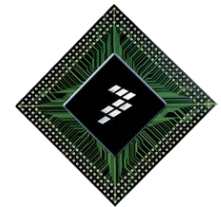




Go Green, Live Healthy, Be Safe

## GHG Update

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# GHG Regulations (EPA)

- GHG Reporting Rule
  - Promulgated for most sectors. Re-proposed for semiconductor
- Endangerment Finding
  - GHGs are a threat to public health & welfare
- Interpretation Rule
  - If GHGs regulated from any source, will be for all sources
- Tailoring Rule
  - Modify “major source” thresholds for pollutants in Clean Air Act to allow for “manageable” GHG emissions regulation
  - Federal permitting (Title V) and New Source Review/PSD (Prevention of Significant Deterioration)

# GHG Reporting Rule - Reproposed

- Gas Consumption Tracking
- Burden and Cost of Apportioning Gas Consumption to Separate Process Categories
- Uncertainty Analysis Does not Support Using Nine Process Categories over Tier 2(b) Emission Factors
- POU Abatement Characterization and Tracking Requirements vs. Default DRE of 60%
- Underestimated Compliance Costs
- Information on Gas Emissions for Separate Process Categories is Highly-Sensitive

# Gas Consumption Tracking

➤ Adoption of Cylinder-Specific Heel Factors is an improvement, but Re-proposal has additional burdens associated with operational tracking

- Inventory
- 1% trigger recalculation
- 20% trigger deviation for cylinders
- 1% full-scale accuracy of instrumentation
- “Calibration” of instrumentation required

# Burden and Cost of Apportioning Gas Consumption to Separate Process Categories

- Tremendous burden and cost to apportion
- Nine Process Categories (3 CVD, 4 etch, 2 clean)
- Requirement for Quantifiable Indicators of gas usage
- Most PFC gas usage is in CVD chamber clean
  - Tier 2(b) does distinguish in-situ vs. remote NF3
- Complexity in etch by film categories

# Uncertainty Analysis Does not Support Using Nine Process Categories over Tier 2(b) Emission Factors

- Only one sample of gas usage distribution used
  - Remote NF3 was only CVD usage
- Underestimated relative error used in analysis
- Validity of claim that 9 categories reduces uncertainty by 50% over Tier 2(b)
  - Clear acknowledgement that most of uncertainty reduction attributed to remote NF3
- Relative errors for chamber clean emission factors have been greatly reduced – but factors have not changed (Tier 2b)

# POU Abatement Characterization and Tracking Requirements vs. Default DRE of 60%

- Tier 2b default DREs cannot be used
- Supplier-provided DREs likely cannot be used
- RSASTP – 20% of units tested each year
- DRE must be measured using EPA Protocol
- Specific requirements to allow for DRE
  - Certification to manufacturer specifications & PFC use
  - Uptime
- 
- EPA 60% default unreasonably low

# Underestimated Compliance Costs

- EPA estimate of \$31K per facility (\$2.55M total)
  - Labor alone estimated to be 5X +
- No associated capital or O&M costs
  - Estimated total \$50M +
- POU Abatement testing cost > 4.4 X the EPA estimate

# Information on Gas Emissions for Separate Process Categories is Highly-Sensitive

- GHG usage and emissions by process is highly sensitive
  - Provides specific knowledge of proprietary device design and manufacturing processes
- By requiring emissions reporting on nine separate process categories, the Re-Proposed Rule would require disclosure of even more detailed and sensitive information than the originally proposed Rule.

# SIA Proposed Alternatives

- Gas-Specific Consumption Factors
- Facility-Wide Apportioning Protocol
- 6 Process Categories (no further delineation in etch)
- Tier 2b Factors where Available – then EPA NODA (Notice of Data Availability) for 2 new categories
- Abatement Default Factors – based on installed capabilities or otherwise reasonable sampling protocol

# Tailoring Rule

- EPA raised thresholds from original 25,000 tpy CO<sub>2</sub>e
  - 100,000 tpy CO<sub>2</sub>e PTE (potential to emit) “major” source
  - 75,000 tpy CO<sub>2</sub>e PTE significance level
  - Note that PTE for most fabs is >> actual CO<sub>2</sub>e emissions
- Implementation phases (Title V permit)
  - January 2, 2011 – facilities that are already “major” sources for conventional pollutants
  - July 1, 2011 – facilities that are not currently “major” sources (but trigger above GHG threshold)
  - Facilities have 12 months to submit “administratively complete” Title V permit applications once “subject to regulation”
  - Fabs not currently major sources delayed 6 months

# Tailoring Rule: Title V

- Rule will shift most fabs from “minor” to “major” source status under Clean Air Act
  - 80% of SIA members newly subject to Title V permit requirements
  
- Due to absence of any current GHG “applicable requirements”
  - Would create Title V “major source” permit at conventional pollutant “minor sources” not subject by statute to Title V
  - Would extend compliance assurance requirements to GHGs in potential conflict with
    - Current GHG Reporting Rulemaking
    - PFC Emissions Reduction Partnership
  
- Federal Enforceability
  - Serious burdens to establish for GHG POU abatement voluntarily installed on hundreds of individual “tools”

## Tailoring Rule: PSD/NSR

- Typical facility likely to trigger multiple times per year due to industry's technologically dynamic nature
  - Including “modifications” and “construction”
- Complex and novel questions raised under traditional netting rules
  - “Net” past decreases vs. planned “increases” as applied to hundreds of process tools, along with boilers/generators
  - Complexity grows if multiple fabs at a “facility”
  - “Aggregation” and “debottlenecking” as applied to “recipe” changes and tool relocation
- Shift will stifle innovation and hamper competitiveness due to **current lack of**
  - “Major source” PALs (Plant-wide Applicability Limits) and other flexibility measures
  - BACT (Best Available Control Technology) guidance/experience
  - Standard testing/monitoring

# Tailoring Rule: Flexible Permitting

- Many states / local agencies have not yet adopted PALs for “major” sources
  - Only 3 of 13 states with SIA fabs have SIP-approved PALs
  - No assurances that PALs will be adopted for GHGs
- Even where available, developing a PAL for a particular source takes significant time
  - PAL development generally requires 18-24 months
  - Could take even longer now due to greatly increased permitting demands on states

# Tailoring Rule: SIA Path Forward

- Work with EPA OAQPS (Office of Air Quality Planning & Standards) to develop implementation guidance for States specifically for semiconductor industry
  - What constitutes BACT for us
  - Encourage expeditious adoption of PALs
  - Potential role for NSPS (New Source Performance Standards)

- House passed GHG “Cap & Trade” Legislation in June, 2009
- Senate version passed Committee October, 2009 , but no further action
- Outlook now complicated for energy & climate legislation
  - Senate wants “Energy Bill” by mid-July but no clear path forward
  - Several legislative options on table
    - Kerry-Lieberman
    - Bingaman-Murkowski
    - Cantwell-Collins
    - Lugar
  - Oil spill legislation may be a Senate vehicle to move forward on energy and/or climate – or stand alone

- Murkowski Resolution sought to nullify EPA's Endangerment Finding & Tailoring Rule
  - Failed 47 – 53
  
- Rockefeller Resolution seeks to defer most of Tailoring Rule (suspends EPA action) for 2 years for stationary sources
  - Light Duty Vehicle Rule moves forward
  - Reporting Rule remains in force
  - Currently only CO<sub>2</sub> and methane – but Staff willing to cover all high GWP gases (SIA lobby)
  - May be rolled into larger Energy bill – or stand alone