

This documentation is intended to educate and provide more information, especially as it relates to efforts to develop PFAS reduction/substitution roadmaps. If further clarification is requested or for answers to questions not covered by this Q&A – please contact your account team and if further guidance is needed [Intel.Supplier.Assurance.Communications@intel.com](mailto:Intel.Supplier.Assurance.Communications@intel.com)

## Key Messages

- PFAS has become a top concern for environmental sustainability and supply chain resiliency. There are numerous regulatory actions being proposed at the State, Federal, and international levels that may restrict and/or ban the usage and/or release of PFAS containing substances. Likewise, there are significant supply line stability concerns, associated with litigation, NGO/investor/consumer interests, market volatility/impacts to adjacent segments, and other external forces. To address the concern, the industry must act with a sense of urgency to reduce and eventually eliminate reliance on PFAS.
- Given the above concerns, Intel is asking suppliers to focus on PFAS as follows:
  - Develop and Share Roadmaps for PFAS Replacement
  - Accelerate Research & Development of Alternative Technologies
  - Active engagement in industry consortia

## Sharing Roadmaps for PFAS Replacement

- Moving forward, suppliers are asked to maintain PFAS reduction/substitution roadmap plans and to share these plans in technical, management, and executive reviews. These roadmaps should include:
  - Timelines and Opportunities to intercept equipment and material designs that remove or reduce PFAS for future technology intercepts or opportunities to provide retrofit solutions where there is good benefit
  - Fundamental research efforts to identify replacements (where they do not currently exist)
  - Opportunities for collaboration to accelerate research & development (R&D) of alternatives
  - In addition to substitution, suppliers should share what other actions they are taking to manage PFAS risks, while continuing to drive R&D on alternative technologies
- Below are some relevant questions that should be addressed in supplier PFAS reduction/substitution roadmaps to enable meaningful discussions and meet Intel expectations:
  - Include and categorize all known materials that are comprised of molecules containing a -CF<sub>2</sub>- or -CF<sub>3</sub> group
  - Categorize PFAS use by application highlighting the proportion of uses categorized as easy, medium, and difficult to replace
  - Do any gaps exist to understand where PFAS materials are supplied to Intel, or where they exist in your supply chain? If so, what is being done to address these knowledge gaps?

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- What are the internal activities and associated timelines to finding commercially viable substitutes for existing PFAS containing formulations or formulation components?
- What priorities do you see regarding replacement based on multiple considerations such as the relative ease of replacement, severity of supply risks, and lifecycle considerations?
- What uses can be reduced and/or phased out in the near term?
- For near to mid-term reductions/substitution opportunities, what potential technology intercepts do you recommend for evaluation?
- For difficult to replace uses, what fundamental research are you engaging in to develop alternative materials and/or enabling non-PFAS technologies?
- What external investments are being made towards either fundamental research or sub-supplier research to find alternatives to PFAS constituents in the formulations?
- What opportunities do you see to accelerate identification of alternatives (i.e., critical points of influence, access to pilot lines)?
- Are there any key elements of external collaboration programs that would be instrumental for influencing progress?
- What investments are your sub-suppliers making to find commercially viable alternatives to PFAS? If no current progress is being made, what opportunities might exist that would align with long-term PFAS-substitution goals?

## Accelerate Research & Development of Alternative Technologies

Below is a non-exhaustive list of organizations that may be useful for research & development of alternative technologies, that will be a necessary for inclusion into PFAS reduction/substitution road-mapping efforts, where suitable alternatives do not currently exist:

- Semiconductor industry organizations:
  - SRC<sup>1</sup> - The SRC is a partnership between semiconductor companies, academic institutions and government agencies. The two major research focus areas in the ESH subprogram are 1) development of new characterization, screen, handling and abatement methods for new materials and processes, and 2) exploration of preferable manufacturing options using green chemistries and sustainable materials
  - SIA Semiconductor PFAS Consortium<sup>2</sup> - An international group of semiconductor industry stakeholders to collect the technical data needed to formulate an industry approach to PFAS. Scope includes identifying research needs and drafting plans to address them appropriately and sponsorship of research projects.
  - PFAS Initiative (SPI)<sup>3</sup>, SEMI is involved in multiple efforts including the publication of joint PFAS research priorities between SEMI & ESIA, advocacy including efforts to generate research funds, and WGs within SPI focused on minimizing supply chain concerns through the development of risk maps, replacement roadmaps, and accelerating alternatives to enable supply resiliency.

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- Region-specific organizations:
  - The US National Semiconductor Technology Center (NSTC)<sup>4</sup> – Is a public-private consortium created by the CHIPS and Science Act of 2022 to implement workforce initiatives, including R&D intending to catalyze and capture the next set of critical technologies, applications, and industries. Members will have access to facilities, partners, and funding opportunities
  - US National Science Foundation (NSF)<sup>5</sup> – Is an independent federal agency that supports science and engineering through provision of grants to US academic institutions for basic research
  - Horizon Europe<sup>6</sup> - Is the EU's key funding program for research an innovation intending to tackle environmental issues, to achieve sustainability goals and to boost EU competitiveness and growth

## Getting engaged in industry consortia to collaborate on technical PFAS industry challenges.

- Based on the scope of PFAS use in the semiconductor industry, limitations in the commercially availability alternatives along with regulatory, environmental, and sourcing risk factors, there is a strong need for industry collaboration. Suppliers are encouraged to join industry efforts aimed at identifying and developing further technical information, identifying information gaps, and to jointly develop plans, as required, to address identified risks. As such, please consider joining consortia such as:
  - SEMI PFAS Initiative<sup>3</sup> – Supports sustainable semiconductor industry growth through identification and mitigation of PFAS-related semiconductor supply chain disruption. Contact [ehs@semi.org](mailto:ehs@semi.org) to join
  - SIA Semiconductor PFAS Consortium<sup>2</sup> - An international group of semiconductor industry stakeholders to collect the technical data needed to formulate an industry approach to PFAS. Scope includes the gathering and vetting of PFAS-use information relevant to the semiconductor industry, developing socioeconomic impact analyses, and developing technical reports, presentations and position papers

## Supplementary Information- Questions and Answers

### **Q1: What is the definition that Intel is using to define PFAS materials?**

A1: The definition that Intel is using for the purpose of PFAS reduction is any material comprised of molecules that contain at least one -CF<sub>2</sub>- and or -CF<sub>3</sub> group (closely aligned to the July 2021 OECD definition<sup>7</sup>). The reason for using this definition is because it mirrors the most inclusive definitions currently being used to determine regulatory scope (to include any molecule that contains a carbon atom saturated with fluorine).

### **Q2: Which current regulations cover PFAS materials?**

A2: (Note: The regulatory environment is constantly evolving, please reference the latest information published by relevant regulatory bodies to confirm the latest status.) At the Federal level in the

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United States, the US EPA has implemented a PFAS Strategic Roadmap that includes making use of many regulatory structures, including the Toxic Substances Control Act (TSCA), Clean Water Act (CWA), Safe Drinking Water Act (SDWA), the Clean Air Act (CAA), Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The US EPA and many US States have adopted and/or proposed regulatory reporting requirements and bans as well.

In Europe, the European Chemicals Agency (ECHA) has proposed a comprehensive ban of PFAS materials, allowing ongoing time-limited use of applications provided a derogation.

In other countries, these substances are controlled by various regulations or United Nation conventions including REACH, EU POPs, the Stockholm Convention, and more.

**Q3: What potential PFAS supply risks exist?**

A3: The risks impacting the use of PFAS include not only direct regulations but also other potential supply chain issues. A recent announcement of the exit of a large PFAS manufacturer from PFAS manufacturing by 2025 is a notable example of a broad supply chain disruption impacting many parts at multiple tiers of the supply chain. With PFAS suppliers existing there are concerns about global PFAS capacity shortfalls, and limitations on the ability to secure adequate replacements. Looking forward, there remains a high probability of unforeseen disruptions. For example, many major PFAS manufacturers are experiencing PFAS litigation pressures which may prompt business decisions impacting the availability of PFAS supply. Additionally, consumer and regulatory driven impacts on other uses (i.e. consumer goods) can also cause market instability for PFAS and supply/demand volatility causing availability and cost concerns.

**Q4: How will Intel determine whether a potential non-PFAS alternative will be implemented?**

A4: As with any new material introduced to Intel's manufacturing environment, all proposed substitutions must be fully qualified and accepted prior to implementation in Intel's manufacturing environments. Selections will be done per existing technology and supplier selection processes to weigh SCQATS (Safety, Cost, Quality, Availability, Technology, and Sustainability) factors. Availability and sustainability concerns should be addressed with mitigation strategies wherever they may be required, and due diligence must be done to avoid regrettable substitutions.

**Q5: When must a supplier provide non-PFAS alternatives to Intel?**

A5: Intel is asking for suppliers to complete an iterative assessment of PFAS uses within its purchased materials and equipment, as well as transparency into uses within the supply chain. The process needs to include a thorough evaluation and documentation of PFAS uses, and assessment of opportunities to implement non-PFAS alternatives as substitutes. Suppliers should provide roadmaps including replacement timelines to phase out existing uses of PFAS as soon as possible, with an emphasis on new product offerings and forward-looking intercept opportunities.

**Q6: Do upcoming products need to be designed as PFAS-free?**

A7: Selection decisions will be made based on SCQATS evaluations via standard supplier and technology selection processes. PFAS use will be weighed as an availability and sustainability risk

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factor. Given that the PFAS regulatory and supply line stability concerns pose significant risks to availability, any potential PFAS alternatives should be evaluated and aligned wherever possible.

**Q7: What are Intel's expectations for suppliers if no drop in non-PFAS alternative is available?**

A7: Wherever it can be demonstrated that a use of a PFAS material is critical for the application and that no feasible non-PFAS alternatives are available, it is expected that:

- roadmaps are provided for future phase out of PFAS substances including strategies to research alternatives, design out current uses, and ramp solutions that are attainable
- risk mitigation plans are provided to offset availability risks of continued use of PFAS
- the use of the material is reduced to the minimize amount required to meet performance requirements
- releases to the environment be eliminated wherever possible (across the entire lifecycle)
- commitments are made to support ongoing fundamental research for non-PFAS materials and technologies
- that technical performance information be summarized and stored in a manner that it can later be referenced and made available for further research and advocacy needs in the future

**Q9: Will Intel be establishing a policy to require removal of PFAS from products supplied to Intel?**

A9: Intel is committed to the phase out of PFAS and is actively working with suppliers and industry consortium toward this objective. Based on the breath and complexity of this topic, Intel is evaluating how to effectively establish policies to this end. Intel will communicate updated PFAS policies to suppliers once they are available.

## Helpful Resources:

1. Information about PFAS use in the semiconductor industry can be found here:
  - SEMI PFAS explainer: [PFAS Explainer: Regulations Concentrations | SEMI](#)
  - SIA PFAS consortium technical papers: [Semiconductor PFAS Consortium - Semiconductor Industry Association \(semiconductors.org\)](#)
2. PFAS definition & scope of use: There are multiple definitions of PFAS used by regulators. The broadest definition which Intel is applying (for supply risk management purposes) is the OECD definition which includes anything with -CF<sub>2</sub> or -CF<sub>3</sub> chain. PFAS is broadly used across many semiconductor applications as described in the above technical papers.
  - [Reconciling Terminology of the Universe of Per- and Polyfluoroalkyl Substances: Recommendations and Practical Guidance \(oecd-ilibrary.org\)](#)

## Sources:

1. <https://www.src.org/program/grc/esh/>
2. <https://www.semiconductors.org/pfas/>
3. <https://www.semi.org/en/semi-pfas-initiative>

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4. <https://www.nist.gov/chips/research-development-programs/national-semiconductor-technology-center>
5. <https://www.nsf.gov/>
6. [https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe\\_en](https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en)
7. [https://www.oecd-ilibrary.org/reconciling-terminology-of-the-universe-of-per-and-polyfluoroalkyl-substances\\_e458e796-en.pdf?itemId=%2Fcontent%2Fpublication%2Fe458e796-en&mimeType=pdf](https://www.oecd-ilibrary.org/reconciling-terminology-of-the-universe-of-per-and-polyfluoroalkyl-substances_e458e796-en.pdf?itemId=%2Fcontent%2Fpublication%2Fe458e796-en&mimeType=pdf)