DRAFT
IPC Response to the Proposed Restriction of PFAS

A responsible industry response to a universal PFAS restriction will require more time

This comment is in response to the European Chemical Agency's (ECHA) public consultation on the proposal for a restriction of per- and polyfluoroalkyl substances (PFAS) in the Annex XV Restriction Report from 22 March 2023. IPC respectfully submits these comments on behalf of more than 3,200 companies in the electronics manufacturing supply chain, including printed circuit board (PCB) manufacturers, electronics manufacturing services (EMS), cable and wire harness manufacturers, electronics industry suppliers, and original equipment manufacturers (OEMs). IPC members represent the complex and global supply chain for electronics and adjacent industries including consumer, commercial, and high-performance electronics used in aerospace, automotive, defense, medical, and other products found homes and businesses around the world.

The electronics manufacturing industry is committed to continuously improving the environmental performance and safety of all products placed on the market.

The complexity of the supply chain and the intermediate and final products manufactured by that supply chain does not easily lend itself to gathering credible and accurate information on all essential chemicals and materials embedded in electronics manufacturing processes and products. The properties of thermal stability, chemical inertness, and dielectric strength – among others – qualify PFAS, especially fluoropolymers, as likely candidates for use in a variety of processes and products. These PFAS-containing electronics, intermediate and final products, have utility in millions of applications, many of which are embedded in everyone's daily operations, enable life sustaining services, and underpin our modern economies.

As of the end of August 2023, more than 150 comments submitted to ECHA by electronics companies or associations state similar findings: the utility of PFAS is important and irreplaceable, the supply chain is layered and dynamic, the products manufactured are complex, and their function is governed by laws of physics and chemistry. The ability to efficiently replace these aspects is limited by these complexities, therefore it is critical that ECHA consider a modification to the derogations proposed by the Dossier Submitters. A universal PFAS restriction in electronics could result in inadvertent impacts on the economic well-being of EU companies and residents, a cascade of potential impacts on transportation, telecommunications, defense, health, testing and measurement equipment necessary to detect PFAS, and the day-to-day operations that engage electronics like mobile phone use and cloud storage. **To effectively minimize impacts to the users of electronics, the EU economy, and to the digital and green transition already happening in the EU, it is necessary to have a derogation for intermediate and final electronics products for the 18-month transition period plus a minimum of 12 years.**

The complex electronics supply chain creates challenges in reliably identifying the presence of PFAS

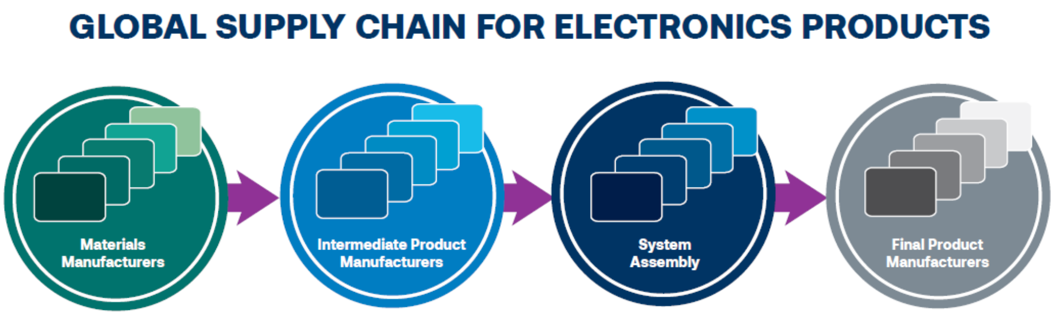


Figure X. Global Supply Chain for Electronics Products. Each rectangle represents the multitude of companies of varying sizes, types of output, and geographies. The supply chain comprises all sizes of companies, almost all countries around the globe, and thousands of part numbers representing the diversity of products.

The global supply chain for electronics products is multi-tiered, with thousands of companies responsible for manufacturing the materials (e.g., adhesives, coatings, and laminates) necessary for intermediate electronics products (e.g., semiconductor and passive components, wire and cable, and printed circuit boards) that are then assembled and manufactured to become final products (e.g., consumer, commercial, and high-reliability electronics). Intermediate electronics products include those items that do not function on their own but require assembly into or onto a system to enable performance. Final electronics products are the finished product that comprises intermediate electronics products. Companies that participate in this supply chain vary in size, output, and geography yet they are all part of an ecosystem, a complex system of interconnected and interacting parts that individually are not functional as when they are organized into a system.

The proposed restriction does not fully consider the cascade of utility PFAS provides in this complex electronics supply chain

PFAS are used because of the properties needed by the intermediate and final electronics products, e.g., inertness, hydrophobicity, dielectric strength. The intermediate and final electronics products that were manufactured by PFAS-containing equipment and that contain PFAS are complex products that function in part because of the properties of PFAS and these products are used in important and diverse end applications. If PFAS are restricted without the time necessary to responsibly manage a response, then the ecosystem depicted in Figure X will become imbalanced and each facet of the system will experience its own disruption and the entire ecosystem will be threatened with failure.

Furthermore, without proper time to develop, demonstrate performance, and study the environmental and health impacts of alternatives, the resulting impact on the electronics products could create additional waste or risk to the end user.

IPC has worked for more than three years with companies to determine where PFAS may be located or used in the manufacturing supply chain. However, the complexity of identifying suppliers and understanding what kinds of PFAS exist in products has proven difficult. Due to the specialized processes and proprietary composition of the electronic components, the design authority of the end product is often unaware of where PFAS are used. Additionally based on the broad and varying definitions in the classification of chemistries as PFAS, when presented with a chemical name, it is unclear to the design authority whether it qualifies as PFAS or would fall under the proposed restriction. The skilled electronics workforce includes many types of engineers and scientists, but very few fluorochemists. It can take up to 12 months to track a single chemical through the supply chain and identifying and tracking tens of thousands of PFAS through the electronics supply chain would be practically impossible within the proposed 18-month transition period.

The identification of chemicals in electronics products is costly. Visibility from the OEMs through EMS and PCB manufacturers to the chemical formulators and chemical manufacturers is constrained by the limited ability to connect with and obligate all supply chain partners to reliably collect and accurately report data on the presence or absence of PFAS used in any number of different electronics manufacturing processes and products. In addition, there has been no reporting or recordkeeping requirements for universal PFAS, therefore, the supply chain does not have mechanisms to track these substances, especially given that PFAS can be present as an impurity or byproduct. While the electronics industry continues to determine where and how PFAS are used, it is anticipated to take decades to find safer and equally effective alternatives and avoid regrettable substitution.

By way of example, a large electronics component manufacturer with multiple global operations has roughly 44,000 different suppliers. Of these, roughly 70% are small and mid-sized enterprises as defined by EU recommendation 2003/361. The lack, to date, of recordkeeping and reporting requirements has meant a shift in resources to ensure supply chain education on the many substances covered under this restriction.

PFAS are used in electronics manufacturing processes and products, but the scope of these uses remains elusive; a restriction of PFAS can have many unintended consequences

Table A.48 in the proposed restriction document provides an overview of uses and properties of PFAS in electronics products, but it is missing uses that have yet to be identified. Given the challenges of identifying PFAS in the complex electronics supply chain, industry has only identified some uses. However, what is known so far is that PFAS are necessary to the functionality and safety of electronic products.

PFAS are used in electronics manufacturing processes and products because of their unique properties. Many publications confer the many properties of PFAS make them a go-to solution for so many products. Some of those properties that make PFAS useful to electronics materials, intermediate products, assembly, and final products include:

- **Chemical stability**: PFAS are resistant to chemical reactions and degradations which allow them to have increased stability over time
- **Thermal Stability**: PFAS-containing products can withstand high temperatures without degrading
- **Low Surface Tension**: PFAS are repellant to liquids and help create nonstick surfaces

- **High Thermal and Electrical Insulation:** PFAS are useful in electrical components and thermal insulation applications
- **Dielectric strength:** PFAS offer higher dielectric strength and better insulation properties for high voltage and high speed applications

Table X highlights the properties of PFAS, the major applications in electronics, examples of typical products used in electronics and typical electronics that contain PFAS. The table focuses on essential PFAS uses with no known alternative. This list is not comprehensive or exhaustive.

Table X. TITLE

Major applications of PFAS in EEE	**Properties where PFAS are required** *Note: not all requirements apply to all applications)*	**Typical articles in EEE with this type of application of PFAS**	**Typical EEE containing articles with this type of application of PFAS**
Additives in adhesives	Chemical properties	Structural adhesives	Various EEE, HDDs, etc.
Battery materials	Chemical, electrochemical, and thermal stability, mechanical flexibility, adhesion properties, permeation resistance, low surface tension	Batteries (binder material for electrodes, Lithium salt anions and additives for electrolyte, Separator material, Sealing and insulation materials)	Various EEE, batteries, ICT equipment, etc.
Coatings and thin film materials	Water and oil repellency, chemical resistance, electrical characteristics, dielectric properties resistant to UV radiation, thermal stability, cleanliness, low surface tension, mechanical stability, manufacturability, low transmission loss at high frequencies, wide frequency range, flame retardancy	Printed circuit boards, flexible circuit coatings, semiconductors, small electronic components (e.g., capacitors, resistors, coils, diodes, transistors, switches, connectors, and electrical junction points), motors, voice coils, liquid crystal panels, touch panels, optical sensors, LED, Toslink, optical fibers, lenses for electronic cameras, projection lenses, polarizers, anti-solder coating, printing applications, epilame in motors	Various EEE, mobile phones, tablets, printers, cameras, HDDs, medical devices, ICT equipment, etc.
Display materials	Low anisotropic refractive index, low viscosity, low voltage drive, heat resistance, durability, dipole moment, chemical and moisture permeation resistance, low surface	Liquid crystal and flat panel display materials and coatings	Various EEE, TVs, monitors, displays, etc.

Major applications of PFAS in EEE	**Properties where PFAS are required** *Note: not all requirements apply to all applications)*	**Typical articles in EEE with this type of application of PFAS**	**Typical EEE containing articles with this type of application of PFAS**
	tension		
Membrane materials (vents)	Cleanliness, formability, manufacturability, particle filtration efficiency, permeability to water and organic vapors, thermal stability, chemical stability	Filter membranes, filter assemblies	Various EEE, printers, computers, HDDs, mobile phones, smart watches, ICT equipment,
Fire prevention, insulation material (safety)	Low dieletric constant, electrical insulation, flame retardancy, chemical resistance, heat resistance, corrosion resistance, crack resistance, durability, dripping prevention, machineability	Insulation on cables, wires, and tubing, seals, enclosures, connectors, immersion cooling fluid for data centers, etc.	Various EEE, cables, monitors, medical equipment, electric appliances, industrial control equipment, printers, ICT equipment, etc.
Lubricants and additives in lubricants	Lubrication properties, chemical stability, insulation properties, non-stick properties, thermal stability, electrochemical stability, mechanical reliability, uniformity, cleanliness, manufacturability, and hydrophobicity	Motors, tape cartridges, tape drives, tape cells, robotics, disks in HDDs, wire coatings, etc.	Various EEE, cameras, motors, fans, HDDs, electric appliances, medical equipment, industrial control equipment, tape libraries, etc.
Mechanical materials	Lubricity and abrasion resistance, low coefficient of friction, flame retardancy, durability, physical properties, low water absorption, low moisture permeability, cleanliness, low stickiness, and manufacturability.	Sliding parts, guides, pistons, seals, bumpers, motors, tubing, protective coatings, image forming parts of printers, industrial brakes, brakes, etc.	Various EEE, motors, fans, printers, HDDs, industrial equipment, cameras, displays, etc.
Optical materials	Water and oil repellency, flame retardancy, high transmissivity of light, low refractive index	Optical fiber, plastic optical fiber, optical lens, LED, monitors, panels, fiberglass, optical adhesive, protective coating material, anti-reflective material, etc.	Various EEE, mobile phones, cameras, lighting, monitors, panels, optical cable, ICT equipment, etc.

Major applications of PFAS in EEE	**Properties where PFAS are required** *Note: not all requirements apply to all applications)*	**Typical articles in EEE with this type of application of PFAS**	**Typical EEE containing articles with this type of application of PFAS**
Piezoelectric materials	Piezoelectricity, durability, heat resistance, flexibility, manufacturability	Films in speakers, microphones, touch panel, sensors, actuators, etc.	Various EEE, touch panels, speakers, sensors, microphones, etc.
Printed circuit board materials	Flame retardancy, dielectric properties, electrical performance characteristics, temperature stability (high and low), low water absorption, mechanical characteristics, repellency, surface tension	Printed circuit boards (rigid, flexed, hybrid) - various uses	Various EEE, transportation/mobility, ICT equipment, base stations, aerospace, etc
Printing materials	Low surface tension, electrical insulation, water repellency, oil repellency, chemical resistance, surface activity, high negative charge	Toner additives, Ink additives, Developer additives	Printers

This is where we can add information about the "top 10" comments from electronics companies to ECHA as of late August 2023 – source is the table put together by Tiger Team B. New info from DigitalEurope

As noted earlier, as of late August 2023, more than 150 electronics companies and associations responded to the consultation on the proposed restriction. IPC evaluated the responses for country of origin, submission content, information on uses, and requests for derogation or exemption. IPC's comment aligns with many of the comments already offered, including the comments provided by W.L. Gore (submission 4489) on wires and cables for electronics and the very detailed response from the coalition of Japanese associations (submission 4543) on the feasibility of alternatives and the use of PFAS in printed circuit boards.

Sufficient time to enable alternatives assessment is crucial to ensure safer options and avoid regrettable substitution

As noted, the electronics manufacturing industry is committed to continuously improving the environmental performance and safety of all products placed on the market.

Given the increased international focus on PFAS, the electronics industry has taken steps to consider alternatives. However, given the industries multi-tiered and complex supply chain, information gathering can be incredibly burdensome, particularly for small and medium sized businesses. While the electronics industry aims to undergo thorough alternative assessments, the current transitional period in the Restriction does not allow adequate time. The electronics industry will need substantial time to undergo an alternatives assessment to ensure safe alternatives and avoid regrettable substitution. (Consider adding https://one.oecd.org/document/env/jm/mono(2015)53/en/pdf)

Due to the widespread and varied nature of PFAS used in electronics in performance materials, broad generalizations on alternatives are not reasonable or valuable to eliminating these substances in products. Replacement of these substances must be undertaken on a case-by-case basis as they are selected for their specific properties that ensure product reliability, safety, and efficiency. For most uses of PFAS in electronics, there are no drop-in solutions which provide the same properties as PFAS-containing materials. Because of this, more research must be conducted on alternatives based on use case and industry must have more time to investigate alternatives.

Though many alternatives have been suggested for functionalities in electronics, they are not accurate. The use of PFAS in electronics materials is for the key functionalities and properties it provides. As an example, a market resource “BusinessAnalytiq” explains that PTFE resin currently costs EUR 16,84/kg in the EU while suggested “alternatives” for PTFE in electrical wire insulation such as PVC, PET, and Nylon are commodity materials that cost less than EUR 1,50/kg. The more expensive PTFE is selected by businesses for the properties that it contains and contributes to product performance and safety. Similar decisions have been made by industry when choosing fluoropolymer lubricants, seals, and other components. Changing to an alternative material in these cases will compromise the function of the device.

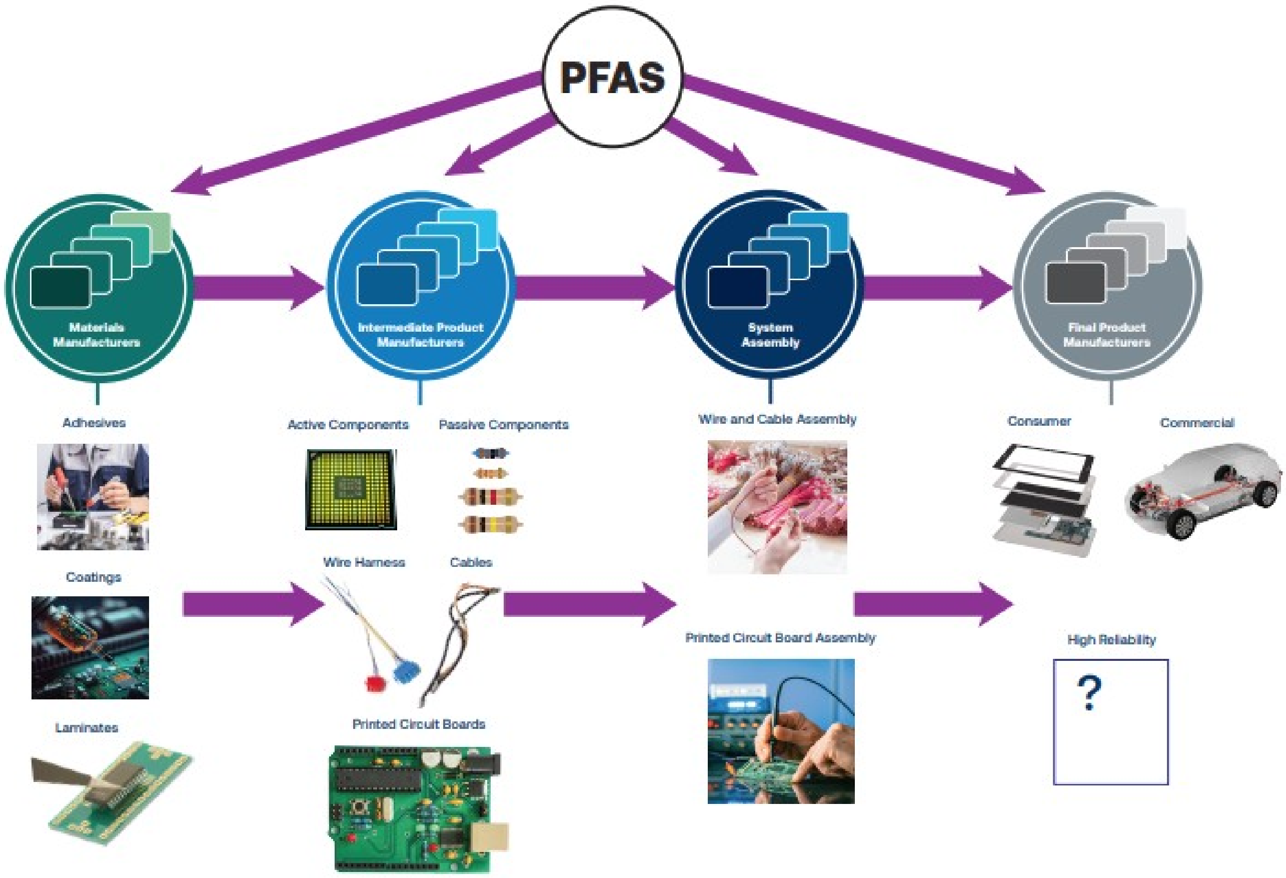
The ChemSec Whitepaper “Check Your Tech: A Guide to PFAS in Electronics” states “There are, according to industry, still also several specialized uses of PFAS that currently do not have viable alternatives at the time of the drafting of this guide. These include printed circuit boards for high-speed telecommunication network infrastructure, wiring and cable insulation for high voltage, lubrication and coatings in information and communication technology (ICT) equipment, acoustic equipment for challenging environments, touchscreen displays with haptic feedback as well as several uses in the production of semiconductors.” (p.4) These uses will need extensive time to research alternatives. Listed alternatives by Chemsec that are technically feasible are different to alternatives that are practically feasible, especially in high-reliability applications.

Technically feasible alternatives that have not been researched in use are not actually alternatives. More research must be conducted to assist industry with this transition and enable safe use.

PFAS-containing and potentially PFAS-containing electronics provide, irreplaceable utility to the world and are an enabler for the EU’s digital and green transitions

Table Y illustrates the interconnected relationships of PFAS-containing electronics, a cascade of utility. The table addresses the typical electronics materials that contain PFAS, such as adhesives and laminates, that are then incorporated into intermediate and final electronics products.

PFAS have proven properties useful to many applications, as do electronics. Together, PFAS-containing electronics provide great utility. A restriction of PFAS affects the materials necessary for making intermediate products, the intermediate products, the assembly of intermediate products, and the final products. PFAS-containing laminates used to make printed circuit boards can be assembled for use in thousands of applications including consumer, commercial, and high-reliability applications. Electronics are foundational to almost all modern technology. The importance of electronics will only grow as all industrial sectors increasingly look to electronics manufacturers as key enablers for product innovation, EU's digital and green transitions, and for regional technological sovereignty. The continued availability of electronics is foundational to the EU's political objectives.



***DRAFT** Figure Y. Utility of PFAS-containing electronics materials, assemblies, and products. The restriction of PFAS in electronics affects the complex supply chain and its complex products.*

It takes all aspects in the electronics supply chain, from silicon to system, to enable electronics systems to function, and to drive the technological advances that enable the dual transition.

Semiconductors function only if assembled into PFAS-containing electronics systems

Semiconductor chips have no functionality of their own. They gain functionality by being placed, along with many other components, on PCBs by electronics assemblers to create systems. These electronics systems feature prominently in the defense/aerospace, high performance computing, information technology, automotive, and medical sectors, but electronics are increasingly important to every industry and are, indeed, central to each industry's digital transition. In turn, electronics are increasingly enabling Europe's green transition, from electric cars and smart meters to the technologies driving more efficient energy use.

The importance of semiconductors in fueling the EU's dual transition as well as our regional technological sovereignty and leadership is well recognized. The recently adopted European Chips Act provides an important first step in ensuring access to needed technologies. Initial discussions on potential PFAS derogations further highlight semiconductors as a potential derogation use. It is, however, critical to recognize that electronics is a complex, inter-dependent industry.

Printed circuit boards provide the backbone for functioning electronics systems

PCBs have dozens of applications and are critical to many industries that rely on electronic equipment. Common applications of PCBs alone include:

- Medical devices including medical imaging systems, monitors, infusion pumps and internal devices
- Low Emitting Diodes (LEDs) that are used in residential lighting, storefront lighting, automotive displays, computer displays, and medical lighting
- Consumer electronics including communication devices such as smartphones, smartwatches, and tablets, computers, and home appliances
- Industrial equipment such as manufacturing equipment, power equipment, and test and measuring equipment
- Automotive components including entertainment and navigation systems, control systems and sensors
- Aerospace components including power supplies, monitoring equipment and communication equipment
- Maritime applications including navigation systems, communication systems and control systems
- Safety and security equipment including security cameras, smoke detectors, and electronic door locks
- Telecommunications equipment such as telecom powers, office communication equipment and LED displays and indicators
- Military and defense applications including communication equipment, control systems, and instrumentation

PCBs support high-functioning uses that often rely on PFAS. Without PFAS, the effectiveness, safety and quality of the final product is often compromised. Because of the ubiquity of PCBs, a restriction of PFAS affecting PCB manufacturing, assembly, and end products can lead to catastrophic impacts to many critical sectors of our society.

PFAS are critical to electronics used in aerospace and defence (A&D) applications

The aerospace and defence industry (A&D) is reliant on electronic equipment, parts, and components. Whether it be the multifunctional displays, flight controls with interconnected specialty electronics and wiring within a commercial or military aircraft, printed wire boards on naval vessels, wiring and cabling for a weapon or radar system, or the photovoltaic cells on a satellite, A&D demands electronic products with the highest level of performance and resiliency towards the harsh environments in which our products operate.

The electronic equipment, parts, and components that we procure must be able to perform not only the first time, but every time without failure in airborne, space, marine, and terrestrial systems and must be able to withstand extreme environmental conditions for 40 years and beyond, to avoid disastrous outcomes related to public safety and national security. Failure is simply not acceptable.

To accomplish this goal, A&D must have access to the top preforming products, materials and chemistries needed to achieve its targeted objective within the boundaries of strict qualification, standardization and performance. Fluorinated materials or PFAS provide the necessary chemical and physical properties to ensure these objectives. Chemical resistance, thermal stability, low surface tension, non-reactive, residue free; and high-dielectric properties are just a few of the properties that enable PFAS-containing electronic equipment, parts, components, and subassemblies to conform with the required performance elements and standardization needs. Alternative materials, including other halogenated materials found in electronic equipment, parts and components do not provide an acceptable level of performance and/or the ability to satisfy conformity requirements.

The A&D supply chain is very complex and composed of many (thousands of) parts that are designed and manufactured globally. A&D procures specialty electronic equipment, parts, and components as well as general industrial products such as cabling, wire harness assemblies, and finished off-the-shelf products that may not be specifically designed or supplied with the A&D sector in mind. For example, the same laminated FR4 circuit board found in consumer IT equipment may also be used in an aircraft or a piece of military hardware.

As noted previously by RAC and SEAC in an opinion on a proposed restriction on terphenyl in March 2023[1]: “the aerospace supply chains are long and complex with many actors involved at different levels - including suppliers (importers, formulators, and distributors), downstream users (original equipment manufacturers (OEMs), design to build (DtB)) or maintenance, repair, and overhaul (MRO) providers (civilian and military) within the industry.

The complexity of the supply chain often makes it difficult for A&D manufacturers, OEMs, or MRO companies to identify where substances are used within final parts or assemblies (or in the early stages of their production). This is particularly challenging when dealing with a very large group of substances like PFAS (~10,000 individual substances covered in the restriction proposal).

Aside from performance driven requirements and discovery challenges of PFAS in the complex supply chain, A&D manufacturers must conform with the strictest qualification and safety protocols across all of industry. Before the production of a part can begin, qualification, certification, and industrialization/implementation must take place. Certification is a key process to ensure that aircraft, military hardware, or any other equipment parts comply with the required level of safety and performance. Requalification may take several years to decades to investigate, test, select and qualify a new piece of A&D hardware constructed with a different material or chemistry. Further, existing equipment including spare parts used in legacy A&D finished products must be preserved to ensure the viability of those legacy programs. It is not feasible to recertify or requalify new equipment, materials or parts used in sustainment because of regional restrictions on use of PFAS.

PFAS are critical to electronics used in automotive applications

[1] https://echa.europa.eu/documents/10162/ec938800-0137-44f3-a329-c227f837a2fc

Electronics are necessary and critical to current and future automotive uses. Automotive electronics is one of the most important components for today's mobility and the mobility of the future. Future trends such as e-mobility, autonomous driving, connectivity or networking of vehicles with each other, with devices or with the traffic infrastructure and also the increasing number of infotainment systems cannot be implemented without reliable and powerful electronics.

“Whether it is electric-drive vehicles, advanced safety systems, autonomous vehicles or connected services, the technologies and innovations shaping the future of our industry require an increasing number of diverse semiconductors – from mature to leading edge nodes.[2]” The digitization of vehicles can only make an active contribution to climate protection through efficient road usage and resource allocation.

At present there are no means of replacing the PFAS used in the manufacture of high-performance semiconductors. Modern automobiles cannot achieve the safety and performance requirements necessary for current and future transportation needs without a diverse variety of semiconductors. A modern vehicle is a complex network on wheels and the number of control units, sensors, actuators and communication devices is growing from vehicle generation to vehicle generation. A modern vehicle can use as many as 3,000 semiconductor chips[3]. Automotive products provide a variety of mobility and transportation applications that benefit society. Modern automobiles cannot achieve the safety and performance requirements necessary for current and future transportation needs without a diverse variety of semiconductors.

Cable harnesses in current vehicles are highly complex technical products and act as a central interface and are ultimately essential for a wide variety of functions (safety, control, assistance, comfort, communication, etc.). The cable harness consists of up to 5 km of cables and can therefore weigh over 50 kg.

PFAS, including fluoropolymers, are found in most electronics components in today's cars including cables and wire harnesses for a wide range of applications including safety, printed circuit boards, semiconductors, brackets, touch panels, LCD modules, wiring of EM modules, electrolytic capacitor encapsulation, film capacitors, microcontrollers, spools, SMD connectors, diodes, and switches.

In contrast to requirements for electronics in the consumer sector, the requirements in the automotive electronics are significantly more robust. For example, electronics must work in a temperature range of -60 °C to +135 °C (reliable for 20 years) and withstand high shock and vibration loads. In addition, there is an increasing need for relatively high-bandwidth, broad-spectrum networks (from audio to 70 GHz radar operations - including GPS, Bluetooth, and wireless Ethernet).

The high demands on automotive electronics can only be guaranteed with the help of the special properties of PFAS and fluoropolymers. Fluoropolymers have high resistance to aggressive media in combination with high mechanical, thermal, dielectric and long-term properties. There are no materials with comparable property profiles available on the market

[2] Transforming Personal Mobility | Alliance For Automotive Innovation (autosinnovate.org)
[3] A Computer Chip Shortage Has Hobbled the Auto Industry - The New York Times (nytimes.com)

today. We have not identified any suitable alternatives with the same reliability and lifetime for automotive electronics.

PFAS are necessary to specialized components and assemblies in digital data storage products

Electrical, electronic and mechanical components and assemblies containing PFAS are widely used in computing and data storage products, including hard disk drives (HDDs) and data storage systems used in data centers. Most of the world's digital data is stored on HDDs, which provide a cost-effective, high performance, secure platform for mass capacity digital storage in highly reliable electronic devices with long product lifetimes. HDDs are electro-mechanical magnetic data storage devices where data is written and read at the nanoscale on recording media surfaces of rotating platters by precisely positioned read/write heads flying <5 nm above the disk surfaces in a sealed, environmentally sensitive, inner HDD chamber.

To meet the challenging functional, reliability and product lifetime requirements of HDDs, multiple PFAS-based materials are used in critical, highly specialized components and assemblies (disk lubricant, epilame in motors, filtration membranes, crash stops, ...) found in the unique sealed inner HDD chamber to provide the necessary cleanliness, physical properties, thermal stability, and durability. PFAS-free alternatives that may be acceptable for similar functions in other products, for example silicone as a lubricant or elastomer, are unacceptable for use in components in the internal HDD chamber where silicone contamination is known to lead to product failure and is prohibited from use.

Other standard electronic components and assemblies containing PFAS, (passives, robotics, tape libraries, capacitors, ICs, wires, cables, connectors, power supplies, fans, PCBs, plastic optical fibers, and others) are used in data storage systems (servers, expansion shelves, JBODs, disk arrays), where the PFAS-based materials are required to meet safety, performance and reliability requirements.

The absence of a workable transition time risks unintended consequences and the undermining of the EU's sustainable aims

IPC has sought to highlight that it takes all aspects of the supply chain to enable electronic systems to function and drive the technological advances that enable Europe's digital and green transitions.

As stated, the electronics manufacturing industry is committed to continuously improving the environmental performance and safety of all products placed on the market. And the industry is committed to replacing PFAS in products and processes where feasible and in a responsible manner. We do this in concert with other policy drivers regarding chemical substances in electronics; electronics are regulated in a wide range of evolving EU-based legislation including the Restriction of Hazardous Substances in Electrical and Electronic Equipment (ROHS) Directive, the Waste from Electrical and Electronic Equipment (WEEE) Directive, and the REACH Regulation. These policies have governed the use of chemicals and materials in the life cycle of electronics. In addition, emerging policies promote circularity and awareness of impacts from the chemical inputs across the product life cycle, e.g., the EU's Ecodesign for Sustainable Products Regulation and the Corporate Sustainable Reporting Directive, In stakeholder submissions to this public consultation, electronics companies and associations have identified multiple uses of PFAS in multiple electronics materials, intermediate products, assembly, and final products that need a 12-year derogation. Differentiating specific uses (e.g., singling out semiconductors separately from laminates, PCBs, or the final products that rely on these materials and intermediate products) for derogation ignores the interconnected nature of the complex system of interconnected and interacting parts that individually are not as useful as when they are organized into a system. Central to this is the provision of a workable, consistent derogation period for electronics with transition times enabling safe product re-design. We highlight that the absence of a workable transition time risks unintended consequences and undermines the EU's sustainable aims.

I. Appendix

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