters and other measurement devices subject to the requirements of this subsection shall be performed at one of the following frequencies:

(A) You may use the frequency specified in each applicable subsection of this chapter.

(B) You may use the frequency recommended by the manufacturer or by an industry consensus standard practice, if no recalibration frequency is specified in an applicable subsection.

(b) Perform all flow meter calibration at measurement points that are representative of the normal operating range of the meter. Except for the orifice, nozzle, and venturi flow meters described in (c) of this subsection, calculate the calibration error at each measurement point using Equation A-2 of this subsection. The terms "R" and "A" in Equation A-2 must be expressed in consistent units of measure (e.g., gallons/minute, ft^3/min). The calibration error at each measurement point shall not exceed 5.0 percent of the reference value.

$$CE = \frac{|R-A|}{R} \times 100 \qquad \text{(Eq. A-2)}$$

Where:

CE = Calibration error (%)

R = Reference value

A = Flow meter response to the reference value

(c) For orifice, nozzle, and venturi flow meters, the initial quality assurance consists of in situ calibration of the differential pressure (delta-P), total pressure, and temperature transmitters.

(i) Calibrate each transmitter at a zero point and at least one upscale point. Fixed reference points, such as the freezing point of water, may be used for temperature transmitter calibrations.

Calculate the calibration error of each transmitter at each measurement point, using Equation A-3 of this subsection. The terms "R", "A", and "FS" in Equation A-3 of this subsection must be in consistent units of measure (e.g., milliamperes, inches of water, psi, degrees). For each transmitter, the CE value at each measurement point shall not exceed 2.0 percent of full-scale. Alternatively, the results are acceptable if the sum of the calculated CE values for the three transmitters at each calibration level (i.e., at the zero level and at each upscale level) does not exceed 6.0 percent.

$$CE = \frac{|R-A|}{FS} \times 100 \qquad \text{(Eq. A-3)}$$

Where:

CE = Calibration error (%)

R = Reference value

A = Transmitter response to the reference value

FS = Full-scale value of the transmitter

(ii) In cases where there are only two transmitters (i.e., differential pressure and either temperature or total pressure) in the immediate vicinity of the flow meter's primary element (e.g., the orifice plate), or when there is only a differential pressure transmitter in close proximity to the primary element, calibration of these existing transmitters to a CE of 2.0 percent or less at each measurement point is still required, in accordance with (c)(i) of this subsection; alternatively, when two transmitters are calibrated, the results are acceptable if the sum of the CE values for the two transmitters at each calibration level does not exceed 4.0 percent. However, note that installation and calibration of an additional transmitter (or transmitters) at the flow monitor location to measure temperature or total pressure or both is not required in these cases. Instead, you may use assumed values for temperature and/or total pressure, based on measurements of these parameters at a remote location (or locations), provided that the following conditions are met:

(A) You must demonstrate that measurements at the remote location(s) can, when appropriate correction factors are applied, reliably and accurately represent the actual temperature or total pressure at the flow meter under all expected ambient conditions.

(B) You must make all temperature and/or total pressure measurements in the demonstration described in (c)(ii)(A) of this subsection with calibrated gauges, sensors, transmitters, or other appropriate measurement devices. At a minimum, calibrate each of these devices to an accuracy within the appropriate error range for the specific measurement technology, according to one of the following: You may calibrate using an industry consensus standards or a manufacturer's specification.

(C) You must document the methods used for the demonstration described in (c)(ii)(A) of this subsection in the written monitoring plan under subsection (6)(e)(i)(C) of this section. You must also include the data from the demonstration, the mathematical correlation(s) between the remote readings and actual flow meter conditions derived from the data, and any supporting engineering calculations in the monitoring plan. You must maintain all of this information in a format suitable for auditing and inspection.

(D) You must use the mathematical correlation(s) derived from the demonstration described in (c)(ii)(A) of this subsection to convert the remote temperature or the total pressure readings, or both, to the actual temperature or total pressure at the flow meter, or both, on a daily basis. You shall then use the actual temperature and total pressure values to correct the measured flow rates to standard conditions.

(E) You shall periodically check the correlation(s) between the remote and actual readings (at least once a year), and make any necessary adjustments to the mathematical relationship(s).

(d) Fuel billing meters are exempted from the calibration requirements of this section and from the monitoring plan and recordkeeping provisions of subsections (6)(e)(i)(C) and (g) of this section, provided that the fuel supplier and any unit combusting the fuel do not have any common owners and are not owned by subsidiaries or affiliates of the same company. Meters used exclusively to measure the flow rates of fuels that are used for unit startup or ignition are also exempted from the calibration requirements of this section.

(e) For a flow meter that has been previously calibrated in accordance with (a) of this subsection, an additional calibration is not required by the date specified in (a) of this subsection if, as of that date, the previous calibration is still active (i.e., the device is not yet due for recalibration because the time interval between successive calibrations has not elapsed). In this case, the deadline for the successive calibrations of the flow meter shall be set according to one of the following: You may use either the manufacturer's recommended calibration schedule or you may use the industry consensus calibration schedule.

(f) For units and processes that operate continuously with infrequent outages, it may not be possible to meet the deadline established in (a) of this subsection for the initial calibration of a flow meter or other measurement device without disrupting normal process operation. In such cases, the owner or operator may postpone the initial calibration until the next scheduled maintenance outage. The best available information from company records may be used in the interim. The subsequent required recalibrations of the flow meters may be similarly postponed. Such postponements shall be documented in the monitoring plan that is required under subsection (6)(e) of this section.

(g) If the results of an initial calibration or a recalibration fail to meet the required accuracy specification, data from the flow meter shall be considered invalid, beginning with the hour of the failed calibration and continuing until a successful calibration is completed. You shall follow the missing data provisions provided in the relevant missing data sections during the period of data invalidation.

(9) **Measurement device installation.**[6] 40 C.F.R. ~~Part~~ 98.3(j) ~~and 40 C.F.R. Part 98.3(d)~~ as ~~effective on or~~ proposed by August 11, 2010 ~~are~~is adopted by reference as modified in WAC 173-441-120(2).

[]

[6] 40 CFR 98.3(j) was first proposed in the August 11, 2010 Federal Register. It was proposed as a new subsection, not an amendment to an existing subsection (j). 40 CFR 98.3(d) consists of special reporting rules for calendar year 2010. Ecology should not adopt subsection (d).

NEW SECTION

WAC 173-441-060 Authorization and responsibilities of the designated representative. (1) **General.** Except as provided under subsection (6) of this section, each facility, and each supplier, that is subject to this chapter, shall have one and only one designated representative, who shall be responsible for certifying, signing, and submitting GHG emissions reports and any other submissions for such facility and supplier respectively to ecology under this chapter. If the facility is required to submit an emission report to EPA under 40 C.F.R. Part 98, the designated representative responsible for certifying, signing, and submitting the GHG emissions reports and all such other emissions reports to EPA shall be the designated representative responsible for certifying, signing, and submitting GHG emissions reports to ecology under this chapter.

(2) **Authorization of a designated representative.** The designated representative of the facility or supplier shall be an individual selected by an agreement binding on the owners and operators of such facility or supplier and shall act in accordance with the certification statement in subsection (9)(d)(iv) of this section.

(3) **Responsibility of the designated representative.** Upon receipt by ecology of a complete certificate of representation under

this section for a facility or supplier, the designated representative identified in such certificate of representation shall represent and, by his or her representations, actions, inactions, or submissions, legally bind each owner and operator of such facility or supplier in all matters pertaining to this chapter, notwithstanding any agreement between the designated representative and such owners and operators. The owners and operators shall be bound by any decision or order issued to the designated representative by ecology, pollution control hearings board, or a court.

(4) **Timing.** No GHG emissions report or other submissions under this chapter for a facility or supplier will be accepted until ecology has received a complete certificate of representation under this section for a designated representative of the facility or supplier. Such certificate of representation shall be submitted at least sixty days before the deadline for submission of the facility's or supplier's initial emission report under this chapter.

(5) **Certification of the GHG emissions report.** Each GHG emission report and any other submission under this chapter for a facility or supplier shall be certified, signed, and submitted by the designated representative or any alternate designated representative of the facility or supplier in accordance with this section and 40 C.F.R. ~~Part~~ 3.10 as adopted~~published~~ on July 1, 2009.

(a) Each such submission shall include the following certification statement signed by the designated representative or any alternate designated representative: "I am authorized to make this submission on behalf of the owners and operators of the facility or supplier, as applicable, for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment."

(b) Ecology will accept a GHG emission report or other submission for a facility or supplier under this chapter only if the submission is certified, signed, and submitted in accordance with this section.

(6) **Alternate designated representative.** A certificate of representation under this section for a facility or supplier may designate one alternate designated representative, who shall be an individual selected by an agreement binding on the owners and operators, and may act on behalf of the designated representative, of such facility or supplier. The agreement by which the alternate designated representative is selected shall include a procedure for authorizing the alternate designated representative to act in lieu of the designated representative.

(a) Upon receipt by ecology of a complete certificate of representation under this section for a facility or supplier identifying an alternate designated representative:

(i) The alternate designated representative may act on behalf of the designated representative for such facility or supplier.

(ii) Any representation, action, inaction, or submission by the alternate designated representative shall be deemed to be a representation, action, inaction, or submission by the designated representative.

(b) Except in this section, whenever the term "designated representative" is used in this chapter, the term shall be construed to include the designated representative or any alternate designated representative.

(7) **Changing a designated representative or alternate designated representative.** The designated representative or alternate designated representative identified in a complete certificate of representation under this section for a facility or supplier received by ecology may be changed at any time upon receipt by ecology of another later signed, complete certificate of representation under this section for the facility or supplier. Notwithstanding any such change, all representations, actions, inactions, and submissions by the previous designated representative or the previous alternate designated representative of the facility or supplier before the time and date when ecology receives such later signed certificate of representation shall be binding on the new designated representative and the owners and operators of the facility or supplier.

(8) **Changes in owners and operators.** In the event an owner or operator of the facility or supplier is not included in the list of owners and operators in the certificate of representation under this section for the facility or supplier, such owner or operator shall

be deemed to be subject to and bound by the certificate of representation, the representations, actions, inactions, and submissions of the designated representative and any alternate designated representative of the facility or supplier, as if the owner or operator were included in such list. Within ninety days after any change in the owners and operators of the facility or supplier (including the addition of a new owner or operator), the designated representative or any alternate designated representative shall submit a certificate of representation that is complete under this section except that such list shall be amended to reflect the change. If the designated representative or alternate designated representative determines at any time that an owner or operator of the facility or supplier is not included in such list and such exclusion is not the result of a change in the owners and operators, the designated representative or any alternate designated representative shall submit, within ninety days of making such determination, a certificate of representation that is complete under this section except that such list shall be amended to include such owner or operator.

(9) **Certificate of representation.** A certificate of representation shall be complete if it includes the following elements in a format prescribed by ecology in accordance with this section:

(a) Identification of the facility or supplier for which the certificate of representation is submitted.

(b) The name, organization name (company affiliation-employer), address, e-mail address (if any), telephone number, and facsimile transmission number (if any) of the designated representative and any alternate designated representative.

(c) A list of the owners and operators of the facility or supplier identified in (a) of this subsection, provided that, if the list includes the operators of the facility or supplier and the owners with control of the facility or supplier, the failure to include any other owners shall not make the certificate of representation incomplete.

(d) The following certification statements by the designated representative and any alternate designated representative:

(i) "I certify that I was selected as the designated representative or alternate designated representative, as applicable, by an agreement binding on the owners and operators of the facility or binding on the supplier, as applicable."

(ii) "I certify that I have all the necessary authority to carry out my duties and responsibilities under chapter 173-441 WAC on behalf of the owners and operators of the facility and on behalf of suppliers, as applicable, and that each such owner and operator shall be fully bound by my representations, actions, inactions, or submissions."

(iii) "I certify that the supplier or owners and operators of the facility, as applicable, shall be bound by any order issued to me by ecology, the pollution control hearings board, or a court regarding the facility or supplier."

(iv) "If there are multiple owners and operators of the facility or multiple suppliers, as applicable, I certify that I have given a written notice of my selection as the 'designated representative' or 'alternate designated representative,' as applicable, and of the agreement by which I was selected to each owner and operator of the facility and each supplier."

(e) The signature of the designated representative and any alternate designated representative and the dates signed.

(10) **Documents of agreement.** Unless otherwise required by ecology, documents of agreement referred to in the certificate of representation shall not be submitted to ecology. Ecology shall not be under any obligation to review or evaluate the sufficiency of such documents, if submitted.

(11) **Binding nature of the certificate of representation.** Once a complete certificate of representation under this section for a facility or supplier has been received, ecology will rely on the certificate of representation unless and until a later signed, complete certificate of representation under this section for the facility or supplier is received by ecology.

(12) **Objections concerning a designated representative.**

(a) Except as provided in subsection (7) of this section, no objection or other communication submitted to ecology concerning the authorization, or any representation, action, inaction, or submission, of the designated representative or alternate designated representative shall affect any representation, action, inaction, or submission of the designated representative or alternate designated representative, or the finality of any decision or order by ecology under this chapter.

(b) Ecology will not adjudicate any private legal dispute concerning the authorization or any representation, action, inaction, or submission of any designated representative or alternate designated representative.

(13) **Delegation by designated representative and alternate designated representative.**

(a) A designated representative or an alternate designated representative may delegate his or her own authority, to one or more individuals, to submit an electronic submission to ecology provided for or required under this chapter, except for a submission under this subsection.

(b) In order to delegate his or her own authority, to one or more individuals, to submit an electronic submission to ecology in accordance with (a) of this subsection, the designated representative or alternate designated representative must submit electronically to ecology a notice of delegation, in a format prescribed by ecology, that includes the following elements:

(i) The name, organization name (company affiliation-employer), address, e-mail address (if any), telephone number, and facsimile transmission number (if any) of such designated representative or alternate designated representative.

(ii) The name, address, e-mail address, telephone number, and facsimile transmission number (if any) of each such individual (referred to as an "agent").

(iii) For each such individual, a list of the type or types of electronic submissions under (a) of this subsection for which authority is delegated to him or her.

(iv) For each type of electronic submission listed in accordance with subsection (13)(b)(iii) of this section, the facility or supplier for which the electronic submission may be made.

(v) The following certification statements by such designated representative or alternate designated representative:

(A) "I agree that any electronic submission to ecology that is by an agent identified in this notice of delegation and of a type listed, and for a facility or supplier designated, for such agent in this notice of delegation and that is made when I am a designated representative or alternate designated representative, as applicable, and before this notice of delegation is superseded by another notice of delegation under WAC 173-441-060 (13)(c) shall be deemed to be an electronic submission certified, signed, and submitted by me."

(B) "Until this notice of delegation is superseded by a later signed notice of delegation under WAC 173-441-060 (13)(c), I agree to maintain an e-mail account and to notify ecology immediately of any change in my e-mail address unless all delegation of authority by me under WAC 173-441-060(13) is terminated."

(vi) The signature of such designated representative or alternate designated representative and the date signed.

(c) A notice of delegation submitted in accordance with (b) of this subsection shall be effective, with regard to the designated representative or alternate designated representative identified in such notice, upon receipt of such notice by ecology and until receipt by ecology of another such notice that was signed later by such designated representative or alternate designated representative, as applicable. The later signed notice of delegation may replace any previously identified agent, add a new agent, or eliminate entirely any delegation of authority.

(d) Any electronic submission covered by the certification in (b)(v)(A) of this subsection and made in accordance with a notice of delegation effective under (c) of this subsection shall be deemed to be an electronic submission certified, signed, and submitted by the designated representative or alternate designated representative submitting such notice of delegation.

[]

NEW SECTION

WAC 173-441-070 Report submittal. Each GHG report and certificate of representation for a facility or supplier must be submitted electronically in accordance with the requirements of WAC 173-441-050 and 173-441-060 and in a format specified by ecology.

[]

NEW SECTION

WAC 173-441-080 Standardized methods and conversion factors incorporated by reference. (1) The materials incorporated by reference by EPA in 40 C.F.R. ~~Part~~ 98.7, including the amendments to § 98.7 proposed at 75 Fed.Reg. 48786-7 (August 11, 2010)~~as effective on or proposed by August 1, 2010~~, are incorporated by reference in this chapter for use in the sections of this chapter that correspond to the sections of 40 C.F.R. Part 98 referenced here.

(2) Table A-2 of this section provides a conversion table for some of the common units of measure used in this chapter.

Table A-2:

Units of Measure Conversions

To convert from	To	Multiply by
Kilograms (kg)	Pounds (lbs)	2.20462
Pounds (lbs)	Kilograms (kg)	0.45359
Pounds (lbs)	Metric tons	4.53592×10^{-4}
Short tons	Pounds (lbs)	2,000
Short tons	Metric tons	0.90718
Metric tons	Short tons	1.10231
Metric tons	Kilograms (kg)	1,000
Cubic meters (m^3)	Cubic feet (ft^3)	35.31467
Cubic feet (ft^3)	Cubic meters (m^3)	0.028317
Gallons (liquid, US)	Liters (l)	3.78541
Liters (l)	Gallons (liquid, US)	0.26417

Barrels of liquid fuel (bbl)	Cubic meters (m^3)	0.15891
Cubic meters (m^3)	Barrels of liquid fuel (bbl)	6.289
Barrels of liquid fuel (bbl)	Gallons (liquid, US)	42
Gallons (liquid, US)	Barrels of liquid fuel (bbl)	0.023810
Gallons (liquid, US)	Cubic meters (m^3)	0.0037854
Liters (l)	Cubic meters (m^3)	0.001
Feet (ft)	Meters (m)	0.3048
Meters (m)	Feet (ft)	3.28084
Miles (mi)	Kilometers (km)	1.60934
Kilometers (km)	Miles (mi)	0.62137
Square feet (ft^2)	Acres	2.29568×10^{-5}
Square meters (m^2)	Acres	2.47105×10^{-4}
Square miles (mi^2)	Square kilometers (km^2)	2.58999
Degrees Celsius (°C)	Degrees Fahrenheit (°F)	°C = (5/9) x (°F - 32)
Degrees Fahrenheit (°F)	Degrees Celsius (°C)	°F = (9/5) x (°C + 32)
Degrees Celsius (°C)	Kelvin (K)	K = °C + 273.15
Kelvin (K)	Degrees Rankine (°R)	1.8
Joules	Btu	9.47817×10^{-4}
Btu	MMBtu	1×10^{-6}
Pascals (Pa)	Inches of mercury (in Hg)	2.95334×10^{-4}
Inches of mercury (in Hg)	Pounds per square inch (psi)	0.49110
Pounds per square inch (psi)	Inches of mercury (in Hg)	2.03625

[]

NEW SECTION

WAC 173-441-090 Compliance and enforcement. (1) **Violations.** Any violation of any requirement of this chapter shall be a violation of chapter 70.94 RCW and subject to enforcement as provided in that chapter. A violation includes but is not limited to failure to report GHG emissions by the reporting deadline, failure to report accurately, failure to collect data needed to calculate GHG emissions, failure to continuously monitor and test as required, failure to retain records needed to verify the amount of GHG emissions, failure to calculate GHG emissions following the methodologies specified in this chapter, and failure to pay the required reporting fee. Each day of a violation constitutes a separate violation.

(2) **Enforcement responsibility.** Ecology shall enforce the requirements of this chapter unless ecology approves a local air authority's request to enforce the requirements for persons operating within the authority's jurisdiction.

(3) **Title V Applicable Requirements.** The requirements of this chapter are not "applicable requirements" for purposes of the Title V operating permit program established in WAC ch. 173-401.[7]

[7] EPA so ruled in the preamble to the final GHG reporting rule, 74 Fed. Reg. 56287-88 (October 30, 2009). This clarification would be valuable to permitting authorities and to the regulated community, as most Clean Air Act requirements must be included as applicable requirements in Title V permits.

[]

NEW SECTION

WAC 173-441-100 Addresses. All requests, notifications, and communications to ecology pursuant to this chapter, other than submittal of the annual GHG report, shall be submitted to the following address: Greenhouse Gas Report, Air Quality Program, Department of Ecology, P.O. Box 47600, Olympia, WA 98504-7600.

[]

NEW SECTION

WAC 173-441-110 Fees. (1) **Fee determination.** All persons required to report or voluntarily reporting under WAC 173-441-030 must pay a reporting fee for each year they submit a report to ecology. Ecology must establish reporting fees based on workload using the process outlined below. The fees must be sufficient to cover ecology's costs to administer the GHG emissions reporting program.

(2) **Fee eligible activities.** All costs of activities associated with administering this reporting program, as described in RCW 70.94.151(2), are fee eligible.

(3) **Workload analysis and budget development.** Each biennium, ecology must conduct a workload analysis and develop a budget based on the process outlined below:

(a) Ecology must conduct a workload analysis projecting resource requirements for administering the reporting program, organized by categories of fee eligible activities, for the purpose of preparing the budget. Ecology must prepare the workload analysis for the two-year period corresponding to each biennium. The workload analysis must identify the fee eligible administrative activities related to the reporting program that it will perform during the biennium and must estimate the resources required to perform these activities.

(b) Ecology must prepare a budget for administering the reporting program for the two-year period corresponding to each biennium. Ecology must base the budget on the resource requirements identified in the workload analysis for the biennium and must take into account the reporting program account balance at the start of the biennium.

(4) **Allocation methodology.** Ecology must allocate the reporting program budget among the persons required to report or voluntarily reporting under WAC 173-441-030 according to the following components:

(a) The reporting fee for an owner or operator of a facility required to report or voluntarily reporting under WAC 173-441-030 is calculated by the equal division of seventy-five percent of the budget amount by the total number of facilities reporting GHG emissions under this chapter in a given calendar year. A person required to report or voluntarily reporting multiple facilities under WAC 173-441-030 must pay a fee for each facility reported.

(b) The reporting fee for a supplier required to report or voluntarily reporting under WAC 173-441-030 is calculated by the equal division of twenty-five percent of the budget amount by the total number of suppliers reporting GHG emissions under this chapter in a given calendar year.

(c) A person required to report or voluntarily reporting under WAC 173-441-030 both as an owner or operator of a facility or facilities and as a supplier must pay a fee for each facility reported and a fee for reporting as a supplier.

(5) **Fee schedule.** Ecology must issue annually a fee schedule reflecting the reporting fee to be paid per facility or supplier. Ecology must base the fee schedule on the budget and workload analysis described above and conducted each biennium. Ecology must publish the fee schedule for the following year on or before October 31st of each year.

(6) **Fee payments.** Fees specified in this section must be paid within thirty days of receipt of ecology's billing statement. All fees collected under this chapter must be made payable to the Washington department of ecology. A late fee surcharge of fifty dollars or ten percent of the fee, whichever is more, may be assessed for any fee received after the thirty-day period.

(7) **Dedicated account.** Ecology must deposit all reporting fees they collect in the air pollution control account.

[]

NEW SECTION

WAC 173-441-120 Calculation methods incorporated by reference from 40 C.F.R. Part 98 for facilities. Owners and operators of facilities that are subject to this chapter must follow the requirements of this chapter and all subparts of 40 C.F.R. Part 98 listed in Table 120-1 of this section. If a conflict exists between a provision in WAC 173-441-050(3) through 173-441-080 and any applicable provision of this section, the requirements of this section shall take precedence.

(1) **Source categories and calculation methods for facilities.** An owner or operator of a facility subject to the requirements of this chapter must report GHG emissions, including GHG emissions from biomass, from all applicable source categories in Washington state listed in Table 120-1 of this section using the methods incorporated by reference in Table 120-1. Table 120-1 and subsection (2) of this section list modifications and exceptions to calculation methods adopted by reference in this section. Owners or operators are not required to report facility GHG emissions unless the emissions are referenced in Table 120-1, even if the source category to which the facility belongs is referenced in another source category that is listed in Table 120-1.

Table 120-1:

Source Categories and Calculation Methods

Incorporated by Reference from 40 C.F.R. Part 98 for Facilities

Source Category	40 C.F.R. Part 98 Subpart*	Exceptions to Calculation Method or Applicability Criteria+
General Stationary Fuel Combustion Sources	C	
Electricity Generation	D	
Adipic Acid Production	E	
Aluminum Production	F	
Ammonia Manufacturing	G	
Cement Production	H	

Electronics Manufacturing	I**	In § 98.91, replace "To calculate GHG emissions for comparison to the 25,000 metric ton CO_2e per year emission threshold in paragraph § 98.2(a)(2)" with "To calculate GHG emissions for comparison to the emission threshold in WAC 173-441-030(1)."
Ferroalloy Production	K	
Fluorinated Gas Production	L**	In § 98.121, replace "To calculate GHG emissions for comparison to the 25,000 metric ton CO_2e per year emission threshold in § 98.2(a)(2)" with "To calculate GHG emissions for comparison to the emission threshold in WAC 173-441-030(1)."
Glass Production	N	
HCFC-22 Production and HFC-23 Destruction	O	
Hydrogen Production	P	
Iron and Steel Production	Q	
Lead Production	R	
Lime Manufacturing	S	
Magnesium Production	T	
Miscellaneous Uses of Carbonate	U	
Nitric Acid Production	V	
Petroleum and Natural Gas Systems	W**	
Petrochemical Production	X	
Petroleum Refineries	Y	
Phosphoric Acid Production	Z	
Pulp and Paper Manufacturing	AA	
Silicon Carbide Production	BB	
Soda Ash Manufacturing	CC	
Use of Electric Transmission and Distribution Equipment	DD**	§ 98.301 should read: "You must report GHG emissions under this subpart if your facility contains any use of electric transmission and distribution equipment process and the facility meets the requirements of WAC 173-441-030(1)."
Titanium Dioxide Production	EE	
Underground Coal Mines	FF	
Zinc Production	GG	

Municipal Solid Waste Landfills	HH	CO_2 from combustion of landfill gas must also be included in calculating emissions for reporting and determining if the reporting threshold is met.
Industrial Wastewater Treatment	II	CO_2 from combustion of wastewater biogas must also be included in calculating emissions for reporting and determining if the reporting threshold is met.
Manure Management	JJ	See subsection (2)(e) of this section.
Carbon Dioxide Injection and Geologic Sequestration	RR**	
Manufacture of Electric Transmission and Distribution Equipment	SS**	
Industrial Waste Landfills	TT	CO_2 from combustion of landfill gas must also be included in calculating emissions for reporting and determining if the reporting threshold is met.

* Unless otherwise noted, all calculation methods are from 40 C.F.R. Part 98, as effective on August 1, 2010.

** From 40 C.F.R. Part 98, as proposed on April 12, 2010.

\+ Modifications and exceptions in subsection (2) of this section and WAC 173-441-173-010 through 173-441-050(2) also apply.

(2) **Modifications and exceptions to calculation methods adopted by reference.** Except as otherwise specifically provided:

(a) Wherever the term "administrator" is used in the rules incorporated by reference in this chapter, the term "director" shall be substituted.

(b) Wherever the term "EPA" is used in the rules incorporated by reference in this chapter, the term "ecology" shall be substituted.

(c) Wherever the term "United States" is used in the rules incorporated by reference in this chapter, the term "Washington state" shall be substituted.

(d) Wherever a calculation method adopted by reference in Table 120-1 of this section refers to another subpart or paragraph of 40 C.F.R. Part 98:

(i) If Table 120-2 of this section lists the reference, then replace the reference with the corresponding reference to this chapter as specified in Table 120-2.

(ii) If the reference is to a subpart or subsection of a reference listed in Table 120-2 of this section, then replace the reference with the appropriate subsection of the corresponding reference to this chapter as specified in Table 120-2.

(iii) If the reference is to a subpart or paragraph of 40 C.F.R. Part 98 Subparts C through TT incorporated by reference in Table 120-1, then use the existing reference except as modified by this chapter.

(e) For manure management, use the following subsections instead of the corresponding subsections in 40 C.F.R. Part 98.360 as effective on August 1, 2010.

(i) 40 C.F.R. Part 98.360(a): This source category consists of livestock facilities with manure management systems.

(A) § 98.360(a)(1) is not adopted by reference.

(B) § 98.360(a)(2) is not adopted by reference.

(ii) 40 C.F.R. Part 98.360(b): A manure management system (MMS) is a system that stabilizes and/or stores livestock manure, litter, or manure wastewater in one or more of the following system components: Uncovered anaerobic lagoons, liquid/slurry systems with and without crust covers (including, but not limited to, ponds and tanks), storage pits, digesters, solid manure storage, dry lots (including feedlots), high-rise houses for poultry production (poultry without litter), poultry production with litter, deep bedding systems for cattle and swine, manure composting, and aerobic treatment.

(iii) 40 C.F.R. Part 98.360(c): This source category does not include system components at a livestock facility that are unrelated to the stabilization and/or storage of manure such as daily spread or pasture/range/paddock systems or land application activities or any method of manure utilization that is not listed in § 98.360(b) as modified in WAC 173-441-120 (2)(e)(ii).

(iv) 40 C.F.R. Part 98.360(d): This source category does not include manure management activities located off-site from a livestock facility or off-site manure composting operations.

(v) 40 C.F.R. Part 98.361: Livestock facilities must report GHG emissions under this subpart if the facility contains a manure management system as defined in 98.360(b) as modified in WAC 173-441-120 (2)(e)(ii), and meets the requirements of WAC 173-441-030(1).

(vi) 40 C.F.R. Part 98.362(b) and (c) are not adopted by reference.

(vii) 40 C.F.R. Part 98.362(a), 40 C.F.R. Part 98.363 through 40 C.F.R. Part 98.368, Equations JJ-2 through JJ-15, and Tables JJ-2 through JJ-7 as effective on August 1, 2010, remain unchanged unless otherwise modified in this chapter.

(viii) CO_2 from combustion of gas from manure management must also be included in calculating emissions for reporting and determining if the reporting threshold is met.

(f) Use the following method to obtain specific version or date references for any reference in 40 C.F.R. Part 98 that refers to any document not contained in 40 C.F.R. Part 98:

(i) If the reference in 40 C.F.R. Part 98 includes a specific version or date reference, then use the version or date as specified in 40 C.F.R. Part 98.

(ii) If the reference in 40 C.F.R. Part 98 does not include a specific version or date reference, then use the version of the referenced document as available on the date of adoption of this chapter.

Table 120-2:

Corresponding References in 40 C.F.R. Part 98 and Chapter 173-441 WAC

Reference in 40 C.F.R. Part 98	Corresponding Reference in Chapter 173-441 WAC
40 C.F.R. Part 98 or "part"	Chapter 173-441 WAC
Subpart A	WAC 173-441-010 through 173-441-100
§ 98.1	WAC 173-441-010
§ 98.2	WAC 173-441-030
§ 98.2(a)	WAC 173-441-030(1)
§ 98.2(a)(1)	WAC 173-441-030(1)
§ 98.2(a)(2)	WAC 173-441-030(1)
§ 98.2(a)(3)	WAC 173-441-030(1)
§ 98.2(i)	WAC 173-441-030(5)
§ 98.3	WAC 173-441-050
§ 98.3(c)	WAC 173-441-050(3)
§ 98.3(g)	WAC 173-441-050(6)
§ 98.3(g)(5)	WAC 173-441-050(6)(e)
§ 98.3(i)	WAC 173-441-050(8)
§ 98.3(i)(6)	WAC 173-441-050(8)(f)
§ 98.4	WAC 173-441-060
§ 98.5	WAC 173-441-070
§ 98.6	WAC 173-441-020

§ 98.7	WAC 173-441-080
§ 98.8	WAC 173-441-090
§ 98.9	WAC 173-441-100
Table A-1 to Subpart A of Part 98--Global Warming Potentials	Table A-1 of WAC 173-441-040
Table A-2 to Subpart A of Part 98--Units of Measure Conversions	Table A-2 of WAC 173-441-080

(3) **Calculation methods for voluntary reporting.** GHG emissions reported voluntarily under WAC 173-441-030(4) must be calculated using the following methods:

(a) If the GHG emissions have calculation methods specified in Table 120-1 of this section, use the methods specified in Table 120-1.

(b) If the GHG emissions have calculation methods specified in WAC 173-441-130, use the methods specified in WAC 173-441-130.

(c) For all GHG emissions from facilities not covered in Table 120-1 of this section or persons supplying any product other than those listed in WAC 173-441-130, contact ecology for an appropriate calculation method no later than one hundred eighty days prior to the emissions report deadline established in WAC 173-441-050(2) or submit a petition for alternative calculation methods according to the requirements of WAC 173-441-140.

(4) **Alternative calculation methods approved by petition.** An owner or operator may petition ecology to use calculation methods other than those specified in Table 120-1 of this section to calculate its facility GHG emissions. Such alternative calculation methods must be approved by ecology prior to reporting and must meet the requirements of WAC 173-441-140.

[]

NEW SECTION

WAC 173-441-130 Calculation methods for suppliers. Suppliers of liquid motor vehicle fuel, special fuel, or aircraft fuel subject to the requirements of this chapter must calculate the CO_2 emissions that would result from the complete combustion or oxidation of each fuel that is reported to DOL as sold in Washington state using the methods in this section.

(1) **Applicable fuels.** Suppliers are responsible for calculating CO_2 emissions from the following applicable fossil fuels and biomass derived fuels:

(a) All taxed liquid motor vehicle fuel that the supplier is required to report to DOL as part of the supplier's filed periodic tax reports of motor vehicle fuel sales under chapter 308-72 WAC.

(b) All taxed special fuel that the supplier is required to report to DOL as part of the supplier's filed periodic tax reports of special fuel sales under chapter 308-77 WAC.

(c) All taxed and untaxed aircraft fuel supplied to end users that the supplier is required to report to DOL as part of the supplier's filed periodic tax reports of aircraft fuel under chapter 308-78 WAC.

(2) Calculating CO_2 emissions separately for each fuel type. CO_2 emissions must be calculated separately for each applicable fuel type using Equation 130-1 of this section. Use Equation 130-2 of

this section to separate each blended fuel into pure fuel types prior to calculating emissions using Equation 130-1.

$$CO_{2i} = \text{Fuel Type}_i \times EF_i \qquad \text{(Eq. 130 - 1)}$$

Where:

CO_{2i}	=	Annual CO_2 emissions that would result from the complete combustion or oxidation of each fuel type "i" (metric tons)
Fuel Type$_i$	=	Annual volume of fuel type "i" supplied by the supplier (gallons).
EF_i	=	Fuel type-specific CO_2 emission factor (metric tons CO_2 per gallon) found in Table 130-1 of this section.

$$\text{Fuel Type}_i = \text{Fuel}_i \times \%\text{Vol}_i \qquad \text{(Eq. 130 - 2)}$$

Where:

Fuel Type$_i$	=	Annual volume of fuel type "i" supplied by the supplier (gallons).
Fuel$_i$	=	Annual volume of blended fuel "i" supplied by the supplier (gallons).
%Vol$_i$	=	Percent volume of product "i" that is fuel type$_i$.

(3) **Calculating total CO_2 emissions.** A supplier must calculate total annual CO_2 emissions from all fuels using Equation 130-3 of this section.

$$CO_{2x} = \sum (CO_{2i}) \qquad \text{(Eq. 130 - 3)}$$

Where:

CO_{2x}	=	Annual CO_2 emissions that would result from the complete combustion or oxidation of all fuels (metric tons).
CO_{2i}	=	Annual CO_2 emissions that would result from the complete combustion or oxidation of each fuel type "i" (gallons).

(4) **Monitoring and QA/QC requirements.** Comply with all monitoring and QA/QC requirements under chapters 308-72, 308-77, and 308-78 WAC.

(5) **Data recordkeeping requirements.** In addition to the annual GHG report required by WAC 173-441-050 (6)(c), the following records must be retained by the supplier in accordance with the requirements established in WAC 173-441-050(6):

(a) For each fuel type listed in Table 130-1 of this section, the annual quantity of applicable fuel in gallons of pure fuel supplied in Washington state.

(b) The CO_2 emissions in metric tons that would result from the complete combustion or oxidation of each fuel type for which subsection (5)(a) of this section requires records to be retained, calculated according to subsection (2) of this section.

(c) The sum of biogenic CO_2 emissions that would result from the complete combustion oxidation of all supplied fuels, calculated according to subsection (3) of this section.

(d) The sum of nonbiogenic and biogenic CO_2 emissions that would result from the complete combustion oxidation of all supplied fuels, calculated according to subsection (3) of this section.

(e) All records required under chapters 308-72, 308-77, and 308-78 WAC in the format required by DOL.

Table 130-1:

Emission Factors for Applicable Liquid Motor Vehicle Fuels, Special Fuels, and Aircraft Fuels

Fuel Type (pure fuel)	Emission Factor (metric tons CO_2 per gallon)
Gasoline	0.008960
Ethanol	0.005767
Diesel	0.010230
Biodiesel	0.009421
Propane	0.005593

Natural gas	0.000055*
Kerosene	0.010150
Jet fuel	0.009750
Aviation gasoline	0.008310

Contact ecology to obtain an emission factor for any applicable fuel type not listed in this table.

*In units of metric tons CO_2 per scf. When using Equation 130-1 of this section, enter fuel in units of scf.

[]

NEW SECTION

WAC 173-441-140 Petitioning ecology to use an alternative calculation method to calculate greenhouse gas emissions. An owner or operator may petition ecology to use calculation methods other than those specified in WAC 173-441-120 to calculate GHG emissions. Alternative calculation methodologies are not available for GHG emissions covered by a source category adopted by reference in WAC 173-441-130. The following requirements apply to the submission, review, and approval or denial of a petition:

(1) **Petition submittal.** An owner or operator must submit a petition that meets the following conditions before ecology may review the petition and issue a determination.

(a) An owner or operator must submit a complete petition no later than one hundred eighty days prior to the emissions report deadline established in WAC 173-441-050(2). Such petition must include sufficient information, as described in (b) of this subsection, for ecology to determine whether the proposed alternative calculation method will provide emissions data sufficient to meet the reporting requirements of RCW 70.94.151. Ecology will notify the owner or operator within thirty days of receipt of a petition of any additional information ecology requires to approve the proposed calculation methods in the petition. If a petition is under review by ecology at the time an annual emissions report is due under WAC 173-441-050(2), the owner or operator must submit the emissions report using the calculation methods approved under this chapter at the time of submittal of the emissions report.

(b) The petition must include, at a minimum, the following information:

(i) Identifying information as specified in WAC 173-441-060 (9)(b) and 173-441-060 (13)(b)(ii) of the designated representative and any agent submitting a petition;

(ii) Identifying information as specified in WAC 173-441-050 (3)(a) of the facility or facilities where the owner or operator proposes to use the alternative calculation method;

(iii) A clear and complete reference to the subparts or sections in EPA's mandatory greenhouse gas reporting regulation that contain the alternative calculation method and the date that EPA adopted the subparts or sections;

(iv) The source categories that will use the alternative calculation method;

(v) The date that the owner or operator intends to start using the alternative calculation method;

(vi) Any other supporting data or information as requested by ecology as described in subsection (2) of this section; and

(vii) The designated representative must sign and date the petition.

(2) **Ecology review of the petition.** Ecology must approve the alternative calculation method before the owner or operator may use it to report GHG emissions. Ecology will issue a determination within sixty days of receiving a complete petition. The alternative calculation method must meet the following conditions:

(a) For GHG emissions that meet the requirements of WAC 173-441-030(1) for mandatory reporting, the alternative calculation method must be a method adopted by the United States Environmental Protection Agency in its mandatory greenhouse gas reporting regulation. The alternative calculation method must be more recent than the method for the given source category adopted by reference in WAC 173-441-120.

(b) For GHG emissions reported voluntarily under WAC 173-441-030(4), ecology must apply the following criteria when evaluating an alternative calculation method:

(i) If the GHG emissions are covered by a source category adopted by reference in WAC 173-441-120, then the requirements of (a) of this subsection apply.

(ii) If the GHG emissions are not covered by a source category adopted by reference in WAC 173-441-120 or 173-441-130, then ecology must consider whether the methods meet the following criteria:

(A) The alternative calculation method is established by a nationally or internationally recognized body in the field of GHG emissions reporting such as:

(I) Ecology;

(II) EPA;

(III) The International Panel on Climate Change;

(IV) The Western Climate Initiative;

(V) The Climate Registry;

(B) If an alternative calculation method is not available from sources listed in (b)(ii)(A) of this subsection, then ecology may accept a method from an industry or trade association or devised by the owner or operator if ecology determines the alternative calculation method is consistent with the requirements established under RCW 70.94.151.

(c) For all source categories, including those covered in (a) and (b) of this subsection, the alternative calculation method must be consistent in content and scope with the requirements established under RCW 70.94.151. In the event that a proposed alternative calculation method does not include all required GHG emissions, the owner or operator must use the calculation methods specified in subsection (3) of this section to calculate those emissions.

(3) **Calculating emissions not included in alternative calculation method.** An owner or operator must report all source categories of GHG emissions for which reporting is required under RCW 70.94.151 and for which calculation methods have been established in WAC 173-441-120 or 173-441-130. If an approved alternative calculation method does not include calculation methods for all required source categories of emissions, then the owner or operator

must use a method described in WAC 173-441-120, 173-441-130, or approved for the owner or operator by ecology in a separate petition to calculate and report those emissions.

(4) **Appeal of determination.** An approval or denial issued by ecology in response to a written petition filed under this subsection is a determination appealable to the pollution control hearings board per RCW 43.21B.110 (1)(h).

[]

NEW SECTION

WAC 173-441-150 Confidentiality. (1) Emissions data submitted to ecology under this chapter are public information and must not be designated as confidential.

(2) Any proprietary or confidential information exempt from disclosure when reported to DOL that ecology obtains directly from DOL remains exempt from disclosure.

(3) Information considered confidential by EPA is not considered confidential by ecology unless it also meets the conditions established in subsection (2) or (4) of this section.

(4) Any person submitting information to ecology under this chapter may request that ecology keep information that is not emissions data confidential as proprietary information under RCW 70.94.205 or because it is otherwise exempt from public disclosure

under the Washington Public Records Act (chapter 42.56 RCW). All such requests for confidentiality must meet the requirements of RCW 70.94.205.

(5) Ecology's determinations of the verification status of each report are public information. All confidential data used in the verification process will remain confidential.

[]

NEW SECTION

WAC 173-441-160 Ecology to share information with local air authorities and with the energy facility site evaluation council. (1) Ecology must share any reporting information reported to it with the local air authority in which the person reporting under these rules operates.

(2) Ecology must share with the energy facility site evaluation council any information reported to ecology under these rules by facilities permitted by the council, including notice of a facility that has failed to report as required.

[]

NEW SECTION

WAC 173-441-170 Severability. If any provision of the regulation or its application to any person or circumstance is held invalid, the remainder of the regulation or application of the provision to other persons or circumstances is not affected.

[]
70334140.2 0009551-00001

W-11

Caudill, Neil (ECY)

From: Llewellyn Matthews [llewellyn@nwpulpandpaper.org]
Sent: Thursday, October 14, 2010 9:20 PM
To: Caudill, Neil (ECY)
Subject: NWPPA Comments on GHG Reporting Rules
Attachments: NWPPAcommentsGHGreporting10.14.2010.docx; AFPA GHG CBI Comments 9-7-10.pdf

Dear Neil,

Please accept the attached comments of NWPPA regarding Ecology's proposed greenhouse gas reporting rules. Please note that we would like the attached letter from AF&PA that discusses one particular issue in greater detail, to be included as an attachment to the NWPPA letter and also included in the record.

I am also sending a hard copy by mail.

Thank-you,

Llewellyn Matthews
Northwest Pulp and Paper Association
7900 SE 28th Street Suite 304
Mercer Island WA 98040

Office: 206 414-7290

cell 425-503-9787
llewellyn@nwpulpandpaper.org

NORTHWEST
PULP&PAPER

Northwest Pulp & Paper Association
7900 S.E. 28th Street, Suite 304
Mercer Island, WA 98040
(206) 414-7290, Fax (206) 414-7297

October 14, 2010
Via email: neil.caudill@ecy.wa.gov

Neil Caudill
Air Quality Program
Washington Department of Ecology
P.O. Box 47600 Olympia, WA 98504-7600

RE: Chapter 173-441 WAC - Reporting of Emission of Greenhouse Gases

Dear Neil;

Please accept this letter as the comments of Northwest Pulp and Paper Association for the record on the proposed rules "Reporting Emission of Greenhouse Gases," WAC 173-441.

Northwest Pulp and Paper Association (NWPPA) represents the pulp and paper mills in the Pacific Northwest states of Washington, Oregon and Idaho. All of NWPPA's members have facilities that trigger the thresholds for reporting greenhouse gas (GHG) emissions in both Ecology's proposed rule and rules adopted by the Environmental Protection Agency. Many of NWPPA's members also have facilities in other states. One of our primary concerns has been that greenhouse gas reporting requirements be as consistent as possible with EPA rules. NWPPA appreciates and thanks Ecology for setting aside an earlier proposal for GHG emission reporting that was based on different concepts than the EPA rules and developing rules that now align as closely as possible with EPA rules.

Specifically, the resolution of the following issues is important to NWPPA members:

- Reporting will begin in 2013 for 2012 emissions.
- The yearly reporting threshold is set at 10,000 metric tons of carbon dioxide equivalent for all sources.
- Ecology is adopting EPA calculation and reporting methods.
- Facility-based reporting will be used instead of entity-wide reporting. This ensures that Ecology receives the same emissions data reported to EPA from those who will report to both.
- Fuel suppliers and importers will report emissions from transportation fuels. They will use the same information provided to the state Department of Licensing instead of reporting by individual vehicle fleets. This gives a much

more complete measurement of the state's transportation emissions, which account for nearly half of Washington's total greenhouse gas emissions.

- Emitters are only required to report direct emissions from certain stationary source categories such as combustion, electricity generation, landfills, and various industrial operations.
- The list of greenhouse gases to be reported includes gases added by Congress or included in EPA's reporting regulation.
- Confidential business information is protected.
- The earlier proposal for third party verification of reported data was eliminated.

NWPPA wishes to draw your attention to two issues of concern that are subject to change at the federal level.

1. Confidential Business Information

NWPPA supports the following language in the proposed rules:

> **WAC 173-441-150 Confidentiality.** (1) Emissions data submitted to ecology under this chapter are public information and must not be designated as confidential.
> (2) Any proprietary or confidential information exempt from disclosure when reported to DOL that ecology obtains directly from DOL remains exempt from disclosure.
> (3) Information considered confidential by EPA is not considered confidential by ecology unless it also meets the conditions established in subsection (2) or (4) of this section.
> (4) Any person submitting information to ecology under this chapter may request that ecology keep information that is not emissions data confidential as proprietary information under RCW 70.94.205 or because it is otherwise exempt from public disclosure under the Washington Public Records Act (chapter 42.56 RCW). All such requests for confidentiality must meet the requirements of RCW 70.94.205.
> (5) Ecology's determinations of the verification status of each report are public information. All confidential data used in the verification process will remain confidential.

NWPPA wishes to call to Ecology's attention that issues of protection of business confidential information, including information used to verify emissions is important to our industry. We believe the proposed rule language in section (5) quoted above is intended to protect as confidential business information data used in verifying emissions data if so requested by the reporting party. However, some aspects of this issue remain unresolved at the federal level.

EPA proposed rules (the Disclosure Rule) published in the Federal Register on July 7, 2010, (see 75 *Fed.Reg.*39094) would establish the conditions for disclosing information reported to EPA under the Agency's mandatory Greenhouse Gas Reporting Rule (74 *Fed. Reg.* 56260 Oct. 30, 2009). EPA's proposed rules would change traditional protection of confidential business information as we know it under the Clean Air Act.

The Clean Air Act (CAA) requires EPA to disclose "emission data" reported to it and forbids the disclosure of confidential business or trade secret information (collectively, "CBI"). Historically, EPA has balanced these two factors by honoring company CBI claims until a specific disclosure demand was made, and then reaching a case-by-case decision. This proposed Disclosure Rule takes a radically different approach. Under it, EPA would make a generic decision to classify as "emission data" (and thus authorized to disclose) not just information that identifies individual sources and their emissions, but all information used to verify those emission calculations. In many and perhaps all cases, this verification data would otherwise qualify as CBI. In particular, GHG reporting may be based on fuel process information in a much more direct way than reporting of other types of air emissions.

NWPPA is attaching for the record, comments prepared by the American Forest and Paper Association dated September 7, 2010 that provide more information on this issue.

Comment:

NWPPA urges Ecology to retain the proposed rule language in section (5) quoted above and retain traditional protection of confidential business information under the Clean Air Act.

In addition, NWPPA urges Ecology to establish internal procedures that safeguard confidential business information in the context of GHG reporting.

2. Wastewater Treatment Systems

This issue is also in flux at the federal level. NWPPA would like the opportunity to review this issue with you if appropriate at a later date.

Thank-you for the opportunity to make these comments.

Sincerely,

Llewellyn Matthews, Executive Director

ATTACHMENT: AF&PA Comments on Disclosure Rule dated September 7, 2010

American Forest & Paper Association

September 7, 2010

EPA Docket Center (EPA/DC)
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: Docket ID No. EPA-HQ-2009-0924, Proposed Confidentiality Determinations for Data Required Under the Mandatory Greenhouse Gas Reporting Rule, 75 *Federal Register* 39094, July 7, 2010

Dear Sir/Madam:

The American Forest & Paper Association (AF&PA) appreciates the opportunity to comment on the Environmental Protection Agency's (EPA's) proposed rule (the Disclosure Rule) published in the Federal Register on July 7, 2010, see 75 *Fed. Reg.*39094. This proposal would establish the conditions for disclosing information reported to EPA under the Agency's mandatory Greenhouse Gas Reporting Rule (the Reporting Rule), 74 *Fed. Reg.* 56260 (Oct. 30, 2009).

AF&PA is the national trade association of the forest products industry, representing pulp, paper, packaging and wood products manufacturers, and forest landowners. Our companies make products essential for everyday life from renewable and recyclable resources that sustain the environment. The forest products industry accounts for approximately 5 percent of the total U.S. manufacturing GDP. Industry companies produce about $175 billion in products annually and employ nearly 900,000 men and women, exceeding employment levels in the automotive, chemicals and plastics industries. The industry meets a payroll of approximately $50 billion annually and is among the top 10 manufacturing sector employers in 48 states.

Our members own and operate approximately 150 facilities subject to the massive data production requirements of the Reporting Rule. Accordingly, AF&PA has a vital interest in the current proposal.

I. Introduction and Summary

The Clean Air Act (CAA) requires EPA to disclose "emission data" reported to it and forbids the disclosure of confidential business or trade secret information (collectively, "CBI"). Historically, EPA has balanced these two factors by honoring company CBI claims until a specific disclosure demand was made, and then reaching a case by case decision.

This proposed Disclosure Rule takes a radically different approach. Under it, EPA would make a generic decision to classify as "emission data" (and thus authorize to disclose) not just information that identifies individual sources and their emissions, but all information used to verify those emission calculations. In many and perhaps all cases, this verification data would otherwise qualify as CBI.

AF&PA supports the automatic disclosure of data on source identity and actual emissions. However, we oppose the automatic disclosure of verification information as inconsistent both with the law and sound policy. Instead, requests for the disclosure of such data should be decided case by case as at present.

We develop those arguments below. In this Summary we only want to point out that EPA would lose nothing by accepting our position as a starting point for this massive new program. Actual emissions data would still be automatically disclosed. That would be more than enough to inform the public and the public debate, particularly in the first few years when this information would still be new to the public forum. Meanwhile, both EPA and industry could gain experience with the actual sensitivity of the verification information. That, in turn, would put EPA in a position to make a more informed decision on generic disclosure later, should it find that advisable. Meanwhile, all this information without exception would still be subject to case by case disclosure as at present. (To be consistent with the current practice for claiming CBI, EPA should incorporate the ability for companies to claim information as confidential in its electronic GHG reporting tool (e-GGRT).)

Our comments begin by summarizing the governing law. We then describe the relevant parts of the Reporting Rule, and the Disclosure Rule proposal. We conclude that EPA has gotten the legally required balance between disclosing emissions information and protecting CBI fundamentally wrong, and that EPA could correct this at no cost to the attainment of its regulatory goals.

II. Legal Background

A. The Law

The Reporting Rule rests entirely on CAA §114(a), which allows the Agency to impose broad reporting requirements on emitting sources and others, but only for the purpose of developing CAA regulations or enforcing the CAA.

The Disclosure Rule is governed by CAA §114(c), which provides that

> Any records, reports, or information obtained under subsection (a) ... shall be available to the public, except that upon a showing satisfactory to the Administrator by any person that records, reports or information, or particular part

> thereof (other than emission data) ... if made public, would divulge methods or processes entitled to protection as trade secrets of such person, the Administrator shall consider such record, report or information or particular portion thereof confidential [and shall not disclose it except for enforcement purposes or when relevant to a CAA proceeding.]

Section 114(a) authorizes EPA only to gather information useful for implementing **some other** CAA authority, i.e., enforcing existing CAA requirements or developing new ones. It does **not** authorize EPA to gather and publicize information for its own sake – for example, to put public pressure on companies to improve their GHG emissions performance by "benchmarking" them against each other.

EPA seems to agree. In justifying the Reporting Rule the Agency stuck closely to the statutory purposes although it did say that the rule could have collateral benchmarking benefits. See 75 *Fed. Reg.* 56265.

If EPA cannot gather information solely for benchmarking purposes, we do not believe it can invoke the benefits of benchmarking by calling it "emission data" and disclosing it. As we discuss below, the Disclosure Rule appears to depart from these restrictions.

In addition, the statute expresses a clear preference for case by case decisions on trade secret status by providing for determinations of that status based on "a showing ...by any person". The Disclosure Rule departs from these restrictions also.

B. The Regulatory Provisions

1. The Definition of Emissions Data

For thirty-five years 40 CFR Part 2 has defined "emission data" subject to mandatory disclosure under CAA §114(c). It states in relevant part:

> *Emission data* means, with reference to any source of emission of any substance into the air—
>
> (A) Information necessary to determine the identity, amount, frequency, concentration, or other characteristics (to the extent related to air quality) of any emission which has been emitted by the source (or of any pollutant resulting from any emission by the source), or any combination of the foregoing;
>
> ...

> (C) A general description of the location and/or nature of the source to the extent necessary to identify the source and to distinguish it from other sources (including, to the extent necessary for such purposes, a description of the device, installation, or operation constituting the source).
>
> 40 CFR 2.301(2)[1]

2. Determining CBI Status

Although CAA §114 only refers to protecting trade secrets from disclosure, EPA has always properly interpreted this statutory provision to "afford confidential treatment to both trade secrets and confidential business information" 75 *Fed. Reg.* 39100.

40 CFR 2.208 sets out the standards that EPA uses in deciding CBI claims. In relevant part, they are:

> (a) The business has asserted a business confidentiality claim which has not expired by its terms, nor been waived nor withdrawn;
>
> (b) The business has satisfactorily shown that it has taken reasonable measures to protect the confidentiality of the information, and that it intends to continue to take such measures;
>
> (c) The information is not, and has not been, reasonably obtainable without the business's consent by other persons (other than governmental bodies) by use of legitimate means (other than discovery based on a showing of special need in a judicial or quasi-judicial proceeding);
>
> (d) No statute specifically requires disclosure of the information; and
>
> (e) ....
>
> (1) The business has satisfactorily shown that disclosure of the information is likely to cause substantial harm to the business's competitive position;

[1] This definition also contains a paragraph (B) concerning disclosure of emissions information related to a CAA regulatory limit. As EPA properly explains, this paragraph is not relevant to the Disclosure Rule since at present there are no such limits on sources subject to the Reporting Rule.

C. Other Materials

In 1991 EPA proposed to "clarify" its policy on when reported material is "emission data" subject to mandatory disclosure. 58 *Fed. Reg.* 7042 (February 21, 1991). EPA never made this proposal final; therefore, it has no binding legal effect. But since the Disclosure Rule preamble discusses it as authority, we will describe it here.

In that notice, EPA proposed to define more precisely the information needed to identify reporting sources and their location, and to determine the characteristics of emissions, within the meaning of 40 CFR 2.301.

Regarding source identity, EPA proposed to disclose exact geographic location (postal address, latitude and longitude, SIC classification, and "[e]mission point, device, or operation description, information").

Turning to emission characteristics, EPA began by saying that "[t]he following data fields are needed to establish the characteristics of the emissions. This information is needed for the analyses of dispersion and potential control equipment."

EPA then went on to specify the exact data involved, 56 *Fed. Reg.* 7042-43. They are:

- chemical identity of the emissions
- identity of the emitting unit
- emission rate, duration , concentration and frequency
- release height and diameter of releasing vent
- release velocity
- release temperature
- description of surrounding terrain
- hourly maximum heat input capacity
- maximum hourly operating rate
- percent of fuel input used for space heating
- "the method by which an emission estimate has been calculated such as material balance, source test, use of AP-42 emission factors, etc."

Since all these are glosses on the requirements of 2.301 to determine the "identity" and "characteristics" of emissions, they are all also subject to the overriding provision of that section requiring such specific detail only "to the extent related to air quality".

III. The EPA Proposal

We will first describe EPA's Reporting Rule, which is necessary background to the Disclosure Rule, and then describe the Disclosure Rule itself.

A. The Reporting Rule

In general, the Reporting Rule requires all facilities that emit more than 25,000 metric tons of greenhouse gas (GHG) a year, measured as carbon dioxide equivalents, to report their emissions.

The rule does that by establishing General Provisions, applicable to all covered sources, and then establishing 25 separate Subparts applicable to direct GHG emitters and five more applicable to suppliers of GHG emitting fuels. [2]

AF&PA will confine its comments to the three Subparts that have by far the greatest impact on our members. These are Subpart A, General Provisions, Subpart C, General Stationary Fuel Combustion, and Subpart AA, Pulp and Paper Production.

1. General Provisions

All sources subject to the Reporting Rule must comply with the General Provisions require them to submit a certified Annual Report that gives their name and location, and their annual GHG emissions broken down by gas and industrial category. 40 CFR 98.3 (c).

The General Provisions do not require emissions reporting at the unit level unless an individual subpart requires it. id.

Similarly, the General Provisions do not require reporting of the data used as input for emissions calculations. Instead, these data must be kept on site and available for EPA inspection for three years. 40 CFR 98.3 (g). See also 74 *Fed. Reg.* 56268-69.

EPA's preamble explains why the Agency required facilities to keep this information. In designing the Reporting Rule, EPA had to choose between an approach in which third parties approved by EPA would validate data submissions, and an approach by which

---

[2] This is the original count. EPA has added reporting categories since then, but that does not affect our argument.

EPA itself would validate them. EPA chose the latter approach. That meant that the Agency had to arrange for access to the data needed for such validation. As EPA states

> In general, reporting of such data is required primarily to enable emissions verification and ensure the consistency and accuracy of data collected under the rule. ... Many of these data are already routinely monitored and recorded by facilities for business reasons.
>
> 74 *Fed. Reg.* 56277.

To underline that point, EPA's Fuel Combustion Subpart refers separately to "emissions data" and "emissions verification data", see 40 CFR 98.36(a).

2. Fuel Combustion Sources

Subpart C of the Reporting Rule covers essentially all fuel combustion sources other than electric generating units.

All such sources must quantify their GHG emissions in one of four ways. They can calculate emissions (1) from their fuel consumption and EPA default values for heating value and carbon content or (2) from their fuel consumption, heating value based on sampling, and carbon content based on EPA default values or (3) fuel consumption and carbon content based on fuel sampling or (4) by using continuous emission monitors (CEMS). 40 CFR 98.33(a).

Fuel combustion sources must also report their emissions on a unit by unit basis, 40 CFR 98.36(a), and must in general report the method of quantifying emissions they used, their emissions by fuel type combusted, and the maximum rated heat input capacity of each unit, 40 CFR 98.36(b).

In addition, a separate paragraph entitled "verification data" requires facilities that do not use CEMs to report total fuel consumption by fuel type and unit, and (depending on the verification method used) also report the total amount of steam produced in each unit, "the ratio of the maximum rated heat input capacity to the design rated steam output capacity of the unit", the heating value of each fuel, and detailed information on how fuel carbon content was calculated, 40 CFR 98.36(e),

As EPA noted, many businesses already collect this data "for business reasons." They have also long kept it confidential for equally good "business reasons."

3. Pulp and Paper Sources

Subpart AA to 40 CFR Part 98 would require all chemical recovery furnaces and lime kilns in sources over the reporting thresholds to report their GHG emissions. These emissions would be calculated using formulas very similar to those required for fuel burning sources and require inputs such as the mass of spent liquor solids combusted in each chemical recovery furnace, the amount of fossil fuel combusted in each lime kiln, and the amount of recovery chemicals needed within the pulping process. Such data, especially on a unit-by-unit basis, but also at the facility level, can provide the means for competitors to determine plant and unit efficiencies, production levels, and overall cost-effectiveness.

B. The Disclosure Rule - "Emission Data"

EPA proposes to make **all** the information just described subject to automatic disclosure as "emission data" once it has been reported to EPA. EPA bases this in part on the "benchmarking" benefits of such disclosure, arguing that "[i]nformation on unit characteristics and operations are valuable to policy makers, the public, and industry because they improve our understanding of the sources of emissions and the relationship between process operating characteristics and emissions", 75 *Fed. Reg.* 39099.

EPA also argues that it correctly

> proposes to determine as "emission data" data required to perform the emissions calculation for direct emitters specified in Part 98 because these inputs to GHG emissions equations are "necessary to determine the identity, amount ... of emissions and are therefore "emission data" under the meaning of 40 CFR 2.301(a)(2)(i),
>
> 75 *Fed. Reg.* 39105.

and because it is

> information necessary for the reporter to actually calculate the emissions and for EPA and the public to verify that an appropriate method was used.
>
> 75 *Fed. Reg.* 39110.

EPA asks for comment on this approach. We respond to that request below.

IV. Discussion

A. "Emission Data"

AF&PA's reservations about EPA's approach center on its proposal for automatic disclosure as "emission data" of the inputs to emissions calculations.

We agree that the material on source identity that the Reporting Rule requires should be made public. We also agree that information on actual emission levels from sources and units is "emission data" and must be disclosed if it has been validly collected.

But we have multiple reservations beyond that point.

To illustrate them, we will discuss the language of the governing legal provisions, how EPA should interpret them, and why the information involved would otherwise qualify for CBI protection. Each separate approach leads to the same conclusion – that EPA has overreached in proposing automatic disclosure of input data. We conclude by explaining why EPA does not need to disclose this information to build a sound and workable program.

1. Governing Legal Language

a) The Statute

CAA §114 refers only to "emission data." "Data," according to Webster's New Collegiate Dictionary, means "factual information (as measurements or statistics) used as a basis for reasoning, discussion, or calculation." Webster's gives an example: "comprehensive data on economic growth are available".

In short, "data" about a given topic, like economic growth, naturally means information that directly describes that topic. It does **not** naturally extend to materials used to validate the accuracy of that information. If it did, there would be no logical limit to the term. EPA's own proposal acknowledges this in referring separately to "emission data" and "emission verification data" as noted above.

EPA's demand for emission verification data does not rest on any need to understand air quality itself. Instead, it is an artifact of EPA's decision – which AF&PA supports – to verify GHG emissions reports itself and not rely on third parties. See 75 *Fed. Reg.* 39104-05.[3] Indeed, some comments on EPA's original Reporting Rule proposal opposed it precisely because it would require sources to report detailed supporting data that was CBI. 74 *Fed. Reg.* 56282.

Data which EPA might need or not need, depending on which approach to verifying emission data it elects, can hardly itself be called emission data.

b) The Regulations

---

[3] This passage reads:

> In addition to reporting facility GHG emissions ... Part 98 requires reporting of a wide range of other facility and process-specific data. Most of this data are required primarily to enable emissions verification.

Nothing in EPA's regulatory definition of "emission data" conflicts with this natural reading. On the contrary, that definition describes "data" as particularizing the presence of materials in the air ("identity, amount, frequency, concentration ") adds a catch-all reference to "other characteristics", and states that even material that fits this definition is only "emission data" "to the extent related to air quality".

EPA relies on the "necessary to determine" language of the regulations to justify its approach. But as the courts have said, a "strict interpretation of the 'necessary to determine' requirement is warranted in order to ensure that the exception does not swallow the rule." *NRDC v. Leavitt*, Civ. No. 04-01295, 2006 WL 667327, at *4 (D.D.C. March 14, 2006).

c) EPA's 1991 Proposal

EPA's 1991 proposal, which was never made final, does not have anything approaching the same legal force as the statute or even its implementing regulations.

However, it is worth noting that everything in EPA's proposed list falls into one of three categories, namely:

- detailed characterizations of materials in the air, in terms of emissions rate, velocity, temperature, and the characteristics of surrounding terrain (which is needed to model air quality impacts)
- a general description of how emissions were determined – for example, by monitoring or from emission factors; and
- a few generic descriptions of emission units, for example their maximum heat input capacity.

Nothing in that notice even comes close to requiring the detailed disclosure of inputs to emissions computation equations that EPA proposes here.

2. EPA's Proposal Rests on an Unreasonable Interpretation of the Statute

For the reasons just given, EPA's proposal conflicts with the plain statutory language insofar as it proposes to label the information needed to verify emission calculations as "emission data." That approach conflicts with the plain language of CAA §114, the case law, and the governing regulations. But even if we concede for the sake of argument that the language might be ambiguous, EPA's interpretation is unreasonable for two separate reasons. First, it would lead to unreasonable discrimination among sources. Second, it fails to balance the small benefits of disclosure with its truly major costs. We will discuss each in turn.

a) EPA's Proposal would Lead to Unjustified Discrimination Among Sources

As EPA acknowledges under this proposal, see 75 *Fed. Reg.* 39109, sources that measure their emissions directly with CEMs would not have to disclose **any** information about their industrial operations, while there would essentially be no limit to the disclosure that might be required of sources that compute their emissions from industrial inputs.

AF&PA believes EPA cannot justify this discrimination. It would put sources in the second category at a severe competitive disadvantage. Moreover, it would put great competitive pressure on these sources to adopt CEMS, even though EPA has been properly reluctant to require CEMS of smaller sources because they are expensive and cannot be justified on cost-effectiveness grounds.

b) EPA has Not Properly Balanced the Benefits of Requiring Input Data Disclosure Against Its Costs

EPA's proposed discrimination against computation sources in favor of CEM sources illustrates a broader problem with its proposal.

Even if we concede, for the sake of argument, that the term "emission data" may be ambiguous, that does **not** give EPA unfettered power – as the proposal suggests – to give it any conceivable meaning. Instead, EPA must strike a reasonable balance between the benefits of a sweeping definition and its costs in damage to other statutory goals.

(1) The Benefits

In this particular context, the benefits are small. Specifically:

- GHG emissions have essentially no local or even regional impacts. Accordingly, particularized local data is not needed to evaluate the problems they raise.

- EPA's prescribed methods of computing GHG releases from fuel and other material inputs rest on well known sampling and computation techniques. There is no reason to suppose sources will make many mistakes in using them, and no reason to doubt the ability of EPA oversight to provide quality control adequate to the purposes for which the data is collected.

- "Benchmarking" the GHG emissions performance of one source against another is **not** a permissible ground for gathering information under §114 and thus not a permissible ground for disclosing it.

- EPA's GHG disclosure program will contribute massive amounts of new information to the public debate even without disclosing computation input information. There is no need to push for automatic disclosure of that information without waiting to see whether the other data slated for disclosure will be sufficient.

(2) The Costs

In judging the reasonableness of EPA's very aggressive interpretation of "emission data," we must consider not just the small benefits of that approach but the damage that it would do to the values that CBI protections were established to protect.

Here, EPA's proposal **already** concedes that the damage would be significant.

It does so in two stages.

First, in order to be able to make generic decisions on disclosure the Agency assumes in advance that reporting companies have properly claimed CBI status for all the information involved, that they are taking reasonable steps to protect this data, and that no statute specifically requires disclosure of the data. 75 *Fed. Reg.* 39101.[4]

No one during the promulgation of the Reporting Rule claimed that the information at issue was available by other means. Indeed, if it had been, EPA would not have had to promulgate the Reporting Rule. Accordingly, EPA's fourth condition, as set out in 40 CFR 2.208(c), has also been met.

In other words, through generic decisions EPA has narrowed the questions it must answer to deny CBI status down to one, namely whether "disclosure of the information is likely to cause substantial harm to the business's competitive position"40 CFR 2.208.(e).

Yet even there, EPA's proposal concedes that the detailed information on fuel use, fuel characteristics, unit activity, and production levels that the Reporting Rule's emission equations require would qualify as CBI if it were not labeled as "emission data." That proposal repeatedly concludes that CBI protections validly apply to information on "actual production data (e.g. raw material consumed or quantity of product produced), or operating efficiency (e.g. amount of product produced per amount of raw material

---

[4] The exact language is as follows:

> Because EPA proposes to determine the CBI status of Part 98 data in advance of their submission, EPA assumes in this proposal that the data meet the criteria at 40 CFR 2.208(a) and (b). Specifically, EPA assumes that the reporting faculties have asserted confidentiality claims. EPA further assumes that the reporting facilities are taking and will continue to take reasonable measures to protect the data. The data elements at issue also meet the criterion at 40 CFR 2.208(d).

consumed)", 75 *Fed. Reg.* 39113, see also p. 39103, or on the amount of feedstock consumed broken down by process, see 75 *Fed. Reg.* 39116. These are precisely the types of verification information required by Subparts C and AA of the Reporting Rule.

AF&PA and its members fully agree with these EPA conclusions. Disclosure of this data raises two primary concerns. First is when a competitor knows or can discern the fuels fired at a mill making a competitive product, the amounts actually fired and the firing capacities for each fuel. Generally fuel price is known from general commerce. Knowing fuel price and quantity determines the magnitude of the cost component. Energy is 10 percent (roughly) of the cost of paper and fuel mix (or fuel cost) is therefore a major variable cost. More specific information (i.e., by unit) allows the competitor more discernment. Knowing cost components can give a competitor an unfair competitive advantage in a given market segment.

The second concern is that fuel suppliers can use knowledge of energy requirements and fuel firing capabilities to drive up fuel price or fuel contract price during negotiations, affecting the competitiveness of the final product.

Against this background, EPA cannot proceed with a generic denial of CBI claims for such data. CAA §114 at the very least expresses a clear preference for case-by-case decisions on CBI status. That position also makes policy sense given the wide variety of individual settings and circumstances in which such claims may arise. Sources are really not able to anticipate in advance every single situation in which data, if released, would raise a CBI concern.

The record that EPA has created supports a case by case approach and is clearly far too weak to support a generic decision in favor of disclosure.

EPA attempts to justify its generic approach to denial of CBI status by pointing to the amount of work this would save reporting organizations such as the companies AF&PA represents. 75 *Fed. Reg.* 39102. Much as we appreciate this concern, we greatly prefer the established and legally required case by case approach in this context despite any greater work it might possibly entail.

V. EPA Proposal Cannot be Defended as Reasonable Policy

Executive Order 12866 requires all agencies to issue "only such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling public need." When regulations are issued, they must rest on a careful cost-benefit analysis, must be drafted to maximize net social benefits, and must be crafted to impose the least burden on society.

EPA's proposal violates all these principles. It simply ignores the need to balance costs against benefits as detailed above. In addition, the Agency has also ignored the old rule that massive changes should be avoided when there is no proven need for them.

EPA's proposed disclosure program will qualify as a massive social change even without disclosing computation input data. That is particularly true given EPA's intention to make data readily available on the internet. This is unprecedented with respect to the volumes of detailed information currently proposed for release. Past non-CBI data has generally been available only through specific request rather than provided within an online searchable database as currently proposed.

Even given EPA's view of the world, there is no way to know now how or whether disclosure of computation inputs will be useful to the functioning of the program, how well the program will work without it, or how much demand for those inputs there will be. There is absolutely no good reason to move forward with required disclosure before waiting to see whether time will give us the answer to these questions.

VI. Nothing is Lost by Adopting AF&PA's Approach

AF&PA is **not** arguing for automatic trade secret status for emissions input information.

Instead, such information should be handled as it is at present. Once a company has made a trade secret claim, EPA should treat the information as trade secret until there is a public demand for it. Any such claim should then be decided through the established procedures.

No right of public access to input data that now exists would be lost under this approach. It would be more consistent with the law, principles of cost-benefit analysis, and the principles of sound policy embodied in Executive Order 12866 than EPA's proposed approach.

We recommend that the Agency adopt it.

Sincerely,

Paul Noe
Vice President
Public Policy

BEFORE THE UNITED STATES OF AMERICA
ENVIRONMENTAL PROTECTION AGENCY

Proposed Confidentiality Determinations for Data Required Under the Mandatory Greenhouse Gas Reporting Rule and Proposed Amendment to Special Rules Governing Certain Information Obtained Under the Clean Air Act	Docket No. EPA-HQ-OAR-2009-0924

COMMENT OF THE FEDERAL TRADE COMMISSION
September 30, 2010

Introduction

The Federal Trade Commission (FTC) appreciates the opportunity to submit this comment to the Environmental Protection Agency (EPA) on its proposed rule concerning confidentiality determinations for greenhouse gas (GHG) data.[1] On October 30, 2009, the EPA issued rules mandating that certain industries report data related to their GHG emissions.[2] The EPA now proposes to group that data into 22 categories and designate the confidentiality status of each category through rulemaking.

Three categories of data that the EPA proposes to make public contain potentially sensitive competitive business information: "inputs to emission equations," "unit/process 'static' characteristics that are not inputs to emission equations," and "unit/process operating characteristics that are not inputs to emission equations." These three categories include data on production, throughput, raw material consumption, capacity, and future operations. Public disclosure of such facility- and firm-specific sensitive

[1] 75 Fed Reg. 39094 (proposed July 7, 2010), *available at* http://edocket.access.gpo.gov/2010/pdf/2010-16317.pdf.

[2] Mandatory Greenhouse Gas Reporting Rule, 40 C.F.R. Part 98 (2009).

business information may make it easier for reporting companies to either tacitly[3] or explicitly coordinate their pricing decisions. This is especially true when certain market conditions are present, such as transparency, high concentration, impediments to entry, homogeneous products, and low elasticity of demand.[4]

Because many industries subject to the GHG reporting requirements share at least some of these market conditions, making confidential business information (CBI) public may lead to collusion that harms consumers through higher prices, decreased quality, and decreased innovation. Therefore, the FTC recommends that the EPA treat data that is an input to emission equations as confidential. The FTC also recommends that the EPA delay publication of any reported data concerning plant or unit capacity or future operating status until after reporting companies receive sufficient time to apply for confidential treatment. The competitive sensitivity of this data can vary by industry, which suggests that more information is needed to make a confidentiality determination.

Interest of the FTC

The Federal Trade Commission is an independent administrative agency charged with maintaining competition and safeguarding the interests of consumers.[5] As part of its competition mission, the agency often provides input to federal and state policymakers on

---

[3] Tacit coordination exists without any actual communication among competitors. *See, e.g. In re* High Fructose Corn Syrup Antitrust Litigation, 295 F.3d. 651, 654 (7th Cir. 2002) (a tacit agreement to fix prices is, "an agreement made without any actual communication among the parties to the agreement.").

[4] *See* U.S. DEPARTMENT OF JUSTICE AND FEDERAL TRADE COMMISSION, ANTITRUST GUIDELINES FOR COLLABORATIONS AMONG COMPETITORS §3.31(b) (2000) *available at* http://www.ftc.gov/os/2000/04 /ftcdojguidelines.pdf, [hereinafter FTC/DOJ GUIDELINES FOR COLLABORATIONS AMONG COMPETITORS].

[5] Federal Trade Commission Act, 15 U.S.C. § 45.

the competitive implications of proposed laws and regulations.[6] In its antitrust enforcement role, the FTC reviews mergers and challenges anticompetitive conduct across many industries that would be subject to the EPA's proposed rule on confidentiality, including petroleum refining, petrochemical production, natural gas processing, and other manufacturing industries, such as industrial gases and titanium dioxide production.[7] In addition, FTC staff regularly studies and reports on competition in the petroleum industry.[8]

In the course of this work, the FTC applies established legal and economic principles as well as empirical analysis and recent developments in economic theory to consider how market structure, transparency, and dynamics affect the ability of rivals to explicitly or tacitly coordinate their competitive responses.[9] In addition, the FTC has

---

[6] *See* FTC Office of Policy Planning, Advocacy Filings, *available at* http://www.ftc.gov/opp/advocacy_date.shtm.

[7] *See* FTC Competition Enforcement Database, *available at* http://www.ftc.gov/bc/caselist/industry/index.shtml.

[8] Representative reviews in the petroleum industry in which FTC determined that a merger presented a competitive problem, and significant structural relief was obtained, include *In re* Valero L.P., FTC Docket No. C-4141 (July 26, 2005) (divestiture of Kaneb terminal and pipeline assets in northern California, eastern Colorado, and greater Philadelphia area); *In re* Phillips Petroleum Co., FTC Docket No. C-4058 (Feb. 14, 2003) (divestiture of Conoco refinery in Denver, Phillips marketing assets in eastern Colorado, Phillips refinery in Salt Lake City, Phillips marketing assets in northern Utah, Phillips terminal in Spokane, Phillips propane business at Jefferson City and East St. Louis); *In re* Valero Energy Corp., FTC Docket No. C-4031 (Feb. 22, 2002) (divestiture of UDS refinery in Avon, California, and 70 retail outlets); *In re* Chevron Corp., FTC Docket No. C-4023 (Jan. 4, 2002) (divestiture of Texaco's interests in the Equilon and Motiva joint ventures, including Equilon's interests in the Explorer and Delta pipelines); *In re* Exxon Corp., FTC Docket No. C-3907 (Jan. 30, 2001) (divestiture of all Northeast and Mid-Atlantic marketing operations of the two parties and Exxon's Benicia, California, refinery). A listing of reports and other FTC activities involving the oil and gas industry is available at http://www.ftc.gov/ftc/oilgas /index.html.

[9] *See, e.g.,* U.S. DEPARTMENT OF JUSTICE AND FEDERAL TRADE COMMISSION, HORIZONTAL MERGER GUIDELINES §7 (2010) (describing anticompetitive effects of coordination among rivals), *available at* http://ftc.gov/os/2010/08/100819hmg.pdf [hereinafter FTC/DOJ HORIZONTAL MERGER GUIDELINES].

issued guidance addressing the harm to competition that can arise from collusion when competitors share sensitive business information.[10] The agency has raised these issues in antitrust enforcement actions as well.[11]

The EPA's Proposed Rule Regarding the Confidentiality of GHG Data

The EPA's Mandatory Greenhouse Gas Reporting Rule requires certain industries to submit data related to GHG emissions on an annual basis.[12] This data must include facility and unit identifier information, emissions, unit operating characteristics, unit and facility production, unit and facility inputs and quantities, and unit capacity utilization.[13] The EPA explains that these comprehensive, nationwide GHG data will provide a better understanding of the sources of GHGs, and will guide development of policies and programs to reduce GHG emissions.[14]

The Clean Air Act requires the EPA to make this data public unless they constitute confidential business information (CBI). The Clean Air Act also requires the

---

[10] FTC/DOJ GUIDELINES FOR COLLABORATIONS AMONG COMPETITORS §3.31(b) (discussing potential harms to competition when competitors exchange or disclose sensitive business information); *see also* DEPARTMENT OF JUSTICE AND FEDERAL TRADE COMMISSION, STATEMENTS OF ANTITRUST ENFORCEMENT POLICY IN HEALTH CARE, Statement 6 (Aug. 1996) (same); *available at* http://www.ftc. gov/bc/healthcare/industryguide/policy/hlth3s.pdf; Letter from FTC Staff to Sen. James L. Seward, New York Senate (Mar. 31, 2009) (disclosure of sensitive business data in one market segment may chill competition in multiple market segments); *available at* http://www.ftc.gov/os/2009/04/V090006newyorkpbm.pdf.

[11] *See, e.g., In re* National Association of Music Merchants, FTC Docket No. C-4255 (Mar. 4, 2009) (prohibiting information exchanges among music merchant competitors), *available at* http://www.ftc.gov/opa/2009/03/namm.shtml .

[12] 40 C.F.R. Part 98 (2009).

[13] For a complete list of reported categories of data, *see* 75 Fed. Reg. at 39097.

[14] *See* ENVIRONMENTAL PROTECTION AGENCY, FACT SHEET, MANDATORY REPORTING OF GREENHOUSE GASES (40 CFR PART 98), *available at* http://www.epa.gov/climatechange/emissions/downloads09/FactSheet.pdf.

EPA to release "emission data" even if that data is CBI.[15] The EPA thus explains that GHG data will fall into one of three confidentiality classes:

- "emission data" as defined by the EPA, which must be publicly released;
- non-emission data that does not amount to CBI and thus must be publicly released; and
- non-emission data that is CBI, which must not be publicly released.

Historically, the EPA evaluated whether information qualified for confidential treatment on a case-by-case basis, upon the request of the reporting company and subject to considerations of whether the disclosure would subject the reporter to business harm.[16] The EPA believes, however, that the volume of GHG data to be reported makes a case-by-case determination unduly burdensome for reporting companies and the agency. Moreover, the EPA states that the amount of time required for the agency to evaluate each confidentiality request would delay making the GHG data public and diminish its usefulness.[17] To address these concerns, the EPA's proposed rule groups GHG data into 22 data categories and identifies the confidentiality status (emission data, non-CBI, or CBI) of each category.[18]

Public Availability of Otherwise Confidential Business Information

---

[15] 42 U.S.C. §7414(c) ("Any records, reports or information obtained under [the Clean Air Act] shall be available to the public, except that upon a showing satisfactory to the Administrator by any person that records, reports, or information, or particular part thereof, (other than emission data) . . . if made public, would divulge methods or processes entitled to protection as trade secrets of such person, the Administrator shall consider such record, report, or information or particular portion thereof confidential . . . .").

[16] *See* 75 Fed. Reg. at 39101.

[17] *Id.* at 39102. Companies must annually report the previous year's data to the EPA by March 31st. The EPA plans to release public data after verifying it. *Id.* at 39106

[18] *Id.* at 39094.

The FTC commends the EPA's thorough and careful analysis identifying data that should be considered CBI or non-CBI. The FTC is concerned, however, that the proposal may allow for the public release of competitively sensitive information. Specifically, because of the potential risk to competition, we suggest that data reported under three categories – "inputs to emission equations," "unit/process 'static' characteristics that are not inputs to emission equations," and "unit/process operating characteristics that are not inputs to emission equations," – may warrant confidential protection.

Inputs to emission equations. The Mandatory Greenhouse Gas Reporting Rule lists methods for calculating GHG emissions depending on the source of the emissions. Many of these methods involve the use of specified emission equations requiring particular data inputs.[19] Inputs to emission equations include, for example, volume of fuel combusted per year; production/throughput and raw material consumption, such as petrochemical production; characteristics of raw materials, products, and by-products; and facility operating information.[20]

The EPA proposes to designate the data category "inputs to emission equations" as "emission data" under the Clean Air Act[21] even though the agency recognizes that much of the data falling within this category would otherwise be CBI. For instance, the

[19] 40 CFR Part 98. *See also* 75 Fed. Reg. at 39108. Often, the rule provides more than one calculation method and allows reporting facilities to select their preferred method. The EPA notes that in many cases, use of a "continuous monitoring system" reduces the number of data elements that a company must report compared to use of an emission equation. *Id.* at 39109.

[20] *See* 75 Fed. Reg. at 39108-09 (describing types of data that would fall within the "inputs to emission equations" data category).

[21] EPA regulations define "emission data" as "information necessary to determine the identity, amount, frequency, [and] concentration . . . of any emission which has been emitted by the source . . . ." 40 CFR 2.301(a)(2). The EPA considers inputs to emission equations to be "information necessary to determine . . . the amount" of any emission and, therefore, views such inputs as "emission data." 75 Fed. Reg. at 39109.

EPA has designated data on production, throughput, and raw materials consumed as CBI when not used as an input to an emission equation.[22] In doing so, the EPA recognized that an individual company could be harmed if rivals obtained the reported data, which could reveal strategic information on capacity, market position and costs.[23] Nevertheless, because "emission data" must be made public whether CBI or not, the EPA's classification of inputs to emission equations necessarily precludes protecting this information.

Unit/process "static" characteristics and unit/process operating characteristics that are not inputs to emission equations. By designating "unit/process 'static' characteristics that are not inputs to emission equations" as non-CBI, the proposed rule would make certain capacity information public. The EPA explains that much capacity information is already publicly available through other reporting programs, reference materials and industry publications, making its release here not harmful.[24] Although that may be true in some industries, there are others in which accurate capacity data is not publicly available. In those cases, capacity information can be competitively sensitive.

By designating "unit/process operating characteristics that are not inputs to emission equations" as non-CBI, the proposed rule could make future operating status information public. For instance, companies must report anticipated dates and steps for

[22] 75 Fed. Reg. at 39106 ("[r]ecognizing that the Inputs to Emission Equations Data Category may contain data elements that are considered sensitive by many businesses . . . .").

[23] *Id.* at 39115-16.

[24] *Id.* at 39112.

installing monitoring equipment.[25] This information could be sensitive when it alerts competitors that a production facility will be taken off-line.

The FTC is concerned that the EPA's proposal to designate "inputs to emission equations" data as public "emission data" and the EPA's characterization of certain capacity and operational status information as non-CBI could injure consumers by harming market competition (not merely individual competitors).[26] Sharing highly sensitive data under the auspices of a government-mandated reporting program may be as likely to lead to anticompetitive behavior as sharing that data by private agreement.

Competition Policy Concerns When Rivals Share Information

In some cases, sharing information among competitors may increase the likelihood of collusion or coordination on matters such as price or output.[27] Coordinated interaction among competitors includes collusive agreements, but it can also include conduct not necessarily condemned by the antitrust laws.[28] Firms that engage in coordinated interaction are better able to predict, even absent explicit agreement, how

[25] *Id.* at 39113.

[26] FTC has recognized that information exchange facilitated by a merger in otherwise concentrated petroleum markets can by itself lead to anticompetitive effects. *See In re* TC Group, L.L.C., FTC Docket No. C-4183 (Jan. 25, 2007) (acquisition of partial interest in two of three independent terminaling companies in the southwestern United States could cause anticompetitive effects due to information exchange); *In re* Chevron Corp., FTC Docket No. C-4144 (June 10, 2005) (Chevron's acquisition of Unocal's reformulated gasoline patents would allow Chevron greater opportunity than Unocal would enjoy alone to coordinate with refining competitors to raise the price for reformulated gasoline).

[27] FTC/DOJ GUIDELINES FOR COLLABORATIONS AMONG COMPETITORS §3.31(b).

[28] This includes parallel accommodating conduct by rivals in which "each rival's response to competitive moves made by others is individually rational, and not motivated by retaliation or deterrence, nor intended to sustain an agreed-upon market outcome, but nevertheless emboldens price increases and weakens competitive incentives to reduce prices or offer customers better terms." FTC/DOJ HORIZONTAL MERGER GUIDELINES §7.

rivals will react to price changes.[29] The antitrust agencies have explained how coordinated interaction harms consumers: "[c]oordinated interaction involves conduct by multiple firms that is profitable for each of them only as a result of the accommodating reactions of the others. These reactions can blunt a firm's incentive to offer customers better deals by undercutting the extent to which such a move would win business away from rivals. They also can enhance a firm's incentive to raise prices by assuaging the fear that such a move would lose customers to rivals."[30]

The potential for information disclosure to harm competition will depend on the structure of the affected market and the type of information disclosed.[31] The ability of rival firms to engage in coordinated conduct depends on the strength and predictability of rivals' responses to price change or other competitive initiative. Markets are more vulnerable to coordinated conduct if each firm's rivals can promptly and confidently observe its behavior. Market factors that support this ability and increase the likelihood of coordination include transparency, concentration, entry barriers, homogeneous

---

[29] The FTC recognizes that rivals in the petroleum and other industries collect market intelligence to anticipate and respond to rivals' output and pricing decisions. *See, e.g., In re* Chevron Corp., FTC Docket No. C-4023, Analysis of Proposed Consent Order to Aid Public Comment (Sept. 7, 2001) ("Integrated refiner-marketers carefully monitor the prices charged by their competitors' retail outlets, and therefore can readily identify firms that deviate from a coordinated or collusive price.").

[30] FTC/DOJ HORIZONTAL MERGER GUIDELINES §7.

[31] *See* Todd v. Exxon Corporation, 275 F.3d 191, 199 (2d. Cir. 2001) (quoting U.S. v. United States Gypsum Co., 438 U.S. 422, 441 n. 16 (1978)) ("A number of factors including most prominently the structure of the industry involved and the nature of the information exchanged are generally considered in divining the procompetitive or anticompetitive effects of [the information disclosed.]"); *see also* FTC/DOJ GUIDELINES FOR COLLABORATIONS AMONG COMPETITORS §3.31(b).

products, and low elasticity of demand.[32] Many of these market factors are present in industries covered by the EPA's rule.[33]

Information disclosures raise particular competitive concerns when the information contains details about output, production capacity, production rates, current price and cost data, and other business plans.[34] Disclosure under the proposed rule of the "inputs to emission equations," which can reveal capacity and capabilities, other capacity information, and forward-looking operational status would increase transparency in the affected industries. In many instances, the actual output of a unit could be made public. In other cases, the amount of feedstock used, the intermediate product produced, or the

---

[32] FTC/DOJ HORIZONTAL MERGER GUIDELINES §7.

[33] For instance, in relevant geographic markets with few players, the FTC has expressed concerns about mergers or acquisitions in the petroleum industry that would reduce the number of competitors necessary to engage in tacit or overt collusion. *See, e.g.*, *In re* Dan Duncan, FTC Docket No. C-4173, Consent Agreement and Order (2006) (in merger matter, consent agreement ordering divestiture of certain pipeline assets related to salt dome storage for natural gas liquids in Mont Belvieu, Texas – a concentrated market with high barriers to entry – in order to protect competition in that region), *available at* http://www.ftc.gov/os/caselist/0510108/ 0510108.shtm; *In re* Dow Chemical, FTC Docket No. C-4243 (2009) (consent agreement regarding Dow Chemical's acquisition of Rohm and Haas, which implicated glacial acrylic acid, butyl acid, ethyl acrylate, acrylic latex polymers for traffic paint, and hollow sphere particles throughout North America – all concentrated markets with high barriers to entry), *available at* http://www.ftc.gov/os/ caselist/0810214/index.shtml; *In re* BASF, Inc., FTC Docket No. C-4253 (2009) (in a merger involving the production of pigments globally – a concentrated industry with high barriers to entry – FTC ordered BASF to maintain the viability of certain assets so as to preserve competition in the relevant market). Additional examples of FTC orders involving industries subject to the GHG reporting requirements may be obtained through the FTC Competition Enforcement Database, *available at* http://www.ftc.gov/bc/caselist/industry/ index.shtml.

[34] *See* FTC/DOJ GUIDELINES FOR COLLABORATIONS AMONG COMPETITORS §3.31(b) (describing potential harm to competition when firms disclose competitively sensitive data); *see also* Susan S. DeSanti and Ernest A. Nagata, *Competitor Communications: Facilitating Practices or Invitations to Collude? An Application of Theories to Proposed Horizontal Agreements Submitted for Antitrust Review*, 63 ANTITRUST L.J. 93 (1994) (describing activities that make it easier for parties to coordinate on price or engage in tacit collusion).

unit's capacity would be made public.[35] As a result, collusion or coordination could become more likely as firms are better able to predict one another's behavior.

For example, improved information on the capacity and capabilities of a rival's facility can make it easier for a firm to anticipate how the rival will react to any strategic changes it makes. More information about a rival's output also will increase a firm's ability to detect when a rival deviates from the agreement, which need not be explicit. In contrast, without output information, it would be difficult for a firm to determine whether a price decrease is due to a fall in overall market demand or an increase in output from a rival deviating from the agreement.

Improved information can lead to better coordination even when there is a gap in time between the reported conditions and the availability of the information. Competitors having capacity information that is one or two years old may be able to discern that capacity has not changed significantly in that time. As a result, publishing capacity data that is several years old could improve competitors' estimates of current capacity. The information on operating conditions, inputs, and outputs that would be made public through disclosure of "inputs to emission equations" data could also give a firm added insight into its rivals' cost structures.

In addition to increasing the likelihood of collusion, this information can decrease the competitiveness of a bidding process. In this case, the disclosed information can allow a firm to better anticipate rivals' bids, which may lead it to bid less aggressively, resulting in increased prices. Therefore, disclosed information that would allow rivals to

---

[35] *See* Memorandum, Data Category Assignments for Reporting Elements, EPA No. EPA-HQ-OAR-2009-0924, *available at* http://www.epa.gov/climatechange/emissions/downloads10/CBI_Data-Category.pdf.

learn more about the underlying costs of their competitors has the potential to harm competition and consumers through higher prices. This can be true even when the information is one or two years old in industries where firms do not regularly upgrade their facilities. If a unit has not been upgraded, the underlying economics of the unit are unlikely to change and therefore the public release of older data may still threaten competition.

Designating Data as CBI

Because the disclosure of competitively sensitive business information can have adverse consequences for consumers, the FTC urges the EPA to consider the implications for competition when it decides what data should be publicly released under the proposed rule. Specifically, the FTC urges the EPA to consider designating as CBI – at least initially – "inputs to emission equations," which can reveal capacity, capacity information in the data category "unit/process 'static' characteristics," and forward-looking operational information in the data category "unit/process operational characteristics." The EPA can then determine the confidentiality status of those data elements whose competitive sensitivity varies by industry.

The EPA may wish to consider an interpretation of "emission data," as that term is used in the Clean Air Act and defined by EPA regulation, that allows the agency to classify inputs to emission equations as CBI.[36] EPA regulations define "emission data" as "information necessary to determine the . . . amount . . . of any emission . . . ."[37]

---

[36] The EPA is seeking comment on its proposed interpretation of the term "emission data" to include data that are required to perform emission calculations specified in the Mandatory Greenhouse Gas Reporting Rules. 75 Fed. Reg. at 39101, 39105.

[37] 40 C.F.R. 2.301(a)(2). The EPA proposes that the inputs to the equations are "necessary to determine" the amount of emissions. 75 Fed. Reg. at 39105.

Inputs to the emission equations may not be "necessary to determine" the amount of emissions because EPA will be releasing the verified amounts to the public.[38] Assuming this interpretation of "emission data" is consistent with the Clean Air Act, classifying inputs to emissions equations as CBI would be an effective way to balance the Act's policy goals of promoting transparency and protecting competition. Publicly releasing the verified, total amount of emissions by unit would achieve the Act's purpose regarding public disclosure, while keeping sensitive business information confidential would achieve the Act's stated goal of protecting CBI. The Commission urges the EPA to interpret the Clean Air Act and related regulations in a way that gives sufficient weight to the Congressionally-authorized goal of protecting market competition for the benefit of consumers.[39]

Capacity and operational data are also potentially competitively sensitive, but the EPA may need more specific information about how competitors might use such information in a particular industry before determining whether it is CBI. For that reason, the EPA may wish to consider delaying a decision on publication of these categories until reporters can provide better information on the impact of making them public and the need for confidentiality in particular industries. If the EPA were to treat the capacity data as confidential, the information might be made publicly available in

---

[38] *See* Natural Resources Defense Council v. Leavitt, Civ. No. 04-01295, 2006 WL 667327, at *4 (D.D.C. 2006) ("[S]trict interpretation of the 'necessary to determine' requirement [for emission data] is warranted in order to ensure that the exception does not swallow the rule.").

[39] The Congressionally authorized goal of protecting competition can be seen in the Clean Air Act's protection of CBI and the federal antitrust laws' prohibition against data sharing that facilitates explicit or tacit collusion and harms consumers. *See* Todd, 275 F.3d at 198-99 (explaining that information exchange among competitors can constitute an antitrust violation even absent an explicit agreement among them).

nationally aggregated form.[40] Delaying release of the data for an extended period could also alleviate competition concerns, but only if the historical data no longer reflected current capacity or current plant capabilities.

[40] It is important to keep in mind that there may be few firms in some geographic regions or in some industries, which would raise the concern that publishing even aggregate data might decrease competition. The Energy Information Administration developed rules to make the public release of data less likely to lead to such undesirable results. *See* U.S. ENERGY INFORMATION ADMINISTRATION, DISCLOSURE POLICY FOR EIA POWER SURVEYS, (updated June 30, 2010) (explaining that certain firm-specific data will not be disclosed), *available at* http://www.eia.doe.gov/electricity/forms/sselecpower98.html.

W-12

Caudill, Neil (ECY)

From:	Terri Glaberson [terri@coolmom.org]
Sent:	Thursday, October 14, 2010 3:16 PM
To:	Caudill, Neil (ECY)
Subject:	ghg emissions ruling
Attachments:	CoolMom letter to Dept of Ecology ghg rule.docx; ATT2641886.htm

Dear Mr. Caudill,

I have embedded my comments in the email and also attached the letter in a doc format on proposed rule text, reporting emissions of GHG.

Please contact me if you have any questions.

thank you

Terri Glaberson, Executive Director, CoolMom.org

206-280-2828

October 14, 2010

Neil Caudill
Air Quality Program
Washington Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600
e-mail: neil.caudill@ecy.wa.gov

Subject: Comments to Washington Department of Ecology – Proposed Rule Text, Reporting Emissions of Greenhouse Gases, Chapter 173-441 WAC

I appreciate the opportunity to comment on the proposed rule text on Reporting Emissions of Greenhouse Gases. As Director of CoolMom.org, representing over 900 members, we **strongly oppose the proposed three-year delay of the reporting program and urge the Department of Ecology to proceed with requirements for emissions reporting to begin in 2010, or as soon as possible thereafter, given rulemaking timelines.**

The reporting rule is a critical component of Washington State's commitments to reduce greenhouse gas emissions, as required by statute and reaffirmed by Governor Gregoire's May 2009 Executive Order titled Washington's Leadership on Climate Change. It is difficult to understand how state-level leadership to reduce global warming pollution can proceed without the foundation of information that emissions reporting provides.

Delaying the start of greenhouse gas (GHG) reporting until 2013 is inconsistent with Washington's two laws that establish a reporting program. Additionally, we can't afford to put off this critical piece to addressing emissions in our State. Our children are counting on us to do the right thing. Can you ensure that our government in Washington State does the right thing?

While we understand that there may be technical issues to sort out with the Environmental Protection Agency regarding the interface between state and federal reporting data, Oregon is on schedule to implement its reporting program this year, suggesting that such problems have been solved in other jurisdictions. CoolMom members are counting on Washington Department of Ecology to help stand up for reduced emissions and the health our children.

Thank you for your attention to these comments. We would appreciate a response describing how the Department intends to proceed with GHG rulemaking.

Sincerely,

Terri Glaberson
Executive Director, CoolMom
terri@coolmom.org
206-280-2828

U-13

Caudill, Neil (ECY)

From: Senior Resources [guide@olypen.com]
Sent: Friday, October 15, 2010 2:31 PM
To: Caudill, Neil (ECY)
Subject: Proposed Port Townsend Biomass Incinerator

Dear Neil Caudill--

The proposed biomass cogeneration plant at the Port Townsend Paper Mill, close to a dense population and critical facilities, is unfortunate.

This biomass plan would be sustained with "corporate welfare" and not otherwise feasible. And, as the proposed plant is a profit driven

enterprise, its primary responsibility would be to shareholders – not neighbors. This is a classic instance of a profit focus that would harm people.

In addition, "fugitive emissions" resulting from delivery and handling of wood and ash have proven to be a serious problem at similar plants.

As at least a half-dozen of these plants are slated for the Olympic Peninsula there is, of course, a concern that there's not enough wood

"waste" to sustain these burners. "Carbon neutral" is a myth — once wood is burnt, a portion lingers in the breathable atmosphere

for decades, even centuries. Indeed, Henry Ford's Model T emissions are still being inhaled!

Thank-you for taking our concerns seriously.

--Stephen Boyd

P.O Box 1717

Port Townsend, WA 98368-0160

—Elaine Phillips

P.O. Box 1717

Port Townsend, WA 98368-0160

W-14

DEPARTMENT OF THE AIR FORCE
REGIONAL ENVIRONMENTAL COORDINATOR REGION 10
SAN FRANCISCO, CALIFORNIA 94105-2230

14 October 2010

Mr. Neil Caudill
Washington Department of Ecology
P.O. Box 47600
Olympia WA 98504-7600

Dear Mr Caudill

As the Department of Defense Regional Environmental Coordinator for Region 10 (REC 10), I have consulted with Department of Defense (DoD) installation, regional, and headquarters program managers and advisors in the review of proposed Chapter 173-441 WAC, establishing mandatory Greenhouse Gas (GHG) reporting pursuant to RCW 70.94. We appreciate that our comments previously submitted on 16 June 2009 and 12 November 2009 have been incorporated by the Department of Ecology in the current proposed rule making and we support their inclusion in the final rule.

The DoD has a strong commitment to GHG emission reduction goals and in accordance with Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance, released the "Department of Defense Strategic Sustainability Performance Plan" (SSPP) on 26 August 2010. Objective 2 of this plan states the DoD is a U.S. government leader in reducing greenhouse gas emissions and is committed to reducing GHG emissions from Scope 1 and Scope 2 sources by 34 percent by FY 2020, relative to levels in FY 2008. As per Section 19(h) of EO 13514, emissions from any vehicle, vessel, aircraft, or non-road equipment owned or operated by DoD that is used in combat support, combat service support, tactical or relief operations, or training for such operations are excluded from Department reduction targets. However, the Department recognizes that significant reductions can be achieved in these systems and is committed to taking advantage of these opportunities. The Department is committed to conducting a comprehensive GHG inventory, starting with FY 2010.

I would like to thank your office for working diligently with my staff to incorporate our comments. If you or your staff have any questions please contact Robert Shirley at robert.shirley@us.af.mil or 415-977-8886 or Scott Dickinson at scott.dickinson@brooks.af.mil or 415-977-8890.

Clare R. Mendelsohn

CLARE R. MENDELSOHN
Director, Air Force Western Regional Environmental Office DoD Regional Environmental Coordinator, Region 10

cc Army Western Regional Environmental and Government Affairs Office (Brad Wright)
Navy Region NW, N40 (Renee Wallis)
US Coast Guard (Jack Hug)

Appendix B: Transcripts from public hearings.

Spokane, WA – October 6, 2010

The Air Quality Program conducted a public hearing for Chapter 173-441 WAC, Reporting of Emissions of Greenhouse Gases, on October 6th, 2010 at Ecology's Eastern Regional Office in Spokane, Washington. Kendra Robinson-Harding and Neil Caudill from Ecology were present. A total of 10 people were in attendance. No one chose to give oral testimony at the hearing.

Lacey, WA – October 7, 2010

The Air Quality Program conducted a public hearing for Reporting of Emissions of Greenhouse Gases on Thursday October 7, 2010 at Ecology's Headquarters. Neil Caudill, Tami Dahlgren, Nancy Pritchett were present. A total of 10 people were in attendance. A total of one testimony was given.

Rashad J. Morris, Washington Environmental Council:

Thank you. My name is Rashad Morris. I'm here to testify on behalf of the Washington Environmental Council. I'm gonna keep my statements rather brief right now because the environmental council will be submitting written statements later. But I just wanted to indicate that the environmental community in general and the Washington Environmental Council in particular is disappointed that the Department of Ecology is delaying this reporting when the initial statute was passed in 2008 that should have put everyone on notice that greenhouse gas emissions would be required to be reported. When the governor issued executive orders in both 2007 and 2009 and once again gave proper notice to emitters and others that they should start at least collecting the data and being prepared to deliver it.

It also should have given the Department of Ecology notice that they needed to start preparing to receive and deal with the data. And then in 2010 when the legislature passed Engrossed Second Substitute Senate Bill 6373, it required that emissions reporting begin in 2010 for 2009 emissions.

And it's disappointing that ecology and its submittal to the code reviser indicated that the soonest they can have an effective date for a rule was 2011.

So I strongly urge the Department of Ecology, and the environmental council strongly urges the Department of Ecology to make haste and do whatever is necessary to get their systems in place todeal with the data that needs to be received. Because it's very important that we start collecting data on emissions so that we can move forward with regulating emissions for the health of Washingtonians, especially the health of Washington's children, and for the development of the clean and efficient economy that we're constantly being promised. Ecology has a role in that and the environmental community and the Washington Environmental Council looks forward to working with ecology going forward. Thank you.