29 June 2007

Maged Younes
Acting Executive Secretary
Stockholm Convention Secretariat
11-13 chemin des Anémones
CH-1219 Châtelaine, Geneva
Switzerland
Via e-mail to ssc@pops.int

Re: Comments of ESIA, SIA, SEMI on Draft Risk Management Evaluation for PFOS

Dear Dr. Younes:

On behalf of the European Semiconductor Industry Association (ESIA), the Semiconductor Industry Association (SIA) and SEMI, I am pleased to submit these comments related to the draft risk management evaluation on perfluorooctane sulfonate (PFOS) in response to your June 1, 2007 invitation to Parties and Observers. As an observer participant in the working group that prepared the draft, we appreciate the effort that has gone into preparation of this material, and we are grateful for the opportunity to provide our comments from the perspective of the semiconductor industry on the current draft.

We have already provided significant publicly available material that demonstrates at great length the continuing critical uses of PFOS for our industry, the lack of alternatives to those uses, the significant economic value associated with the semiconductor manufacturing that depends on those uses, and the *de minimis* environmental impact associated with these uses. We will not revisit those background points here but continue to stand ready to provide more information about these points if that would be helpful to the Committee.

We confine our observations to two points with respect to the current draft.

<u>Annex A or B?</u>

Our primary concern relates to the language in the draft that promotes listing PFOS in Annex A. We believe that if PFOS is added to the Convention, it should be added to Annex B alone, to reflect the ongoing need for certain identified critical PFOS production and uses -- uses that have high socioeconomic value but relatively low environmental impact.

These uses of PFOS are ongoing, and, with respect to the critical uses identified by our industry, have no identifiable drop-in replacements available today. We believe that Annex B was intended precisely for this purpose, *i.e.*, to accommodate the listing of chemicals for which important ongoing uses continue but where severe global restrictions are otherwise warranted.

The revised working draft itself reflects the high value and comparatively low impact of these uses. Because of the uncertain nature of the research and innovation process required to develop alternatives for these specialized uses, for which substitutes have not yet been identified, we do not believe that it would be appropriate to craft exemptions for production and use of PFOS for semiconductor manufacturing as "specific exemptions" as that term is used under the Convention.

The current draft properly recognizes the need for continued production and use of PFOS for our critical uses, but nevertheless recommends an Annex A listing. Although we believe that only an Annex B listing would be appropriate, at a minimum we suggest that the draft be revised to reflect an appropriate balance between the options for Annex A and Annex B listings. This could be accomplished by changing the text at the beginning, in Part 3.2, and at the end of the draft, as follows:

Executive summary

PFOS was proposed as a POPs candidate by Sweden in 2005. The 2nd meeting of the POPs Review Committee decided that PFOS is likely, as a result of its long-range environmental transport, to lead to significant adverse human health and environmental effects, such that global action is warranted.

As PFOS is both an intentionally produced substance and an unintended degradation product of related chemicals, under the Convention the most adequate control measures would be listing in Annex A or B. To allow for some critical uses of PFOS-related substances, which may ultimately degrade to PFOS, an acceptable purpose/specific exemption for use of PFOS and production of PFOS as an intermediate only as required to produce other chemical substances designated for these critical uses could be given together with a detailed description of the conditions for these uses in a new Part III to Annex A or B. Stockpiles and waste containing PFOS or PFOS-related substances would be subject to the provisions in Article 6.

[****]

3.2 Suggested Risk Management Measures

[****]

Option 2. Listing of PFOS in Annex B.

Listing of PFOS in Annex B would be consistent with the POPs properties of this intentionally produced substance. While allowing for some specified acceptable purposes/specific exemptions, it would still send a signal that production and use of PFOS should eventually be phased out. To allow for the medium-term use of PFOS-related substances in critical applications, an acceptable purpose for production of PFOS could be given e.g. "as required to produce other chemical substances to be used solely in accordance with Part III of this Annex". This approach would also be consistent with other recently adopted international risk management measures for PFOS, such as the EU directive 2006/122, which generally bans PFOS use except for certain exemptions for continued uses with specific high socio-economic relevance, and which provides for a review process but does not impose a time limit on those exemptions.

[****]

Conclusions

In comparing options 1 and 2 with option 3 and 4, it seems most logical to regulate PFOS under the Convention as an intentionally produced POP, which should eventually be phased out. It is therefore proposed to list PFOS in Annex A or B of the Convention. ~~Given the toxicity and extreme persistence of PFOS the goal should be elimination of emissions of PFOS. It is therefore suggested to list PFOS in Annex A of the Convention.~~

There is, however, a need for some remaining critical uses over the foreseeable future. To allow for this, one could introduce specific exemptions for production as required only to produce other chemical substances designated for these critical uses and to describe the conditions for the use of PFOS-related substances further in a new Part III to Annex A or B. A suggested outline of Part III can be found in the Appendix.

4. Concluding statement

In accordance with paragraph 9 of Article 8 of the Convention, the Committee recommends the Conference of the Parties to the Stockholm Convention to consider listing and specifying the related control measures of PFOS in Annex A or B as described above.

Costs of Transitioning from PFOS.

Our other comment relates to the language in section 2.3.2 that provides an estimate of the costs per kilogram for reductions in the semiconductor industry. Although we agree that, given the small amounts released and the high costs associated with development of new resist systems, the cost for avoided emissions will be very high, we do not believe that certain language in the section setting out an estimate of these reduction costs is accurate.

Among other things, the analysis assumes that alternatives exist that would permit these new developments to be completed within 5 years, which is not presently the case. It is therefore not possible at present to calculate the costs per kilogram of replacing PFOS in the semiconductor critical uses because there is no alternative process that can replace it. In addition, the figures below relate only to the costs of one part of the costs that the industry will incur when an alternative is developed. It is therefore likely that the ultimate costs associated with transitioning out of PFOS, once that is even technically feasible to do, will significantly exceed the rough calculations reflected in the draft evaluation. We refer the Committee to our Annex F submission on this point (relevant excerpt attached as Tab 1 to this letter for convenience) for a complete description of the costs involved.

Taking into account the observations above, we recommend the following revisions to the text in 2.3.2:

Costs: It is not possible to quantify the costs that will ultimately be involved in replacing PFOS with alternative substances, given that such alternatives are not currently available. The requirements for innovation and the limits of technical feasbility -- not cost -- are the factors that currently limit access to alternatives. If those hurdles can eventually be overcome, however, there will be substantial costs associated with the transition to the use of alternative substances in the photolithography process. .

Replacing existing resists systems would require extensive R&D followed by a time-consuming manufacturing process requalification. The development cost of a completely new photoresists system - one resist system - for the industry has been estimated at US$192M for 193nm resist, US$287M for 157nm, and US$218M for EUV resist. The cost for 157nm resist development is the highest, because it has more novel requirements than either 193nm or EUV resists. There are also extensive introduction costs associated with bringing a new system into high volume production, including requalification costs and significant lost revenues associated with much lower yield as new systems are brought on line. It should also be noted that each production site has considerably more than one resist, ARC or developer in use. The substitution efforts may, therefore, comprise a considerable number of substances and processes, and the costs will be a corresponding multiple of the substitution costs for one single substance. It should also be noted that many resists are specifically tailored to one individual company's process, so a valid replacement for one does not mean it can be necessarily applied industry-wide.

~~Development costs of a new photoresist system thus add up to US$700M. Assuming that variable costs are the same as in the present system, it takes 5 years to develop the new system and the time span for the analysis is 25 years. This would imply that the reduction in release of PFOS related substances is equal to 20 years of releases (50 kilogram per year), i.e. a total of 1000 kilogram. Costs would be US$0.7M per kilogram PFOS. This calculation indicates the level of magnitude of the costs of reducing the release.~~

Further Information

We appreciate the opportunity to share our observations and look forward to working closely with the POPRC as it further refines the draft risk management evaluation. For further information about these comments, please contact me at +1-202-789-6080, rlamotte@bdlaw.com; Chuck Fraust, +1-408-573-6609, cfraust@sia-online.org, Aimee Bordeaux, 1-408-943-6939, abordeaux@semi.org; or Shane Harte, +32-2-706-8600, sharte@eeca.be.

Thank you very much for your consideration.

Sincerely,

K. Russell LaMotte

Tab 1
Excerpt from Annex F Submission

It is not possible to quantify the costs that will ultimately be involved in replacing PFOS with alternative substances, given that such alternatives are not currently available. The requirements for innovation and the limits of technical feasbility -- not cost -- are the factors that currently limit access to alternatives.

If those hurdles can eventually be overcome, however, there will be substantial costs associated with the transition to the use of alternative substances in the photolithography process. We estimate the following costs based on the fact that any alternatives that may be developed will not be drop-in substitutes for PFOS and will therefore require the development and implementation of completely new photoresist systems

<u>R&D costs to develop a new system</u>: Replacing existing resists systems would require extensive R&D followed by a time-consuming manufacturing process requalification. The development cost of a completely new photoresists system - one resist system - for the industry has been estimated at US$192M for 193nm resist, $287M for 157nm, and US$218M for EUV resist. The cost for 157nm resist development is the highest, because it has more novel requirements than either 193nm or EUV resists. See "The business case for the continued need of PFOS," International Sematech position statement (December 2004).

<u>Introduction costs of new system into high volume production</u>: The development process for technology introduction typically takes 18-24 months after the resist has been proven production worthy (capable of high speed production with acceptable yields). The introduction process starts by producing a small volume of wafers and ramping the factory's production to full volume over 18 to 24 months. This is normally a time of improving yields. The exact data for technology introduction is proprietary information that varies from company to company. However, initial yields are well below 30% and take the full introduction time to reach 70% and higher. In full production, these yields will reach over 90%. So far the industry has not had to change resists in the middle of a technology, but if it had to, some assumptions can be made. Introducing a new resist requires a qualification process. This qualification is costly and involves many engineers. If development engineers are working primarily on legacy resists, they cannot work on the newest technologies and the total technology development timeline will be impacted.

This direct cost cannot be estimated, since it will vary by company. However, market costs associated with a resist infrastructure can be projected, as illustrated in the scenario below (assuming a requirement the change in resist infrastructure occurs simultaneously worldwide):

Assume that the introduction yield starts at 30% and increases 3% per month over the next 18 months to a high volume production yield of 81%. A typical advance wafer manufacturer runs 20,000 good wafers per month (98% yield) in one fabrication facility ("fab") with a value of $5,000 per wafer (totaling US$100M per month). Over these 18 months, that fab would have generated US$1.8B in revenue. Revenue for the fab converting to a new resist would have been approximately US$1.1B, a reduction in contribution to the economy of US$0.7B over the 18 months. Additional revenue would be lost as the facility increases its yield to 98% with current manufacturing methods. Furthermore, it has been shown that a delay in the introduction of a new product (i.e., the time-to-market) costs a manufacturer over US$2M per day in profits for each day introduction is delayed. See "The business case for the continued need of PFOS," International Sematech position statement (December 2004).

It should be noted that each semiconductor manufacturer or each production site has considerably more than one resist, ARC or developer in use. The number of these products and processes strongly depends on technology requirements and processes and product mix. The substitution efforts may, therefore, comprise a considerable number of substances and processes, and the costs will be a corresponding multiple of the substitution costs for one single substance. It should also be noted that many resists are specifically tailored to one individual company's process, so a valid replacement for one does not mean it can be necessarily applied industry-wide.