

WSC/SEMI AGREEMENT FOR PFOS

Voluntary Semiconductor Industry Commitment

Background

Perfluorooctyl sulfonates (PFOS) play an important role in photoresists (resists) and antireflective coatings (ARCs) used in semiconductor manufacturing. Resists are patterned by optical lithography and the resist patterns are then transferred into the semiconductor chip by a variety of techniques to form the tens of millions of conductors, insulators, and transistors that make up a single integrated circuit.

A modern integrated circuit uses resist patterns a dozen or more times before the circuitry is complete. Resists that contain PFOS produce the millions of tiny features (<250nm in size) which are essential to the speed and compact size of today's microprocessors and memory chips. By extension the vigor of the electronics and communications industries depends on them too.

Electronic devices are core technologies in our society. Besides their importance in computing and telecommunications, they are increasingly important in all aspects of manufacturing and service industries. As an example, microprocessor technologies have been essential to advances in medicine, powering innovations in genetic screening of drugs, analysis of body functions and tomography. Environmental objectives are also served by advances in monitoring technologies, energy efficiency, environmental forecasting, and industrial process efficiency that depend on innovations in electronics.

PURPOSE

This document represents a voluntary, industry-wide commitment and, as such, is not meant to commit any one company to a specific course of action. This document is designed to commit the industry as a group to actions set forth below regarding PFOS and alternatives. The WSC will develop protocols for implementation of the commitments and intentions to ensure consistent approach and reports. Furthermore, WSC associations will promote this activity within their member companies. In addition, it is expected that new WSC member associations will adopt and endorse this agreement.

INTRODUCTION

The semiconductor industry is the world's most innovative industry. Over the last forty years its average annual growth has exceeded all other industry sectors. Semiconductors are the key components of electronics, which permeate all industries.

Growth and technological progress drive the semiconductor industry to be proactive: to anticipate, and avoid problems rather than correcting problems. The semiconductor industry has established an excellent Environmental, Safety and Health (ESH) performance record. The industry wants to continue to be proactive in these areas. Therefore the WSC ratified the "Guiding Principles"¹ in anticipation of future needs and to reinforce our leadership position. In accordance with scientific findings, we will make appropriate investments in support of our commitments. Similarly, SEMI (the global suppliers to the semiconductor industry) created the Global Care initiative.²

Photolithography

Photolithography is one of the most important processes in semiconductor manufacturing. The most critical need in photolithography is to be able to develop increasingly smaller features on the surface of a silicon wafer. Small feature development currently requires the use of chemicals which contain certain fully fluorinated materials in photo-acid generators (PAGs) and anti-reflective coatings (ARCs). The most common fluorinated material has historically been perfluorooctyl sulfonate (PFOS).

The semiconductor industry is working toward elimination of PFOS in certain photolithography materials where substitutions are available. However, technical findings indicate that substitution alternatives that are not suspected PBT or vPvB materials that are effective for use as PAG's and ARC's may not exist or be invented and in place for 15 years or longer³. An invention cannot be scheduled; there is no way to know when it will occur. The continued progress of the global semiconductor industry depends on the availability of certain chemicals for critical uses.

The semiconductor industry recognizes potential environmental and human health impacts attributed to PFOS. Regulatory actions by the United States and the EU and increased attention at the OECD have illustrated the growing global awareness.

In order to accomplish these purposes, the WSC and SEMI as industry groups commit to the following actions consistent with the WSC's Guiding Principles and SEMI Global Care initiative of pollution prevention, ESH conscious design, safe and healthy work environments, and international cooperation. These

¹ WSC's ESH Guiding Principles can be found at our web site at www.semiconductorcouncil.org.

² SEMI's Global Care initiative is described at our web site at www.semi.org.

³ SEMATECH Position Statement Regarding the Business Case for the Continued Need of PFOS, International Sematech, November 24, 2004.

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commitments will be met through internal industry cooperation and the principles of ALARA (as low as reasonably achievable)⁴.

⁴ ALARA: a policy to address concerns about ESH issues when there is scientific uncertainty. "It is a policy used to minimize known risks, by keeping exposures as low as reasonably possible, taking into consideration costs, technology, benefits to public health and safety and other societal and economic concerns." World Health Organization, March 2000.

WSC Commitments for PFOS Chemicals

Scope: These commitments apply to the use and emissions of PFOS in "critical" and "non-critical" photolithography applications associated with the manufacture of semiconductor devices (see Appendix with simplified mass balance picture).

Critical applications: any component, including photoactive compounds (PAC), PAG or surfactant, of photoresists and anti-reflective coatings.

Non-critical applications: any other semiconductor material including photolithography developers.

Within the above defined scope and with the goal of evaluating the entire life cycle of PFOS in semiconductor photolithography processing including elimination of existing uses, substitution of existing chemical supplies, modification of manufacturing equipment, control of potential environmental releases and R&D for future chemical supplies, the WSC and SEMI commits to the following commitments and intentions.

Commitments:

C1) ESIA, JSIA, KSIA, SIA- elimination of non-critical PFOS usage by May, 2007; TSIA- elimination of non-critical PFOS usage by May, 2009

C2) Excluding wastewater with traces of PFOS, all solvent wastes from critical uses of PFOS in photolithography will be sent to incineration for destruction beginning on December 31, 2006.

C3) WSC and its affiliated associations, in cooperation with SEMI, will engage in a worldwide PFOS data collection effort to set a 2005 baseline. Data will be evaluated and updated every 2 years. This data will be used for a mass balance model.

Intentions:

I1) Work towards identification of PFOS substitutes for critical applications. The semiconductor industry recognizes that there are concerns with PFOS with additional focus on the horizon regarding perfluorooctanoic acid (PFOA) and the class of chemicals within perfluoroalkyl sulfonates (PFAS) which are currently under study. Identifying potential substitutes will be done in close collaboration with SEMI to identify or develop new chemicals to substitute for critical uses of PFOS. Subsequently, the newly developed chemicals have to be qualified in photolithography manufacturing processes. Economical feasibility of the new

materials will be established as well. These are all conditions to be fulfilled previous to implementation.

I2) Collaborate with SEMI tool suppliers to:

- a) evaluate potential permanent solutions for all new equipment sets that would enable segregation of PFOS waste water.
- b) evaluate potential retro-fit solutions for existing equipment sets that would enable segregation of PFOS waste water, and
- c) establish ecological versus economical impact (ALARA principle) to demonstrate implementation feasibility.

I3) Evaluate potential PFOS wastewater discharge control technologies. This would include a survey of potentially feasible technologies and an analytical sampling effort to better understand existing wastewater conditions.

I4) Based on the commitments embodied above, the WSC and SEMI will review, internally verify and make available the following information. Such reporting must have provisions that ensure the full confidentiality of company specific business information. Every 2 years the WSC and SEMI will collect and make available aggregated industry information to provide a transparent communication of industry progress:

- a) the results of PFOS wastewater treatment evaluations including any wastewater measurement data;
- b) a description of the current relevant research and development activities and any conclusions including the results of collaboration with equipment and chemical suppliers;
- c) industry phase-out schedules that are known for critical uses in semiconductor manufacturing and processing; and
- d) the results of the PFOS mass balance model.

Commitments and Intentions elements of PFOS agreement

	Description of element	Partners involved
C1	End all non-critical PFOS uses and emissions ESIA, JSIA, KSIA, SIA- May, 2007 TSIA- May, 2009	SC industry, associations, SEMI, WSC
C2	Send all solvent wastes from remaining critical uses to incineration for destruction Date: December 31, 2006.	SC industry, associations, SEMI, WSC
C3	Periodically collect PFOS use data for a mass balance model Date: 2005 baseline data; evaluate and update every 2 years.	SC industry, associations, WSC
I1	Work towards PFOS substitutes for critical applications	SC industry, ISMI and other R&D, SEMI chemical suppliers
I2	Evaluate potential segregation of PFOS effluent streams in new and existing tools	SC industry, SEMI tool suppliers
I3	Evaluate potential PFOS wastewater discharge control technologies	SC industry, ISMI and other R&D, SEMI
I4	Periodically make available aggregated industry information for above commitments and intentions Date: Every 2 years.	SC industry, associations, SEMI, WSC