ESIA
European Semiconductor Industry Association

Date 17.06.2015

ESIA Submission
to ECHA Consultation on Restriction proposal for Perfluorooctanoic acid, including its salts, and related substances

The European Semiconductor Manufacturing Industry is an extremely minor user of PFOA related substances within its manufacturing processes. As outlined in the draft restriction dossier, the semiconductor industry requests an exemption to allow for continued use of these compounds in photolithography formulations based on disproportionate socioeconomic impact of a ban would have on the industry. The semiconductor industry requests a 10 year exemption for semiconductor photolithography use, followed by a review to determine if an exemption extension is required.

These substances are used due to their high technical functionality in speciality formulations in the industry manufacturing process called photolithography. Over the past number of years the European semiconductor industry has been transitioning away from uses of PFOA itself in photolithography. However based on upstream industry information the industry now uses some substances that are newly brought within scope of this draft restriction as PFOA-related substances.

These PFOA –related substances remain critical for the industry as there are no adequate technically feasible alternatives that can be used as replacements for <u>all</u> applications.

Any potential environmental releases are well managed by the semiconductor industry. This is due to careful collection of the used liquid, typically followed by solvent waste incineration. There is very minimal emissions release to wastewater containing PFOA related substances (3.8% of total usage). There are no emissions to air arising from their use. In addition, these substances do not remain on the finished patterned semiconductor wafer. Stringent risk management measures are implemented in the manufacturing factories. There is no release to the work place environment during production due to the use of closed systems.

ESIA is an Industry Association of:
EECA : European Electronic Component manufacturers' Association
Rue de la Duchesse 11/13, B-1150 Bruxelles - Belgium
Tél: + 32 2 290 36 60 • Fax: + 32 2 290 36 65 • E-mail: secretariat.gen@eeca.be • Web: www.eeca.eu/esia/home

European semiconductor industry has a long history of responsible use of perfluorinated substances and has made significant efforts and progress to transition to perfluorinated substances of lower chain lengths (short chain Perfluoro Carboxylic Acids (PFCAs) and Perfluoro Sulphonic Acids (PFSA) alternatives) **that give less concern based on current knowledge.**

Question 1: PFOA and PFOA-related substances are used in a wide range of industrial applications as well as consumer products. Based on the information in Table C.1-1 (*overview of available fluorinated and non-fluorinated alternatives for different branches)* and Appendix C Table A.C.1-1 (*potential alternatives and technologies*), could you:

- Provide technical and economic information on any application or use (identified or not identified in the restriction dossier) for which alternatives are not available and/or the performance of alternatives is not considered adequate?
  - Specify the quantities used?
  - Provide information regarding the potential risks to the environment or to human health via the environment related to any of these uses?

  Please note that information regarding sectors that involve higher amounts used are particularly welcomed (e.g. textiles).

The Semiconductor manufacturing industry produces semiconductor devices (microchips). PFOA related substances are used in very minor quantities at low concentrations in some speciality formulations in a semiconductor industry manufacturing step called photolithography. These substances are critical to this manufacturing step due to their high technical functionality **(*as per Appendix C, Table A.C.1.1 Potential alternatives and technologies in the annex XV proposal*).** The industry and its photolithography formulation supply chain are aware of the concerns regarding these chemicals, and have already made substantial efforts where technically feasible to eliminate them from the manufacturing process formulations. Over the past number of years the European semiconductor industry has been transitioning away from uses of PFOA itself in photolithography. Currently however for the critical photolithography uses there are no adequate technically feasible alternatives for PFOA related substances that can be used as replacements for all applications. European Semiconductor Industry Association (ESIA) believes that RMO 1b (as per Section E.1.2 of the Annex XV restriction proposal) should be considered as appropriate especially for sectors that require exemptions and a longer transition time (effective date) due to remaining critical uses where substitution is technically unfeasible, where the use in absolute terms is very low, emissions are well managed and substances subject to restriction do not remain in the final product.

Page 157 E2.2.1.2.2 Technical Feasibility

There are no feasible alternatives for all critical uses in photolithography

Quantities Used

Overall the semiconductor industry is a very minor volume user of PFOA related substances in photolithography. The industry has been transitioning away from PFOA itself in recent years. Within the timeframe of the ECHA public consultation, the European Semiconductor Industry Association conducted a survey of its members to estimate the total amount (kg) of PFOA and PFOA related substances contained in European semiconductor photolithography chemical products in 2014. Members in turn reviewed their suppliers and the amounts received were aggregated at sector level. The resulting total was 19 kg of PFOA related substances, which is the best estimate of use within the sector available currently It should be noted that this estimate is based on responses from ESIA member companies. It can be possible that there may be some minor users of in scope substances outside of the ESIA membership.

Referencing the OECD Emission Scenario Document on *Photoresist use in the Semiconductor Industry*[1], which estimates emissions at between 1 and 7%, and based on further refinement using expert judgement from semiconductor industry manufacturing process engineers, a conservative emission factor for the sector is calculated as 3.8%. Applying this emission factor results in 0.7kg of PFOA-related substances being attributed to emissions to wastewater in 2014. This value accounts for 0.001 % of total estimated emissions (with reference to ***Table F.1-1: Estimated annual use volumes and emissions of PFOA (red) and PFOA-related substances (blue) in the annex XV proposal page 163).***

Waste Streams and Potential Risk

PFOA related substances are used in very small quantities as an ingredient at low concentration in photoresist and ARCs (Anti-reflective coatings) chemical formulations in semiconductor photolithography. The potential risk to the environment and human health is managed in semiconductor manufacturing through stringent risk management measures implemented in the manufacturing factories.

The semiconductor manufacturing industry sector has implemented stringent risk management measures and safety practices to prevent release of chemicals during all stages of the manufacturing process including the waste stage.

There is no release to the work place during production due to the use of closed systems, thus preventing worker exposure.

Inside the semiconductor wafer manufacturing clean room, the presence of uncontrolled particles, as well as of chemical vapours and gases constitutes an unacceptable risk from a safety and health and a production perspective. This risk is

[1] http://www.oecd-ilibrary.org/environment/series-on-emission-scenario-documents_23114606 No 9

controlled through the application of closed system manufacturing equipment which are installed in a cleanroom environment. Automated chemical delivery systems are installed to create a barrier between workers and the process and protect against chemical and physical hazards in the work environment.
Solvent waste containing PFOA related substances is typically collected at the factories and sent for incineration at temperatures where PFOA related substances are fully destroyed, thus preventing potential emission to the environment. There is very minimal release to the environment in wastewater.

Page 67 - Paragraph B 4.4.2.3 **Environmental release from the semiconductor industry**

The paragraph B 4.4.2.3 relating to environmental emissions from the EU semiconductor industry states: "…Since the substances are enclosed in the product, emissions during the use phase are considered negligible…"

ESIA disagrees with the statement. PFOA related substances do not remain enclosed in the die patterned finished wafer. ESIA recommends to remove this statement from this section of the report. In addition there are no emissions to air arising from the manufacture of semiconductors due to low use and low volatility of photolithography formulations. VOC treatment systems are in place at semiconductor manufacturing fabs that would treat any potential emissions of PFOA and related substances. Environmental release category 5 (ERC5) has been attributed to use in semiconductor manufacturing fabs with an associated 50% release factor. This is inaccurate as the substances do not remain enclosed in the die patterned finished wafer and the release factor is significantly lower. The more accurate characterisation of ERC for semiconductor manufacturing is, therefore, ERC 4. The release factor based on expert engineer research is 3.8%. as a conservative figure.

Semiconductor manufacturing equipment

Semiconductor manufacturing equipment used in the semiconductor factories to make the semiconductor device (microchip) and production installations (piping) have parts made of fluoropolymer and fluorotelomer material that may possibly contain substances within the scope of this restriction dossier. Semiconductor manufacturing equipment companies and their suppliers could be impacted by a potential restriction on articles, as parts, instruments and sub-assemblies of semiconductor manufacturing equipment which may contain fluoropolymer and fluorotelomer material, for example in O-rings, seals or Teflon tubing, due to their chemical resistance properties. This manufacturing equipment would be classified as 'articles' under REACH and are typically supplied from companies operating outside of the EU.

Semiconductor device manufacturing is one of the most complex and sophisticated manufacturing technologies in the world. The process of building a 3-dimensional nano-scale structure on a silicon or other wafer can require typically over 500 manufacturing process steps and uses over 100 different types of equipment supplied by many equipment manufacturers and sub-suppliers. The manufacturing equipment are highly complex machines. To give scale of the issue the industry could have approximately 100,000 replaceable spare parts for servicing the manufacturing equipment per European semiconductor manufacturing company. These substances could appear in parts that are sourced very deep in the upstream supply chain. Therefore assessing the full impact of the article aspect of the restriction proposal will be a complex and time consuming process. The industry would need further information from upstream tiers of the global supply chain to confirm the presence of these substances in equipment parts

It is worth noting that semiconductor manufacturing equipment will not end up in any typical household waste stream. The equipment machinery has a high capital value and a long life cycle. Semiconductor manufacturing equipment is typically reused and resold. In terms of potential exposure the industry would recommend that the scope of article provisions in the restriction proposal dossier should be narrowed to focus on consumer articles only where there is a high exposure potential for the environment and humans and where the risk management is not in place.

The semiconductor industry would recommend that the proposed restriction risk management option on use in articles be limited to the markets and uses that have been evaluated in the restriction dossier.

Question 2: Economic impacts of the proposed restriction have been assessed for the uses and supply chains, representing the major current applications of PFOA and PFOA-related substances. The following markets have been assessed:

- ✓ manufacture of fluoropolymers (PFOA)
- ✓ surface treatment of textiles (PFOA-related substances)
- ✓ surface treatment of paper (PFOA-related substances)
- ✓ manufacture and use of fire-fighting foams (PFOA-related substances)
- ✓ coatings and printing inks (PFOA-related substances).

In addition the potential impact of the proposed restriction on the photographic and the semiconductor industry were discussed without providing explicit cost estimates for these sectors. The cost estimates were based on differences in price and the loading required to achieve the requested performance.

• Would you consider the presented calculations to be representative for your use? If not, do you have specific information on the substitution costs in your application?

- Do you have information on any other costs of the restriction which might not be included in the dossier?

- Information on which of the substances (PFOA-related) are most relevant in terms of production/use volumes is also invited. Some examples of PFOA-related substances are given in Appendix B.1 of the restriction report.

No cost analysis has been performed on small volume users like semiconductor industry in the annex XV dossier. Due to the high tech nature of semiconductor production compared to 5 sectors/markets that have been assessed in the annex XV dossier the costs from these other sectors cannot be extrapolated to the semiconductor sector and as such are not representative for semiconductor industry.

The economic impact to the semiconductor industry was not assessed as part of the Annex XV restriction proposal. For the semiconductor industry it is not only a question of substitution cost but of finding alternatives. Despite significant R&D in recent years there are still some photolithography applications containing minute quantities of PFOA related substances for which replacements have not yet been identified.

The photolithography process which patterns the micro/nano circuitry of the device is at the heart of semiconductor manufacturing. Variance from company technology, process line, product line, technology node (size of transistor), and photolithography process step within a process line means that there is not one unique process photolithography step but hundreds of photolithography applications requiring varying chemical formulations. Depending on the technical challenges and performance criteria in question, PFOA related substances may be required as a surfactant or photo acid generator in some photolithography applications both in photoresists and in anti-reflective coatings.

The table below provides a summary comparison of the health, environmental and socio-economic implications of the restriction with and without an exemption for photolithography in the semiconductor manufacturing industry

Impact	Exemption for Semiconductors	No Exemption for Semiconductors	Comment
Human Health	Adequate control using risk management measures – no health	Adequate control using risk management measures – no health impact to	No health benefit to workers or to consumers arising if there is no

	impact to workers or to consumers.	workers or to consumers.	semiconductor exemption.
Environment	Worst case scenario 0.7 kg per annum of PFOA related substances are emitted to wastewater across Europe until all uses are replaced. No air emission due to low volatility of PFOA related substances and abatement in place. Waste containing PFOA related substances are typically sent to incineration	Some PFOA related substances uses may be replaced over time. For others the equivalent manufacturing will likely be relocated to outside the EU, a corresponding proportion of the 0.7kg/annum will be emitted elsewhere globally. Significant materials and energy use to transfer some production outside the EU.	Any significant environmental benefit arising from no exemption is highly questionable as on a global basis some of the emissions will still exist. As a proportion of the emissions from the substances in scope across the EU in industry and in historic articles, the PFOA related emissions from the semiconductor portion can be regarded as insignificant.
Economic	Significant costs to identify, develop and qualify feasible alternatives.	Impact will vary across the sector up to 100% reliant and in certain examples manufacturing would temporarily not be able to operate within the EU. In other examples manufacturers may have reduced capacity to manufacture until replacements are invented, implemented and requalified. Customer commitments may not be met leading to significant financial impacts.	The impacts of non-use are significant In certain cases production leakage to factories outside the EU that without such legislative measures would not take place.
Social	Continued provision of highly skilled jobs in the EU in the semiconductor industry.	EU Jobs may be at risk as well as EU jobs in linked industry upstream and downstream activities. Future EU investment confidence would be damaged leading to loss of future investment and	There is a desire to maintain highly skilled jobs within the EU.

		therefore a loss in jobs.	
Wider Economic	Overall, micro- and nano-electronic components and systems enable the generation of at least 10% of GDP in the world.	There may be a negative impact on the EU semiconductor sector and associated supply chain. There will be nervousness to invest the large amounts of capital required to build a semiconductor fabrication plant, Europe's position as a global competitor in the semiconductor sector may be damaged.	The importance of the semiconductor sector in the EU has been recognised by the Commission as a Key Enabling Technology (KET) and is essential for jobs and growth in the EU. A European strategy for micro and nanoelectronics components and systems was announced in 2013. This EU strategy facilitates industry investments of 100 billion euros and to help create 250,000 jobs in Europe up to 2020. The EU and member states and regions are currently implementing the European Industrial Strategic Roadmap
Overall comparison	The semiconductor industry's risk management measures are shown to protect human health and the environment. There is no impact on consumers as the product (microchip) does not contain PFOA related substances. The negative impacts of an exemption are considered to be relatively small and will be addressed in the industry's continued efforts over time as	The negative impacts of no exemption for the semiconductor industry are considered to be high and will lead to production leakage to non-EU countries in certain circumstances. Some semiconductor companies will suffer significant financial damage.	The analysis supports the case for an exemption for the semiconductor industry until such time as the industry has identified developed and qualified replacements for PFOA related substances.

	research is conducted to identify, develop and qualify replacements.		

Socio-Economic Impacts of no Semiconductor Sector Exemption

If no exemption for the semiconductor industry is granted within the PFOA restriction proposal, there will be severe economic impacts for the sector in the EU. The extent of this impact will vary across the sector. One large manufacturing centre is entirely reliant on the use of minor amounts of PFOA related substances and would temporarily not be able to operate within the EU; production would most likely be moved to a non-EU location with the potential loss of over four thousand direct highly skilled jobs and €550 million annual GVA (gross value add) to the economy. This manufacturing centre which has recently completed a €3 billion plant upgrade to run a new technology would suffer immense financial damage.[2] Other semiconductor factories across the EU may no longer be able to operate at maximum capacity until replacements are invented, implemented and re-qualified. Customer commitments may not be met, leading to significant financial impact. There may be a longer term negative impact on the EU semiconductor sector as there will be a lack of confidence to invest the large amount of capital required to build a semiconductor fabrication plant (typically > €1billion) in the EU in the future. Europe's position as a global competitor in the semiconductor sector may be damaged.

The US EPA has proposed a Significant New Use Rule (SNUR) under TSCA to limit future use of the Long-Chain Perfluoroalkyl Carboxylate and Perfluoroalkyl Sulfonate Chemical Substances (LCPFAC and PFAS substances), including PFOA and PFOA-like substances. However, EPA cannot propose a SNUR for an ongoing use and is seeking comments on whether there are any ongoing uses of the substances covered by the proposed rule. Semiconductor use of PFOA and PFOA-like substances is ongoing, and these uses will fall outside of the scope of the rule when finalized. Granting an exemption for EU semiconductor manufacturers until such time as alternatives are available will ensure that the EU is not disadvantaged in terms of global competitiveness. Furthermore ESIA urges ECHA and the EC to work in conjunction with their counterparts at the US EPA to enable consistency in terms of the scope of any exemption granted.

PFOA Related Substance Criticality in Photolithography

Photolithography is the process which generates the lines, holes and patterns on the wafer which form the circuit after processing in other modules. It is generally the

[2] [2] A separate case study report on the socio-economic impacts of the proposed restriction is being submitted to the consultation process by the semiconductor manufacturer in question.

technology limiter in all semiconductor processes. It is the patterning resolution of the photolithography process which determines how many chips can be made from one wafer and how fast the transistors on the chip can run. Photolithography is the most capital intensive part of the process flow and is usually the most critical for production output. PFOA related substances are used in some photoresists anti reflective coatings (ARCs)

Two types of equipment linked together for leading-edge applications

- "Track" which coats the wafer with photoresist and develops away the exposed resist
- "Scanner" which exposes the resist in a masked pattern using laser light source

Photoresists -The photoresist coat process takes place in the track. First a primer is applied to the wafer to increase the adhesion of photoresist. Then during coat, photoresist is dispensed onto the wafer. The wafer is spun at high speed so that the photoresist spreads evenly across the wafer surface. Each resist is a custom designed blend designed for the particular layer, wavelength, substrate reflectivity and thickness required. Finally, during bake the resist is dried by removing solvent to produce a mechanically stable film. The biggest challenges are coverage over uneven surfaces, thickness, pattern defects and particle contamination. PFOA related compounds are used here as a surfactant to improve coverage and uniformity and also to change the absorption and refractive index.

During exposure the Wafer is exposed chip by chip in the scanner using a product and layer specific photomask. It usually uses 248nm or 193nm laser source. The key process challenges are lens focus, resolution and lens distortion. The critical application of PFOA related substances here are as PAG (photo acid generator) in some resists which is converted to a photo acid by the light.

Anti-Reflective Coating - Bottom ARC layers are spun onto the wafer prior to resist coating. They are used to reduce the reflectivity variation of a substrate much like "anti-reflective" glass. This stops "notching" in the pattern caused by reflection from underlying layers. PFOA related substances are used to improve film forming properties and adjust refractive index (RI). It is essential that the RI of ARC is square root of the RI of photoresist. This specification narrows down available alternatives only to substances that are chemically closely related to the substances currently in use.

Once the photolithography process step is complete the wafer is moved to an implant, dry etch or wet etch process step where the photoresist-covered areas are protected from the process as the exposed areas will be etched or implanted according to the pattern defined in the photolithography step. Once the etching or implanting is complete the remaining photoresist is stripped of the wafer in an oxygen plasma chamber. This process of patterning is repeated several times (in the range between 20 and 60, according to technology) with the manufacturing process to build up the layers of features of the transistors and interconnects that finally becomes an array of microchips on the silicon wafer.

PFOA related substances have excellent surfactant properties as well as being very stable molecules that are able to withstand the aggressive chemical and high temperature and energy environments that a wafer is exposed to during post lithography processing.

In general the industry is moving towards shorter-chain PFCA and PFSA compounds but due to the technical demands of process shorter chain molecules do not in every case deliver the required performance.

Substitution challenges requiring extended timelines for exemption

Despite significant R&D in recent years, currently there are no replacement substances for all uses of PFOA related substances in photolithography, which provide the critical functionality and equal performance required. Once a replacement is found the process of technology implementation, test and approvals and final replacement is not simple. The semiconductor industry needs to continue using these substances as long as no suitable alternatives are industrially available. A restriction without adequate timelines for transition for PFOA related substances in photolithography in Europe has the potential to undermine semiconductor production and future innovation in Europe.

The industry would underline the economic cost of final replacement and requalification for the end industrial user is enormous when considering the final PFOA related substances amounts used. This is because once a replacement substance has been identified it is not a 'drop-in' substitution. Each photolithography step has unique process performance criteria and has to be re-designed and qualified individually. Sometimes a chemistry change can give rise to the requirement for a photomask re-design. Mask re-design is a hugely onerous process as a large amount of specialised programming support is required to implement the revised optical proximity corrections which are integrated into the mask pattern. Furthermore changes in the photolithography process step can have upstream or downstream effects requiring re-design of additional process steps such as etching, stripping, cleaning and others. The industry will require an exemption to ensure the final remaining uses of PFOA related substances are not restricted in a disproportionate way. An effective date such as 18 months after entry into force would mean that a considerable amount of European semiconductor manufacturing may not be able to continue manufacturing. This 'non-use' scenario would have a very damaging effect on the industry without any commensurate benefit for environment and human health accruing from the non-use by the semiconductor sector.

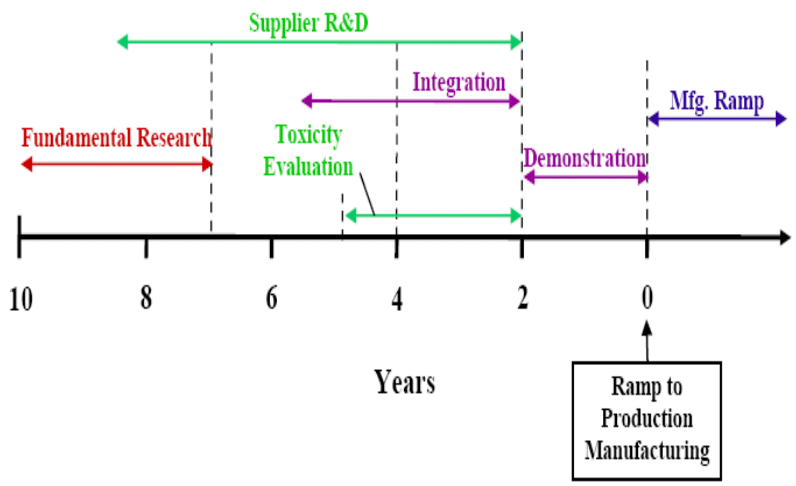
ESIA requests a 10 year exemption for semiconductor photolithography use followed by a review to determine if an exemption extension is required for the semiconductor industry where no proven substitute exists for all applications. ESIA would underline this message to the socio economic analysis committee for their consideration comparing the ‘non-use’ scenario where no exemption would apply and an ‘applied for use’ scenario which outlines the impact of an exemption for the semiconductor industry.

The technology pipeline for semiconductor process development is typically of 10 years duration.

To appreciate the process of innovation in the semiconductor industry, it is important to understand two parallel dynamics that are at work. First, the semiconductor product (’microchips’) cycles tend to be very short. The products that are sold today are not expected to meet customer needs for long periods of time, an expectation that any consumer who owns and then upgrades his or her home computer can appreciate. Second, the technology development cycles, in contrast, often take a long time. Because of the complexity of the products and associated production processes, a major innovation can take years to bring to market. Manufacturers of electronic devices, working in conjunction with their materials and equipment suppliers, must typically proceed through multiple stages of research, technology integration, demonstration and manufacturing ramp-up to achieve a process change effectively. One technology development cycle typically takes around 10 years from fundamental research to production ramp up.

Since the PFOA related substances play a fundamental function to some remaining photolithography processes as described and they are used in multiple steps, the replacement of the PFOA related substances should be considered as a technology development, instead of mere product development. Therefore if a semiconductor manufacturing company were to start this technology development by the end of 2015 when the proposed restriction was decided, it will take around 10 years for the alternative technology into use Totally new, disruptive technology where the function of the perfluoroalkylated substances (including shorter chain alternatives) currently performing in the photolithography process will be superseded for the patterning of the smallest dimensions is not envisaged for another 20 years. Based on past experience, the chance of finding a theoretical alternative to PFOA related substances for all photolithography applications by the time of the restriction enters into force is very low.

Figure 1: Semiconductor Material Development Cycle



The semiconductor industry has a good track record of addressing materials of concern and since the early 2000s and has now implemented almost complete replacement for PFOS over a 10 year period as well as significantly reducing use of PFOA. For non-critical and for new semiconductor manufacturing processes PFOS free chemistry is used. This process has taken time due to the critical nature of the process involved, however past replacement timelines are not necessarily an indication of future performance and so a time limited exemption without a review period, may likely not be prudent or workable.

Question 3: The environmental and human health concern on the manufacturing and use of PFOA-related substances is based on their possible degradation to PFOA. Do you have information on:

• Substances having linear or branched perfluoroheptyl derivatives with the formula C_7F_{15}-as a structural element, including its salts, (except C_7F_{16}, C_7F_{15}Cl or C_7F_{15} Br) which do not have the potential to degrade to PFOA?

• Substances having linear or branched perfluorooctyl derivatives with the formula C_8F_{17}- as a structural element, including its salts, (except C_8F_{18}, C_8F_{17}Cl, C_8F_{17}Br, C_8F_{17}-SO_2X', C_8F_{17}-C(=O)OH or C_8F_{17}-CF_2-X' (where X'=any group, including salts)) which do not have the potential to degrade to PFOA?

ESIA cannot comment on question 3.

Question 4: The proposed restriction includes a concentration limit of 2 ppb. Do you have information on:

- The possible impact of the proposed concentration limit regarding the manufacture, use and placing on the market of the short-chain PFASs, or other substances and articles with PFOA/PFOA-related substances as impurities?
- The availability of analytical methods including the limit of quantification of those methods in relevant matrices?

The threshold of 2ppb would mean a de facto ban on of all the short chain PFCA and PFSA alternatives in photolithography. These are the substances which the semiconductor industry is transitioning into for its photolithography critical manufacturing processes since the last 15 years due to the regulatory concerns with PFOS and now PFOA.

Semiconductor industry would have concerns on the concentration limit approach as a user of manufacturing equipment articles containing fluoropolymers that may have been made in the upstream supply chain using in scope substances. The 2ppb limit seems not practical in an industrial setting. The industry's upstream supply chain is predominantly outside Europe and the industry operates globally and would favour harmonisation at a global level in line with analytical method capabilities for complex matrices. As of today, it is our understanding that there are limitations to analytical methods to demonstrate compliance at levels as low as 2ppb.
Besides, given the enormous amount of equipment and auxiliary parts in a semiconductor manufacturing fab that could be affected, demonstration of proof would give rise to a disproportionate administrative and analytical burden and would entail extremely high cost if at all possible.

ABOUT ESIA

The European Semiconductor Industry Association (ESIA) is the voice of the Semiconductor Industry in Europe. Its mission is to represent and promote the common interests of the Europe-based semiconductor industry towards the European Institutions and stakeholders in order to ensure a sustainable business environment and foster its global competitiveness. As a provider of key enabling technologies the industry creates innovative solutions for industrial development, contributing to economic growth and responding to major societal challenges. Being ranked as the most R&D intensive sector by the European Commission, the European Semiconductor ecosystem supports approx. 200.000 jobs directly and up to 1.000.000 induced jobs in systems, applications and services in Europe. Overall, micro- and nano-electronics enable the generation of at least 10% of GDP in Europe and the world.