

# SIA Update – PFOS and PFCs/GHGs

Laura Mendicino  
Freescale Semiconductor



# SIA EHS Structure

The Semiconductor Industry Association (SIA) has formed a World Semiconductor EHS Task Force with members from many SIA companies

Purpose is to represent the US industry at the WSC level as well address issues at the domestic level

This Task Force has 4 topic-specific committees (aligned w/WSC)

- PFC MOU Committee

- PFOS Committee

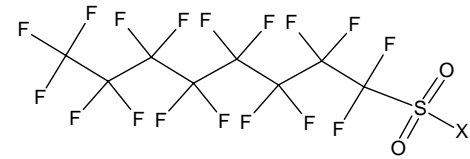
- Quantitative Targets Committee

- Energy Committee

Other issues/topics are addressed as needed

# PFOS Background

PFOS is a persistent, bioaccumulative toxin



PFOS was first restricted in the US under TSCA SNUR (Significant New Use Rule) provisions (2002)

SIA and SEMI secured exemptions from the USEPA for critical photolithography applications via a Voluntary Agreement

- non-critical uses would be phased out (most have done this)
- PFOS alternatives would be developed for long-term
- no releases to the environment – incineration only

World Semiconductor Council adopted the same Voluntary Agreement in 2006 (Europe, Japan, Korea, China, Taiwan)

# Current PFOS Restriction Status

The UN has proposed a ban on PFOS as a Persistent Organic Pollutant (POP) that is preceded by 2 regulatory activities

- Long Range Transboundary Air Pollution (LRTAP) Treaty

- Stockholm Convention on POPs

PFOS could be banned from manufacture, use or both in the signatory countries (some exemptions may be allowed)

LRTAP will be decided by December, 2008 (still unresolved as of latest working group mtg in Geneva). Stockholm will likely follow LRTAP lead and will be finalized in May, 2009. Phase-out periods (manufacture or use) under Stockholm will be only months, not years.

**\*\*The Japanese Chemical Substance Control law is *currently* structured such that if a chemical is part of the Stockholm Convention, *it will be banned for manufacture or use in Japan regardless of any exemptions allowed.***

# Current PFOS Restriction Status

JEITA (SIA-equivalent) has petitioned to METI (EPA equivalent) to allow a provision for exemptions in the Japanese Chemical Substance Control Law. Status and likelihood of such a provision is not yet known but JEITA is hopeful.

2 of the 4 major Japanese resist suppliers have production operations in other countries, including the US (FujiFilm & JSR). RHEM also has manufacturing in Japan as well as the US. If critical use exemptions are allowed in LRTAP and/or Stockholm, production could be moved to countries with exemptions to “buy time” for continued use.

# Current PFOS Restriction Status

Resist/arcs manufactured only in Japan are at risk. Depending on the outcomes of LRTAP and Stockholm, all PFOS-containing resists/arcs could become unavailable.

Regardless of any exemptions allowed, the long term prognosis for PFOS-containing resists/arcs is that they will ultimately be banned. The question is timing.

Most resist suppliers have developed non PFOS-containing alternatives for their existing products and are not using PFOS in their newer offerings. Most semiconductor companies are working towards phase-out.

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Greenhouse Gases (GHG) Emissions are growing global concern

PFCs used in semiconductor manufacturing are suspected to contribute to global warming

Intergovernmental Panel on Climate Change determines Global Warming Potential (GWP) of gases like PFCs relative to CO<sub>2</sub> (in carbon dioxide equivalents)

Many voluntary and regulatory programs world-wide (in various stages) to reduce GHG emissions

# Kyoto Protocol

It all began with the United Nations Framework Convention on Climate Change (Kyoto Protocol)

Adopted in 1997

Effective February, 2005

Includes CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, SF<sub>6</sub>, HFCs, PFCs (not NF<sub>3</sub>)

182 parties (countries) have ratified

Developed countries required to reduce GHG emissions

Undeveloped countries only required to report GHG emissions

The US has NOT ratified

# SIA MOU with USEPA

Many US-based semiconductor entered into a voluntary agreement with the USEPA to reduce PFC emissions by 10% (absolute) over a 1995 baseline by 2010

First MOU executed in 1996

MOU 2 re-affirmed commitment in 2000

Includes  $\text{CF}_4$ ,  $\text{C}_2\text{F}_6$ ,  $\text{C}_3\text{F}_8$ ,  $\text{C}_4\text{F}_8$ ,  $\text{CHF}_3$ ,  $\text{SF}_6$  and  $\text{NF}_3$

Emissions are reported in MMTCE (million metric tons of carbon equivalents) to USEPA via a third party (company identity protected)

# WSC Voluntary Agreement

Following the SIA lead, the World Semiconductor Council then established Voluntary Agreement with all members in 1999. Each SIA (US, Korea, Japan, Europe, China, Taiwan) have their own VA with their respective countries

Same 10% reduction commitment, but some different baseline years established

China recently joined the WSC so their VA is not yet solidified

Emissions (MMTCE) are rolled up annually to the WSC thru the individual SIAs

# Post 2010 Voluntary Agreement

The SIAs are now in discussions for what a post-2010 program might be (including the US via the SIA PFC MOU committee)

Needs to be consistent among the SIAs if it is to be adopted at the WSC level

Some considerations for a post-2010 VA

- Expand to current non-WSC member companies?

- Absolute reduction target?

- Normalized emissions reporting?

- Different expansion cycles for different regions?

- Timeline?

- Calculating and reporting methodologies

# USEPA GHG Regulation

FY2008 Consolidated Appropriations Act included a provision to develop a MANDATORY GHG reporting rule for all sectors of the economy using the existing authority under the Clean Air Act

Data collection and reporting from stationary or mobile sources, upstream and downstream sources

Proposed rule in September, 2008 with final rule by June, 2009

Includes CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFC, PFC, SF<sub>6</sub>

Flexibility in threshold for reporting and frequency of reporting

Build on methods from existing programs (Climate Leaders, WRI/WBCSD [IPCC], other industry protocols)

## California AB-32

The California Global Warming Solutions Act of 2006 (AB-32) requires California to return its GHG emissions to 1990 levels by 2020

In October, 2007 the California Air Resource Board (CARB) approved a final list of Discrete Early Action Measures

- Supposed to achieve the “[1] maximum technologically feasible and [2] cost effective reduction in GHG emissions”
- Reduction of PFCs in semiconductor industry has been targeted as a discrete early action measure

The Draft Scoping Plan suggested a regulatory process starting in 2008 with a compliance date of 2012 for the semiconductor industry with a total reduction of emissions that is still unclear

CARB also proposed a “performance standard for semiconductors and related devices” based on a per wafer basis

## Some Potential Concerns with AB-32

Lack of transparency of “data” CARB used to determine performance standard and costs associated with meeting their target (too low)

Proposed aggregate reduction is more aggressive than originally discussed

Separate performance standards for CVD and etch

Proposed reductions are **not** “cost effective” as required

There is no credit for voluntary measures (early reductions) already taken by SIA MOU companies

CARB seeks to ban use of SF<sub>6</sub> for chamber clean

CARB has stated that this regulation could be used as a model for any new national regulatory or voluntary program

## Other general concerns with PFC/GHGs

The July, 2008 report published by the EPA Office of Inspector General - “Voluntary Greenhouse Gas Reduction Programs have Limited Potential”

- Weakness in having MOUs – they do not establish consequences for failure to report or actively participate
- MOUs do not provide provisions for EPA to independently verify data

Will future Voluntary Agreements help avoid regulation (state or federal) or allow for early action credit?

Western Climate Initiatives Partners

One proposed approach is to regulate gas suppliers and cap production of PFCs

SIA committees continue to monitor the regulatory outlook that does or could impact the semiconductor industry

SIA may provide comments on proposed legislation as an industry association rather than individual companies where appropriate

SIA is working with CARB on the final outcome of AB-32 for our industry

SIA (and other WSC member organizations) exploring a post 2010 Voluntary Agreement for PFCs