PFAS in Belgium: market study and support for the development of more sustainable alternatives

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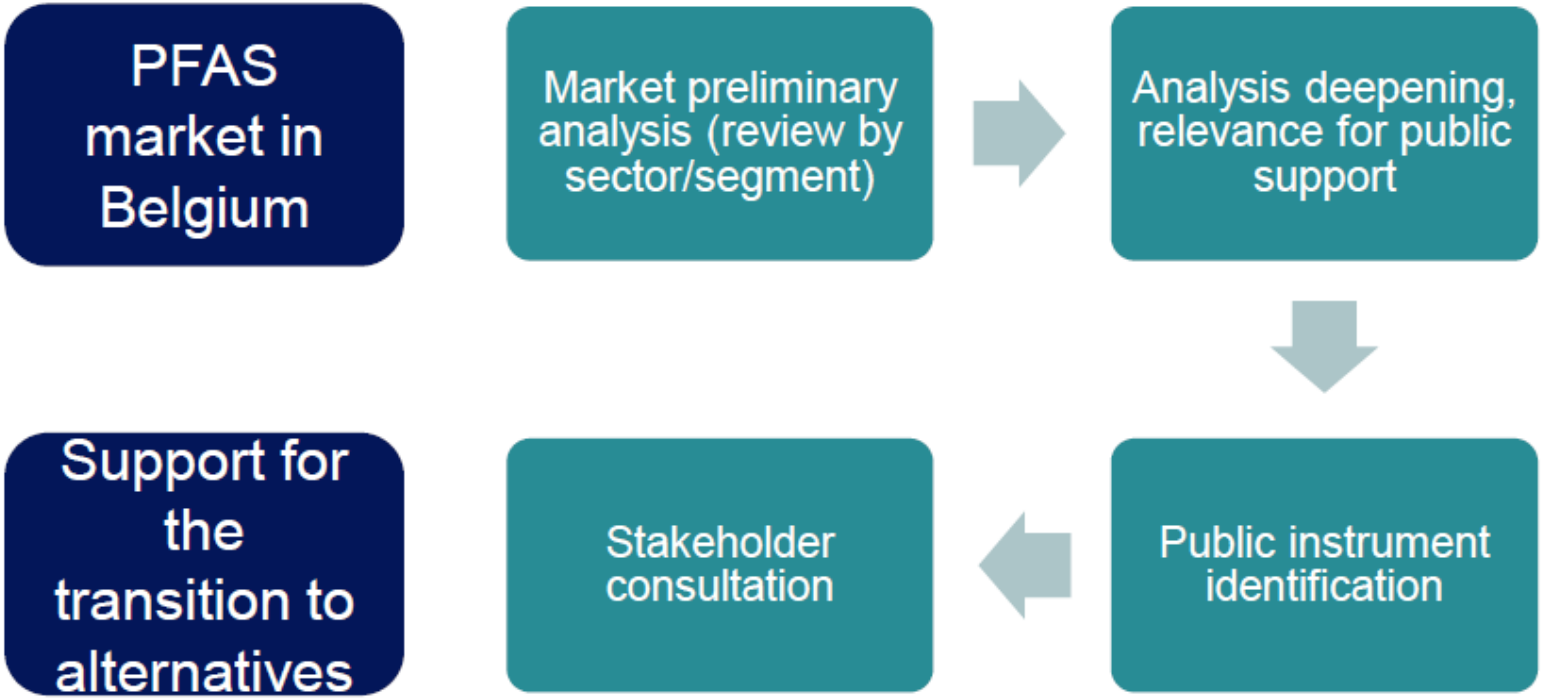
- Objectives
- Conclusions
- Results of the priority sectors
- Overview of other sectors
- Next steps

Objectives of the study

Reminder



Policy recommendations - overall

Overview

- **Search of PFAS-free alternatives in a wide range of sectors**
- **Challenge to find alternatives**
  - \ PFAS properties (oil repellence, biocompatibility, durability, chemical resistance…)
  - \ PFAS enabling combination of properties

Barriers to the development of alternatives

Technical and knowledge barriers

Lower performance, safety concerns, skills gap for use.

Competing regulations imposing other demands

For example concerning global warming, EcoDesign, safety requirements.

Additional costs which can be prohibitive

CAPEX (installations, more complex products) or OPEX (operating costs).

Uncertainty as to which PFAS will be banned

When and for what applications; together with which alternatives will be brought in.

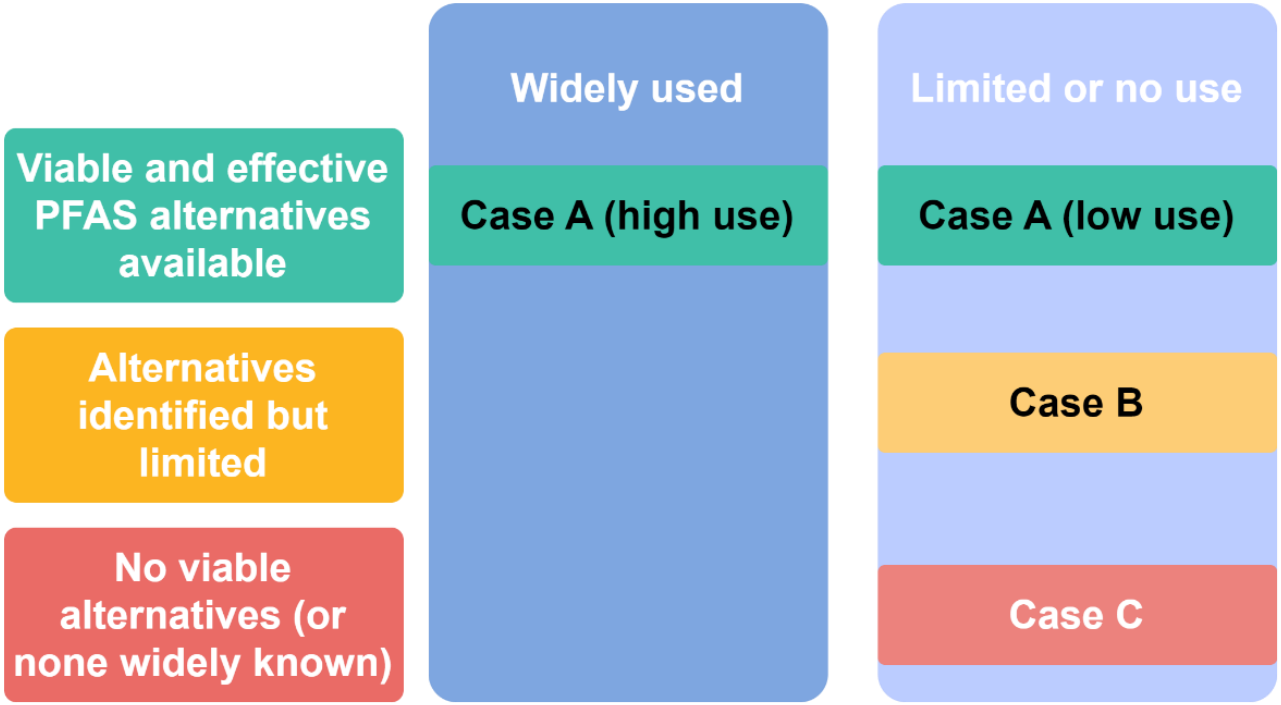
Concerns over sharing of innovation results

Potential market power of companies finding viable alternatives).

Lack of centralisation of information / coordination

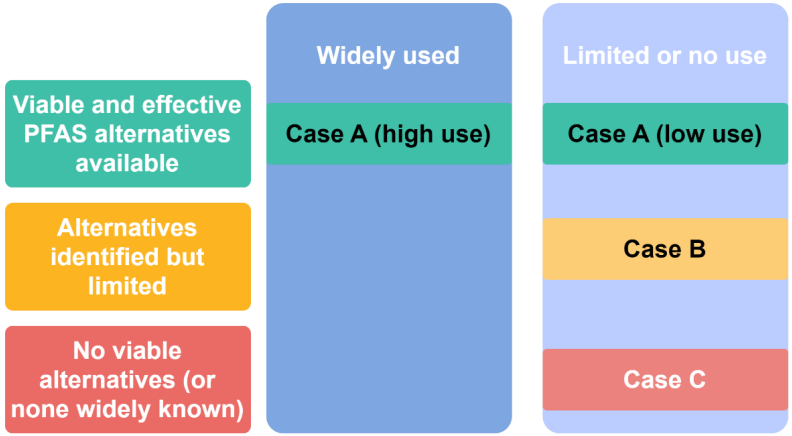
Reduces flow of information as to potential solution and possible duplication of work.

3 maturity levels of PFAS substitution



3 maturity levels of PFAS substitution

Case A

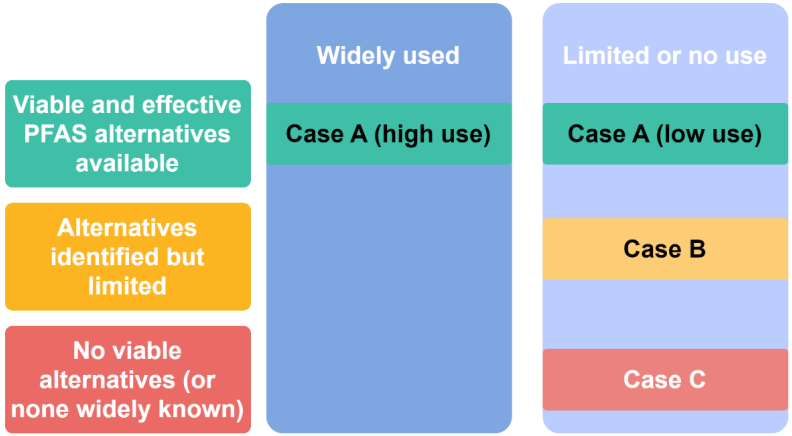


Case A

- increasing consumer / producer information on products containing (or not) PFAS
- short term subsidisation to encourage users to switch system
- ensuring the easy availability of technical information on the alternatives for users
- ensuring that there is sufficient competent and trained staff to install and maintain these systems
- place increasing restrictions on PFAS use by way of environmental permits (up until a full ban would be implemented)

3 maturity levels of PFAS substitution

Case B

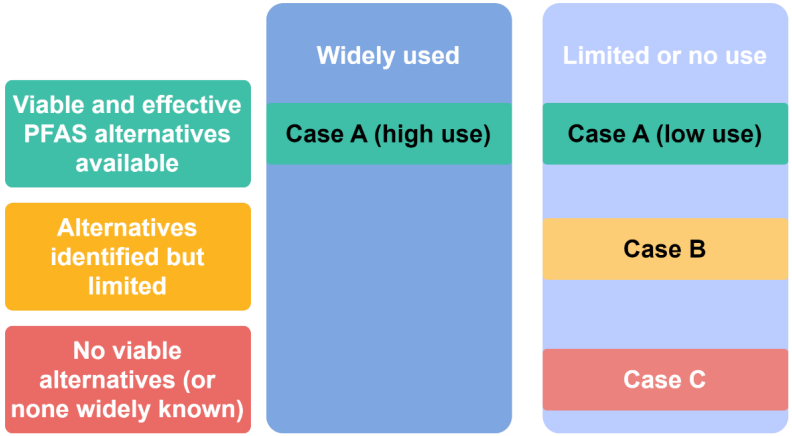


Case B

- **Performance restrictions/limits**
  - \ R&D can help → R&D subsidies, information exchange and either/or collaborative R&D or optimising private incentives to innovate.
  - \ R&D cannot help → subsidies to encourage switching to products with quality reduction or alternative products providing a similar function without PFAS
- **High CAPEX cost to switch**
  - \ Related to purchase/installation costs → subsidies that decrease over time
  - \ Related to R&D → see performance restriction limits
- **High OPEX cost to run the alternative solution**
  - Decreasing subsidies but trade-off with other public policies (e.g. R&D)

3 maturity levels of PFAS substitution

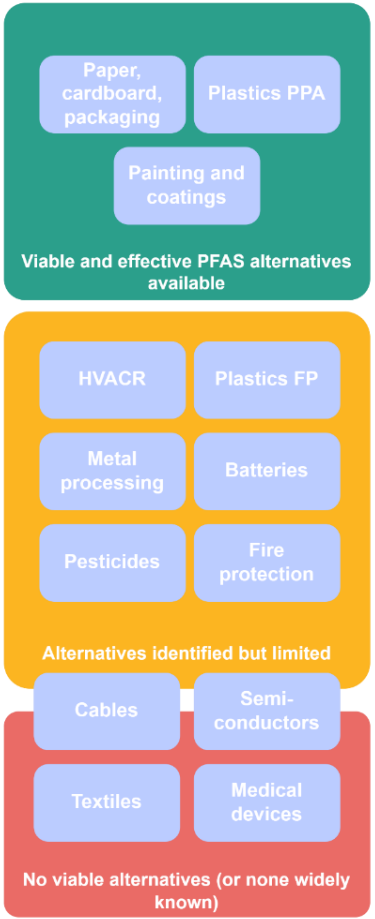
Case C



Case C

- **Long-term: R&D subsidies, information exchange and either/or collaborative R&D or optimising private incentives to innovate**
- **Short-term: support measures to reduce emissions of existing PFAS systems until they can be replaced**

Overview of cases in different sectors



- **While cases A, B and C are assigned to each in the following slides, given that some (in particular medical devices and HVACR) have many different applications, this status may not apply equally to each PFAS application.**

Policy recommendations – by priority sector

Technical textiles

Technical textiles

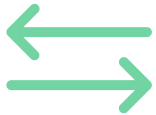
Use, properties and alternatives

PFAS used for:

- Personal protective equipment
- Automotive textile used as seats covers
- Construction materials

PFAS properties

- water repellence
- oil repellence
- chemical and fire resistance
- protection against infectious risk



No PFAS free alternative enabling

- Oil repellence
- The combination of properties listed above
- Washability (and therefore reusability)

Technical textiles

Barriers to PFAS substitution

- **Solution likely to come from companies developing chemicals for the textile industry (ongoing R&D for years/decades from demand for alternatives)**
- **Several issues are likely to arise when the solution is found:**
  - **Price increases and foreclosure:** potential market power following chemical company solution and patent protection (essential facility), so could :
    - Profitably raise prices; and/or
    - Selectively choose (or exclude) recipients of solution.
  - **Bringing to market:** Steps for technical textiles producers to be implemented (lab testing, certification and real-life testing)
- **In the short-term, no PFAS alternatives for personal protective equipment:**
  - trade-off between environmental toxicity (PFAS) and the health of the people wearing PFAS-free personal protective equipment, having lower performance.
  - If a single use solution for PFAS were possible: trade-off between environmental toxicity (PFAS) and circular economy (linked to other environmental impacts).

Technical textiles – case C

Context and recommendations

No alternatives that allow sufficient oil repellence properties are currently available. Thus, there are different policy forms which may help

Short term

- Assess the need for personal protective equipment in a public call for tenders; and
- potentially adapt new requirements for certain uses (to reduce the need for PFAS in the short term)

Long term

- Once an alternative is available from the chemicals industry
  - subsidies for testing
  - organising a collaborative workshop to foster the development

Policy recommendations – by priority sector

HVACR (Heating, Ventilation, Air Conditioning and Refrigeration)

HVACR

Overview

- **Belgian (and EU) companies are not typically involved in the production of PFAS for HVACR but are rather involved in the use of PFAS in final or intermediate products**
- **Many different applications of PFAS**
  - Focus on gases in the study
  - PFAS also used in other parts of the equipment (including PFAS polymers)

HVACR

Applications and most important properties

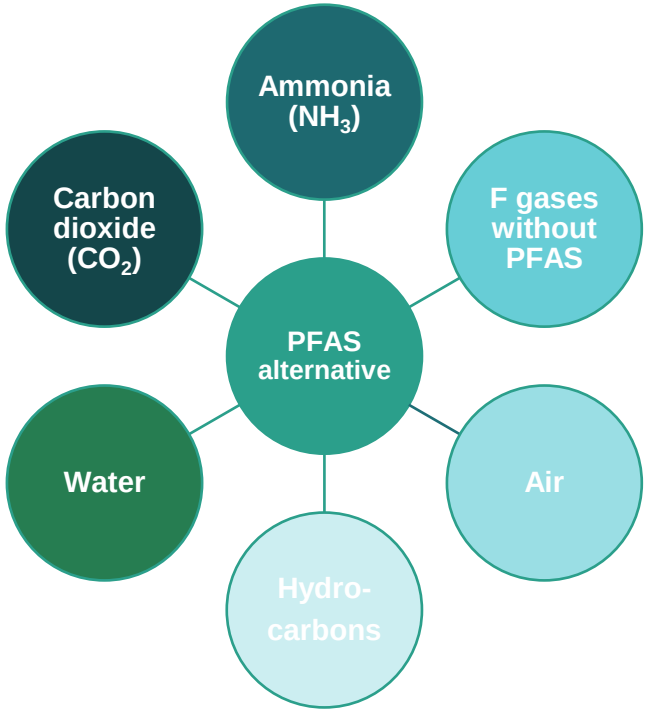
Hydraulic heat pumps	Reversible static air conditioning + heating	Mobile air conditioning
Commercial Refrigeration + integrated heating in shops	Industrial Refrigeration	Waste heat recovery
Foam blowing agents	Sealings	Compressors

Properties

- the precision of temperature control
- range of temperatures
- life span
- low energy consumption
- consequences on the pressure of the circuit
- low flammability
- heat capacity (energy per unit of mass)
- low GWP (Global Warming Potential)

HVACR

Possible alternative products



HVACR

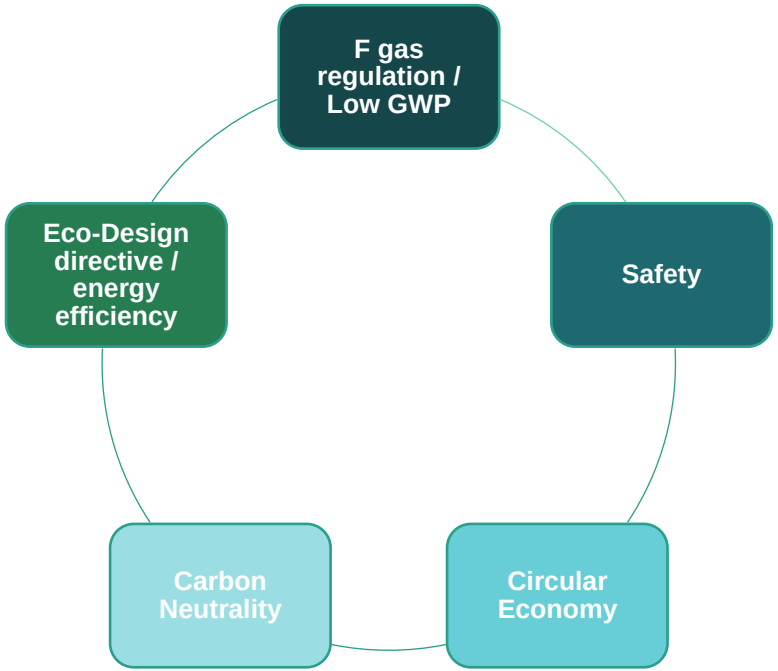
Heating, Ventilation, Air Conditioning and Refrigeration

Alternative	Performance	Likely uses	Costs
Ammonia	➢ elevated aquatic toxicity ➢ higher fire risk	➢ industrial applications	➢ higher CAPEX ➢ higher OPEX ➢ skills gap
Hydrocarbons	➢ an elevated flammability and explosion risk	➢ large chemical industrial sites	➢ higher CAPEX ➢ higher OPEX ➢ skills gap
Water	➢ currently limited temperature range	➢ requires compressors operating under vacuum which requires R&D - Used in water heat pumps	➢ Uncertain
Carbon dioxide	➢ appealing CO_2 flammability and toxicity properties ➢ potential issue related to pressure requirements and temperature resistance	➢ refrigeration ➢ combination with ammonia for even lower temperatures, although it may not be suitable for certain applications ➢ domestic water heating in some cases	➢ higher CAPEX ➢ skills gap
F gases without PFAS	➢ likely to be banned with the F-Gas regulation ➢ very high GWP	➢ similar uses to PFAS in terms of range	

HVACR

Barriers to PFAS substitution

- **Barriers**
  - \ Technical barriers
  - \ Increased CAPEX or OPEX linked to the alternative
  - \ Lack of technical capacity to implement alternatives
  - \ Uncertainty as to what substance will be banned and when



HVACR – Case B

Context and recommendations

Some sub-applications have PFAS-free alternatives

Others do not or entail significant cost increases or performance drops/safety risks

- CAPEX and R&D subsidies (including modulation of existing ones)
- Collaboration with city planning
- Stimulation of collaborative R&D/private incentives to innovate
- Ensuring the presence of skilled workers who can install and maintain PFAS alternatives
- Establishment of prioritisation lists of desirable alternatives

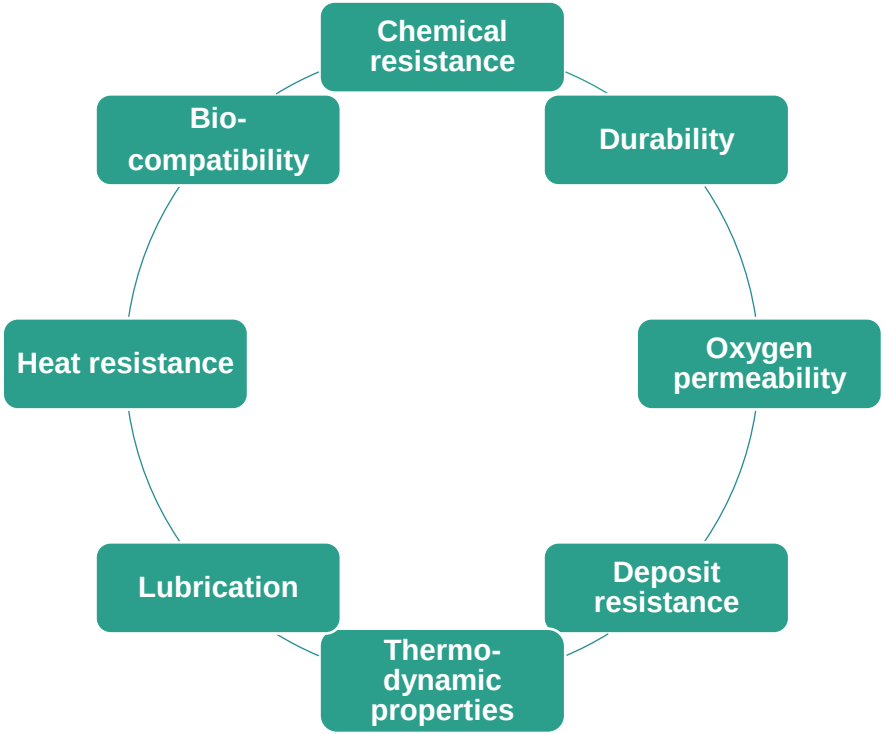
Policy recommendations – by priority sector

Medical devices

Medical devices

Applications and relevant PFAS properties

- **PFAS used in various medical devices to enhance patient safety and comfort**
  - \ Fluorinated gases: used in anaesthetic gases and refrigeration
  - \ Polymeric PFAS (fluoropolymers): used in implants, syringes, tubing...
  - \ Monomeric PFAS: used in a variety of medical devices including contact lenses.



Medical devices

Barriers to PFAS substitution

Performance of alternatives for medical devices

Lack of consensus on viable alternatives

Strict regulatory standards

Uncertainty regarding passing regulatory approval and long delay to do so

Segmented and sometimes small markets

Medical devices – Case C (1/2)

Context

PFAS are still being discovered in some parts of the supply chain

General lack of knowledge of potential viable alternatives at this stage

Lack of significant collaborative research/information sharing

Large number of applications → no clear path at this stage of which applications or potential alternatives to stimulate

Some applications where the solution will be relatively straightforward

Others where it will be difficult

Medical devices – Case C (2/2)

Recommendations

R&D subsidies

Stimulation of collaborative R&D

Private incentives to innovate

Establishment of prioritisation lists of alternatives with groups of applications

Overview of other sectors

Overview of other sectors

Sector	Key point on PFAS use in Belgium	Specific recommendation
Batteries **Case B**	- Approximatively 10 companies are likely to use PTFE and PVDF to produce materials and components of batteries in Belgium. - Debates about alternatives are only emerging and PFAS-free membranes, separators are under investigation.	- R&D subsidies, information exchange and either/or collaborative R&D or optimising private incentives to innovate.
Cables **Case B & C**	- PFAS mainly consist in fluoropolymers, a volume of 40 t/y have been extrapolated for Belgium. - Different alternatives have already been tested (PEEK, PC, EPDM), with currently no technically feasible alternatives for all cables.	- R&D subsidies, information exchange and either/or collaborative R&D or optimising private incentives to innovate. - Provide subsidies that decrease over time to encourage substitution
Fire protection **Case B**	- Fire suppressants & firefighting foams are a well-known stream of PFAS pollution, subject to specific regulation. - PFAS play a key role and the use of less performing chemistry leads to other environmental and health issues. - CO_2, hydrocarbon, siloxanes are among the best alternatives, some of them are developped in Belgium	- R&D subsidies, information exchange and either/or collaborative R&D or optimising private incentives to innovate. - Provide subsidies that decrease over time to encourage substitution

Overview of other sectors

Sector	Key point on PFAS use in Belgium	Specific recommendation
Metal processing **Case B**	- Industrials widely use 6:2FTS in hard chrome plating (1-2t/y) for the automotive, aeronautic or firearm markets. - Industrials are already facing challenge with the Cr(VI)-based process and seems unaware of the PFAS use. - Various strategies have been adopted for substituting PFAS: other chemistry, plating, process…	- Focus on the development of alternatives that are both Cr(VI)-free and PFAS-free - Increase producer information levels - R&D subsidies
Paints & Coatings **Case A**	- According to IVP Coatings, PFAS-containing paints & coatings may represent up to 10% of the Belgian market (i.e., € 200 million). - Industrial & transportation protective coatings are the main application of PFAS (FPs, 300t/y). - Epoxy, PU or silica-based coating already have high market share	- Increase consumer information levels - Ensure technical guidance for substitution - Place increasing restriction on PFAS
Paper & Cardboard **Case A**	- PFAS are not essential; and widely accepted alternatives already exist, no evidence and limit hint of PFAS use in Belgium have been found. - PFAS are mainly introduced via import, increased recycling leads to spreading PFAS throughout all the paper and board market.	- Gain knowledge on PFAS content of import product - Gain knowledge on PFAS incorporation during the end-of-life management

Overview of other sectors

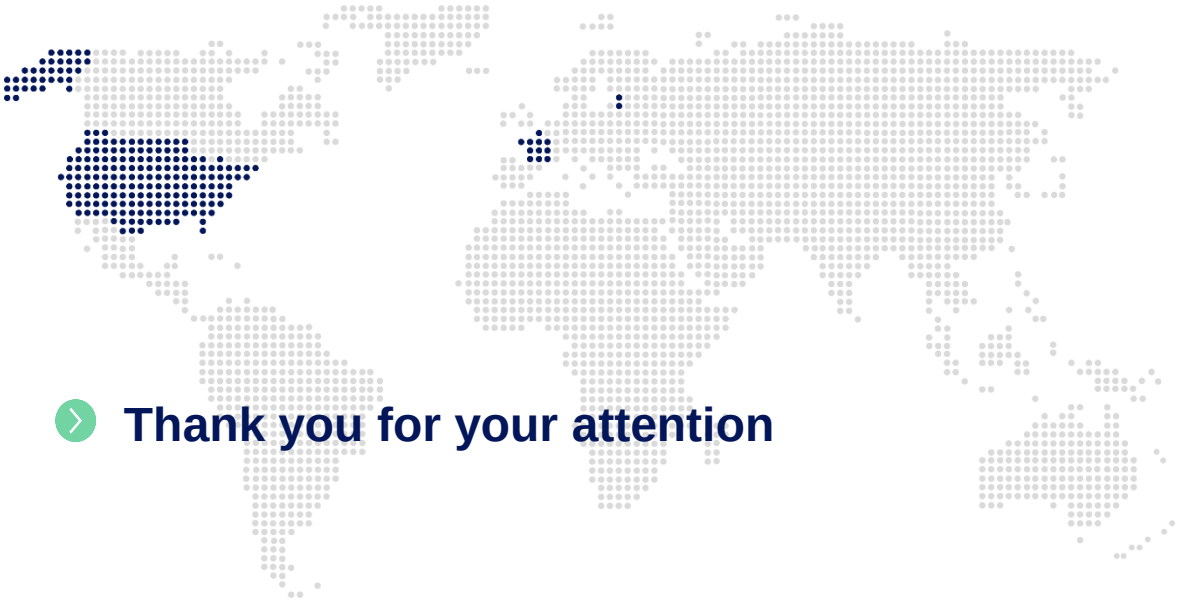
Sector	Developpement of alternatives	Specific recommendation
Pesticides **Case B**	- Belgium is one of the largest consumers (7 kg/ha) and producers (10% of the EU industry) of pesticides in Europe, suggesting high PFAS use (529 t/y) - The subject of PFAS used as active substance in the manufacture of PPP is widely unknown in Europe & Belgium - There is very limited work on PFAS alternatives.	- Increase consumer/producer information levels - Encourage overall reduction of PPP
Plastics **Case A & B**	- Numerous PFAS-free polymerisation aids and polymer processing aids are already commercialized and used, none of them have been developed by Belgian actors. - FPs-free sealings appear to be extra-challenging: PEEK, PPS PPA, ACM or nitrile rubber do not fulfil all requirements, and would lead to higher leakage risk and maintenance cost.	Aids: place increasing restrictions on PFAS use Focus the help on the downstream actors of the value chain (R&D & substitution subsidies)
Semiconductors **Case B**	- FPs and PFBS are used in highly diverse applications. However, the Belgian share of the EU industry only represent 1.5% (i.e., 66t/y PFAS used). - For a limited set of applications, HDPE, mineral oils or NF_3, are potential alternatives. - Some companies do not share information on alternatives because of possible competition	No specific recommendation, see all Case B recommendations

Next steps

Next steps

Deadline for comments on the final draft report: **14/12/23?**

Translation of the executive summary



Thank you for your attention

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RDC environment