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I. Introduction

Disclaimer: Throughout this document, the term 'RACHP' shall be considered synonymous with the term 'HVACR' which is often used globally to represent the same or very similar industry sector as RACHP.

The European Partnership for the Energy and the Environment (EPEE) [1] welcomes the opportunity to participate in the consultation by providing evidence and data on the RACHP sector to the ECHA responsible committees to support them in their review of the restriction proposal.

EPEE is the European association representing the entire value chain of the Refrigeration, Air-Conditioning and Heat Pump (RACHP) Industry since 2000. EPEE's membership is composed of over 48 member companies, as well as national and international associations covering three continents (Europe, North America, Asia).

As an expert association, EPEE supports safe, environmentally and economically viable technologies, and works to ensure a better understanding of the sector in the EU. EPEE proactively contributes to the development of effective European policies, regulations, and standards. As part of this, EPEE and its members ensure that refrigerants are responsibly used in RACHP equipment, in an energy efficient, safe, environmentally sound, affordable, and reliable manner, over their entire lifecycle, including the equipment's End-of-Life (EoL).

Since 2012, EPEE has developed its own modelling tool covering the EU and UK, **The HFC Outlook Model**, which is based on value chain data provided by members and aims at forecasting the refrigerants development in RACHP equipment in the future years.[2] Its projections are built bottom-up, providing an analysis of the stock of equipment in more than 50 F-Gas market sub-sectors. This includes the RACHP sectors but also non-RACHP F-gas applications such as MDIs, technical aerosols and foams.

This detailed and granular model enables EPEE to give solid and robust data that can be used to support policy making. For this submission to the PFAS Public Consultation, EPEE has extracted emission data from this model to project emissions from individual refrigerants until 2035 and certain degradation data for the RACHP sector as it is covered by the Restriction Proposal. More details are given later in this document.

The applications that EPEE members cover can be divided by:

- Market types: residential, commercial, transport, industrial;
- Sector types: refrigeration, comfort cooling and heating, heating and/or steam production for industrial processes;
- Technology sub-types: stand-alone, direct expansion, chillers, flooded systems.

Detailed descriptions of those applications, based on the categories used in the HFC Outlook model, are indicated later in Table 5. This submission will cover both F-gases and fluoropolymers (see **Part II: Fluoropolymers**), since both these groups of substances are crucial for the RACHP sector.

EPEE members use refrigerants as an essential element for the good functioning of their RACHP components, equipment and systems to heat and cool. Refrigerants enable the use of RACHP

[1] epeeglobal.org
[2] HFC Outlook EU (epeeglobal.org)

applications which are beneficial to society, operating in homes, industrial sites, offices and public buildings, including hospitals, airports and train stations.[3] Most F-gases, which are a core part of the full portfolio of refrigerants EPEE members use, fall under the PFAS definition use as basis of this restriction proposal.

RACHP applications usually operate under higher pressures within a wide temperature range: temperatures can range from -50°C to 175°C and pressures can range from near a vacuum and up to 45bar (R410A) and up to 120 bar for CO_2 systems. They must comply with energy efficiency demands following Ecodesign standards while operating according to safety codes and standards.

II. Importance of the Refrigeration, Air-Conditioning and Heat Pump Sector to Society

A. Benefits provided by the RACHP Industry to Society

Cooling and heating are a fundamental need for society:

- Refrigeration ensures safe and affordable food supplies and reduces CO_2 emissions by avoiding food loss and waste.
- Comfort cooling is necessary in areas where summer temperatures are increasingly becoming a threat to productivity and health, including in hospitals.
- Using heat pumps for comfort heating is key to achieve the decarbonisation of heating and for heat recovery of low-grade waste heat.

All applications operating in homes, industrial sites, office buildings and public buildings including hospitals, airports and train stations, are beneficial to society. The magnitude of the sector is reflected in the 20% ratio of the entire global consumption of electricity. Heat pumps also improve the energy system via its demand side response and storage features.[4]

- **Heat pumps[5] and air-conditioning systems:**
    - Residential uses: space heating and cooling and sanitary water heating with hydronic (air-to-water and ground-to-water) or air-to-air heat pumps;
    - Services: Commercial and public sector buildings, space heating and cooling and sanitary water heating, large systems for offices (chillers, variable refrigerant flow systems (VRFs), rooftop units…);
    - District heating and cooling;

[3] More info on the use of F-gases in the RACHP sector can be found on the EPEE website: [Home - Count on Cooling]

[4] See for instance COM(2020)299, *Powering a climate-neutral economy: An EU Strategy for Energy System Integration.*

[5] 'A heat pump is a device that can provide heating, cooling and hot water for residential, commercial and industrial use. Despite the name, all heat pumps can provide both heating and cooling. They work well in nearly all types of climate. Heat pumps take energy from the air, ground and water and turn it into heat or cool air. This works due to what is known as the refrigerant cycle.' About heat pumps – European Heat Pump Association (ehpa.org)

  - Industrial uses: low temperature process heating (below 130°C) and high temperature water and/or steam for industrial processes and industrial building space heating and cooling industrial drying;
  - Air-conditioning for cars, vans, trucks or large vehicles like buses, trains or marine vessels and ships;
  - Waste heat recovery, with the purpose of enhancing circularity and to reduce energy consumption from industrial, commercial activities;
  - Data centres where efficient cooling is key, but also where heat pumps can recover waste heat.
- **Refrigeration**:
  - Residential purpose including refrigerators and freezers (not in EPEE's scope);
  - Food retail and food service refrigeration, including standalone units, chillers, condensing units and centralized refrigeration systems;
  - Industrial cooling in applications such as food and beverage production, processing and packaging, chemicals, pharmaceuticals, oil and gas etc;
  - Transport of goods in vans, light trucks or larger systems like trailers and containers such as shipping containers (reefers). Those systems are essential for securing the cold chain for perishable food products, medical products (e.g., medicines, vaccines, blood, and plasma), sensitive electronics, and other critical products that rely on specific controlled temperatures for preservation.

The benefits of heating and cooling directly impact the health and well-being of Europeans. For instance, for cooling, those direct benefits align with eight of the UN's Sustainable Development Goals. Those benefits include the improvement of work force productivity by 15% and reduced food loss and waste.[6]

Figure 1 - Sustainable Development Goals enabled by Cooling – Count On Cooling website

Beyond all the benefits that the RACHP sector delivers to society by providing comfort and enabling industrial processes, it is key to understand that the sector delivers a huge opportunity to decarbonize the European heating sector, thus helping to ultimately reach climate goals for 2030 (55% CO_2 emissions reductions compared to 1990) and the European Carbon Neutrality objective by 2050.

[6] CountOn Cooling - The benefits of cooling

Figure 2 below is an analysis of the impact of heat pumps showing the direct HFC emissions and indirect energy-related emissions from the rapidly growing bank of heat pumps, together with the amount of CO_2 emissions avoided through the use of these heat pumps and the massive cut in fossil fuel emissions related to low temperature heating. In 2050, the emissions savings will be 100 times more than the GHG emissions of the sector.

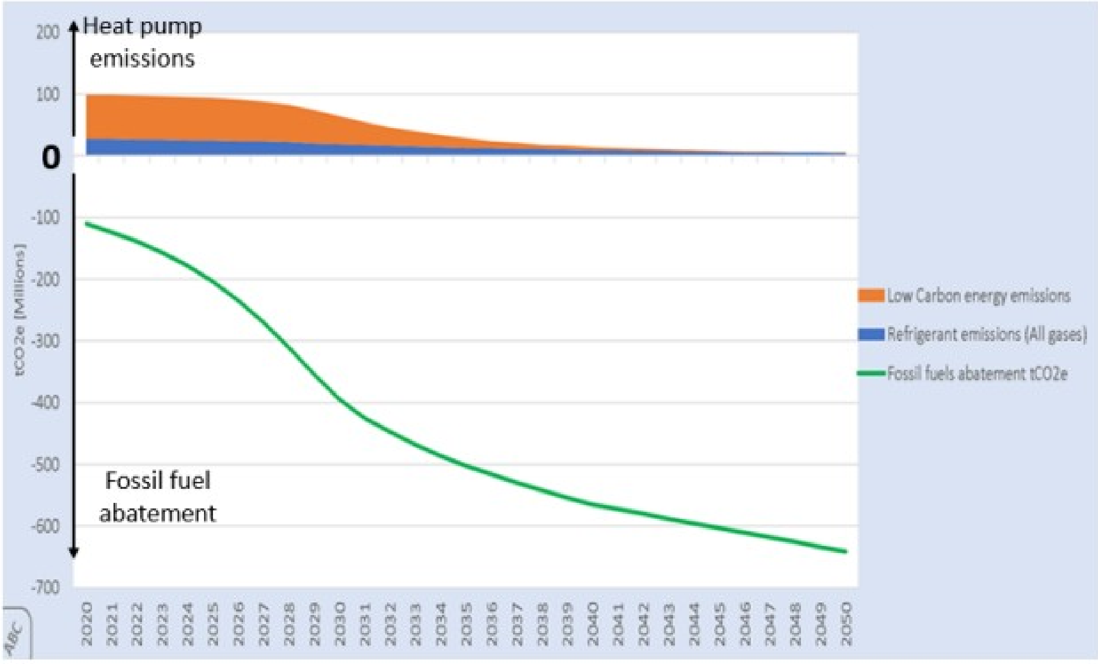

Figure 2 - Avoided GHG Emissions through use of Heat Pumps, HFC Outlook EU model[7]

Figure 1: Avoided GHG Emissions through use of Heat Pumps, HFC Outlook model[7]

This roll-out of heat pumps and their key role is fully recognised and encouraged by the EU legislation with numerous initiatives and action plans that are briefly explained in the next section.

B. Legislative Framework of the RACHP Industry

Given the societal and climate benefits and widespread use explained in the previous section, the RACHP industry and its downstream users are highly regulated sectors in the EU with a well-established, successful framework of regulatory management measures (RMM). There are three core pieces of legislation within this: the F-gas Regulation, the Eco-design Directive, and the Waste Electrical and Electronic Equipment (WEEE) Directive. There are also certain pieces of national legislation which add to this framework, e.g. the German Circular Economy Act.

The **F-gas Regulation** is the main piece of EU legislation that regulates the use of fluorinated gases, as the transposition of the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, including the 2016 Kigali Amendment. These global commitments aim at implementing an HFC phase-down to reduce HFC production and consumption by more than 80% based on their greenhouse impact over the next 30 years. The EU Regulations are well ahead of the Montreal Protocol targets. The first EU F-Gas Regulation in 2006 had two main objectives:

[7] HFC Outlook EU – Main Findings – February 2023

- **Prevent emissions** of F-gases from existing equipment by requiring checks, proper servicing and recovery of the gases at the end of the equipment's life. Improving the prevention of leaks from equipment containing F-gases via:
  - containment of gases during operating life of RACHP systems;
  - recovery of F-gases during servicing and at end-of-life;
  - training and certification of personnel and of companies handling these gases;
  - labelling of equipment containing F-gases;
  - reporting on imports, exports and production of F-gases
- Bans on use of F-gases in some applications where less harmful alternatives are widely available, based on Global Warming Potential (GWP) and dates for both new equipment and for service.

A revised, second F-gas Regulation entered into force in 2014. This was a significant upgrade because it further limited the amount of climate impacting HFCs (including blends) which can be placed on the market in the EU from 2015 onwards, gradually reducing the supply of HFC-based CO_2 equivalents in the EU by 2030 to 21% of 2015 levels. HFC manufacturers and importers apply for and receive annually declining quotas for placing F-gases on the market, based on past market share.

F-gases account for 3% of all EU greenhouse gas emissions[8]. The Regulation has been recognized as a success:

1) F-gas emissions have declined since peaking in 2014 (13% lower in 2019 in the EU-27 + UK than in 2014) (EEA, 2021a);
2) Placing on the EU market of bulk HFCs in CO_{2eq} quickly decreased, even compared to the maximum authorized quantities (see table below):

	Maximum authorized quantity (CO_{2eq}%)	Placing on the EU market of bulk HFCs (CO_{2eq}%)
2015	100%	85%
2020	Decreased by 45%	Decreased by 52%

Table 1 - Evolution of the maximum authorized quantity and of the placing on the Market of bulk HFCs in CO_{2eq}%

The EU is leading the world towards the use of lower GWP alternatives to HFCs: these are both F-gases and non-fluorinated alternatives i.e. CO_2 (R-744), propane (R-290) and ammonia (R-717). Climate related emissions of HFC refrigerants have been significantly reduced through (a) use of lower GWP alternatives, (b) emission reductions during operation, and (c) reductions in end-of-life emissions.

The 2014 Regulation is currently under review, and it is likely that a third F-Gas Regulation will lead to even stronger containment measures of HFCs and HFOs, greater cuts in available quota of HFCs and further F-gas bans in RACHP systems which may include full F-gas bans for some product segments. It is expected that an agreement will be found by the end of 2023, and that the Regulation will enter into force in 2024.

By reducing the use and the emissions of fluorinated gases, the F-gas regulation has the same purpose as the PFAS proposal by limiting the environmental release and impact of F-gases.

The **REPowerEU Communication**[9] and the new Commission initiative of the **Action Plan for the acceleration of heat pumps** expected at the end of 2023 both increase the ambitions for the sector in

[8] EEA, *Hydrofluorocarbon phase-down in Europe* (2022), https://www.eea.europa.eu/data-and-maps/indicators/emissions-and-consumption-of-fluorinated-3/assessment

[9] COM(2022)/108, *RePowerEU: Joint European Action for more affordable, secure and sustainable energy*, https://energy.ec.europa.eu/system/files/2022-03/REPowerEU_Communication_with_Annexes_EN.pdf

terms of deployment of installed units. Those initiatives are key in the European Strategy to phase out dependency on fossil fuels, fixing the ambitious target of 30 million newly installed heat pumps in 2030, and saving 35 bcm (billion cubic meter) of gas in 2030. This ambition is also confirmed by the **Renewable Energy Directive**, adopted in September 2023, under which heat pumps provide renewable heating and cooling, and support Member States' targets.

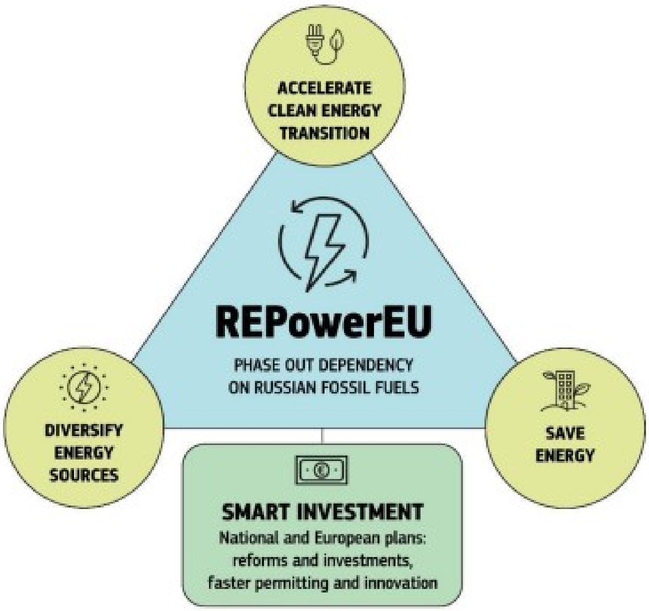

Figure 3 - Principles of the REPowerEU Communication

The **Ecodesign Directive** (2009/125/EC) and **Energy Labelling Regulation** (2017/1369) set minimum energy efficiency requirements for specific products groups such as heat pumps, air conditioners or VRF systems. The Directive ensures that inefficient or outdated products are gradually eliminated from the EU market. Since the introduction of the Ecodesign Directive, energy savings have been considerable. According to an EPRS Briefing on the Revision of the Ecodesign Directive, from 1959 to 1970, the average consumption of a domestic refrigeration unit was 839 kWH/year, decreasing to 292 kWH/year by 2005. The Commission found this to be a direct result of voluntary agreements, energy labelling and minimum energy efficiency requirements. By 2020, the Commission estimated that the annual electricity consumption had reached 181 KWh/unit, as a result of the energy efficiency directives and ecodesign/energy labelling policies[10].

In 2024, the Ecodesign Directive will be repealed and replaced by the Ecodesign for Sustainable Products Regulation (ESPR), which introduces additional sustainability requirements going beyond energy efficiency. Requirements such as durability, repairability and recyclability are expected to be introduced. The RACHP products covered under the Ecodesign Directive are engineered and designed using PFAS substances (F-gases and fluoropolymers) to comply with the minimum energy efficiency standards set by the Ecodesign requirements. In view of upcoming prohibitions concerning the use of certain types of refrigerants, EPEE is especially concerned that current Minimum Energy Performance

[10] EPRS, Briefing, "Revision of the Ecodesign Directive", Izabela Bacian, April 2022, Revision of the Ecodesign Directive (europa.eu)

Standards may be difficult or even unfeasible to meet. Depending on the type of alternative refrigerant, it may lead to increased cost to achieve similar efficiencies. However, the transition to these types of products could also lead to important efficiency losses either within the product range or even to other concepts of products and technologies serving the same purpose of heating and cooling.

The **WEEE Directive (Directive 2002/96/EC)** is introducing the EPR obligation for EEE-producers. The first and original objective is to prevent waste electrical and electronic equipment, and to contribute to the efficient use of resources and the retrieval of secondary raw materials through re-use, recycling and other forms of recovery to reduce and avoid disposal. Eventually, the aim is to improve the global performance of the equipment life cycle. This Directive requires the removal of all the fluids with a GWP above 15 that can be used in the equipment. The WEEE Directive therefore covers RACHP equipment under Category 1 on Temperature Exchange Equipment.

The **Energy Efficiency Directive** (2023/1791/EU)[11]: gives legal strength for the first time to the principle of “energy efficiency first”, meaning that energy efficiency measures are central to any policies or investment decisions. The universal PFAS restriction proposal, however, puts energy efficiency at risk. PFAS used in the sector now (especially fluoropolymers, see Part II of the EPEE reply to the Public Consultation) provide this efficiency, while alternatives, when those alternatives even exist today, often do not.

However, redesigning equipment with new components will likely make those units more expensive, including for key uses such as food refrigeration, heating and cooling units, and would have consequences on citizens’ health.

[11] As adopted on the EU Official Journal on September 20: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2023:231:TOC

III. The use of F-gases in RACHP equipment – refrigerants

A. Technical use of F-gases in RACHP equipment

Before providing any data, we believe it is important to explain the main criteria behind the selection of the refrigerant for its use in a given application, in a given location. Selection depends on several factors all of which need to be balanced with each other:

- It must be compliant on emissions and climate change legislation, i.e. meet the requirements of the current RMM including the F-gas Regulation;
- It must be compliant on **energy efficiency**, i.e. fulfil the requirements of the Ecodesign provision while respecting the Energy Efficiency First Principle at all times;
- It must meet **safety requirements and standards**. These ensure that the equipment is put safely in operation and operated in a safe manner.

It is important to mention that non-fluorinated alternatives cannot meet these criteria in all applications when used as refrigerants.

Alternatives	Constraints / impacts
R-717 (CO_2)	High pressure equipment / Highest energy consumption
R-744 (ammonia)	Toxic Excess ammonia in the environment also contributes to the acidification and eutrophication of ecosystems and to climate change[12]
R-290 (propane)	Highly flammable > requires ATEX equipment to be handled for logistics (highest costs) Cost of additional safety measures are underestimated in the GIZ study on splits If emissions occur, will create Ozone in low atmosphere (as VOC)[13]

B. The F-gas emissions Model

EPEE created and continues to update its *EU HFC Outlook* model to project pathways for the refrigerant transitions in view of the EU F-Gas Regulation.[14] This is based on value chain data provided by members and it aims to forecast the refrigerant development in RACHP equipment in the years to come. Its projections are built bottom-up, providing an analysis of the stock of equipment in more than 50 F-Gas market sub-sectors. This includes the RACHP sectors but also non-RACHP HFC applications such as MDIs, technical aerosols and foams. It was built by Gluckman Consulting for EPEE.

This detailed and granular model enables EPEE to give solid and robust data that can be used as support to policy making. The 2012 version helped EPEE assess the European Commission's phase-

[12] REACH registration dossier on NH3 : Registration Dossier - ECHA (europa.eu)
ADEME website (agency of the French Minister of Environment): Les émissions d'ammoniac (NH3) – Ademe
[13] Propane (R290), for instance, a non-fluorinated refrigerant, and its atmospheric degradation products have a high Photochemical Ozone Creation Potential (POCPs), meaning a high contribution to smog formation See EFCTC, https://www.fluorocarbons.org/environment/environmental-impact/vocs-and-pocps/
[14] This EPEE model is highly regarded, and parallel models are used beyond EU borders. For example, the UN has worked with EPEE to create country specific models to help Montreal Protocol Article 5 countries prepare their F-Gas reductions plans. EPEE also maintains this model covering the UK.

down proposals and showed that the phase-down steps in the 2014 EU F-Gas Regulation were challenging but achievable.

The 2022 version of the *HFC Outlook EU Model* builds on the initial modelling work done. It predicts a trajectory for an HFC phase-down in the EU in view of the EU F-Gas Regulation adopted in 2014. The current version is the most granular tool that exists to model the likely transition and evolution in refrigerant choices, based on real data from the RACHP sector. Beyond this, the model also provides data on emissions which are based on real leak rates data from electronic logbooks and other available sources. The latest version also uniquely covers (indirect) energy-use linked emissions.

C. Which emissions from the RACHP sector?

Using its HFC Outlook EU Model, EPEE has extracted relevant data for this Public Consultation. The proposal asks for further detail on emissions including estimations of the share of emissions (in percentages) attributable to the three different stages products, i.e. the manufacture phase, the use phase and the end-of-life phase. Our data shows a very different picture and draws very different conclusions from the emission data in the restriction proposal. We set it all out below.

The modelling shows that the level of emissions and the split between the three stages can vary considerably between the different technology types used in the RACHP sector. Data collected by the industry also shows that there have been significant reductions in emission rates, driven by the controls in the first and second F-Gas Regulations. This reduction is expected to continue with future and further controls in the third F-Gas Regulation.

Many types of small RACHP equipment are factory built sealed systems, e.g. domestic refrigerators, standalone retail display cabinets. This type of system typically has refrigerant charge in the range of 0.05 to 0.5 kg. They have a very low operational leakage rate – well below 1% per year (see Figure 4 below). There is a potential for EoL emissions from small sealed systems; both the F-Gas Regulation and the WEEE Directive require refrigerants to be recovered and either re-used or destroyed.

Larger RACHP equipment often requires site-installed refrigerant pipework to connect the various components of a system. For example, large supermarket refrigeration systems can have refrigerant evaporators located in 10 or more refrigerated display cases connected to compressors in a machinery room and to condensers located outdoors. A large supermarket system might contain from 100-1000 kg of refrigerant. This type of installed system now has leak rates under 5% and this is expected to further improve over the next few years. (See Figure 4 below)

An important part of the RACHP market is split systems used for comfort cooling and heating. Air-to-air units are used in small sizes for residential applications and larger sizes for commercial buildings. Recently reported data (from electronic logbooks required in some EU Member States for mandatory record keeping under the F-Gas Regulation) show that this type of equipment has annual leakage below 2%.

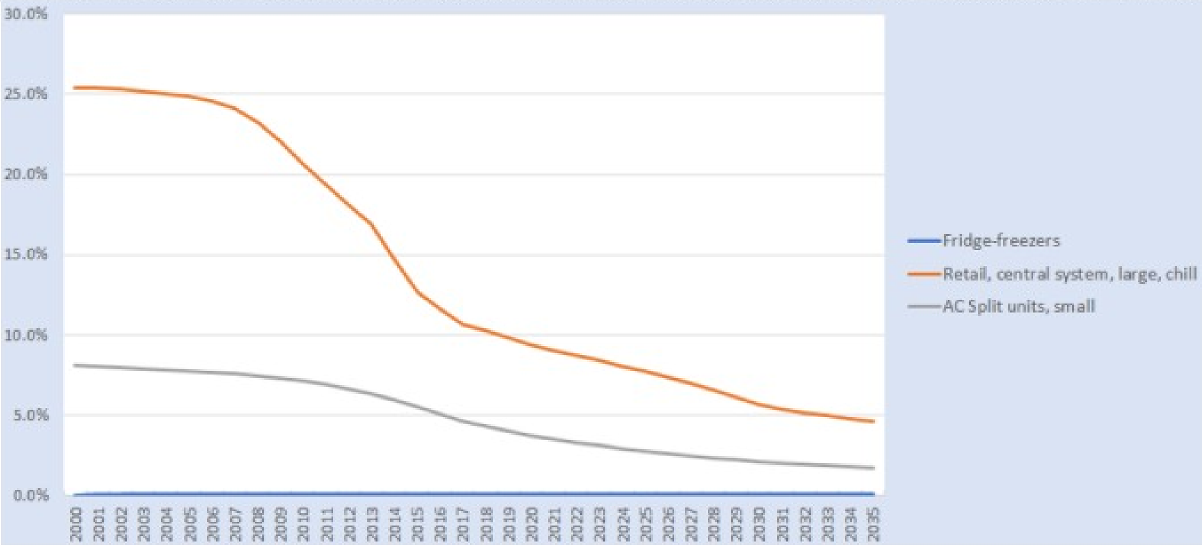

Figure 4 - Modelling projections for operational leakage rates for 3 types of RACHP equipment until 2035

Figures 5 and 6 show the split of emissions in metric tonnes of F-gases between factory manufacture, site installation, operating life leakage and end-of-life emissions. For large site installed equipment (Figure 5) operating life emissions are dominant, whereas for small sealed systems (Figure 4), end-of-life emissions are dominant.

Those graphs show the already engaged efforts to decrease emissions from different applications. They were started in 2007 when the first F-gas Regulation entered into force, requiring installer certification and leak prevention (containment of gases, proper recovery of equipment). After the first revision was entered into force, it was followed by a second stage in 2014. This last step was ensured thanks to new HFC leak check requirements to reduce leakages.

The second and ongoing revision of the F-gas Regulation foresees an extension of the requirements on leak checks to HFOs and blends. This latest step is key in the further decrease of the emissions and is expected to have a major impact on the emission values.

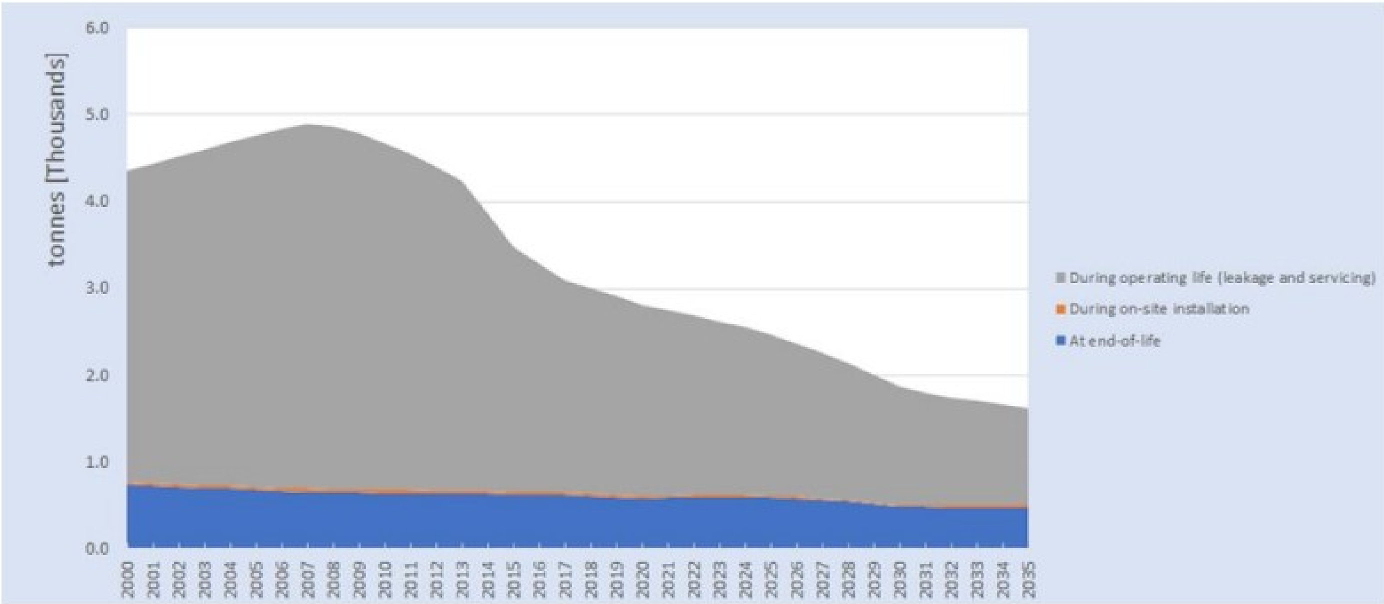

Figure 5 - Source of emissions of F-gases, large commercial refrigeration systems from year 2000 to 2035 in metric tonnes

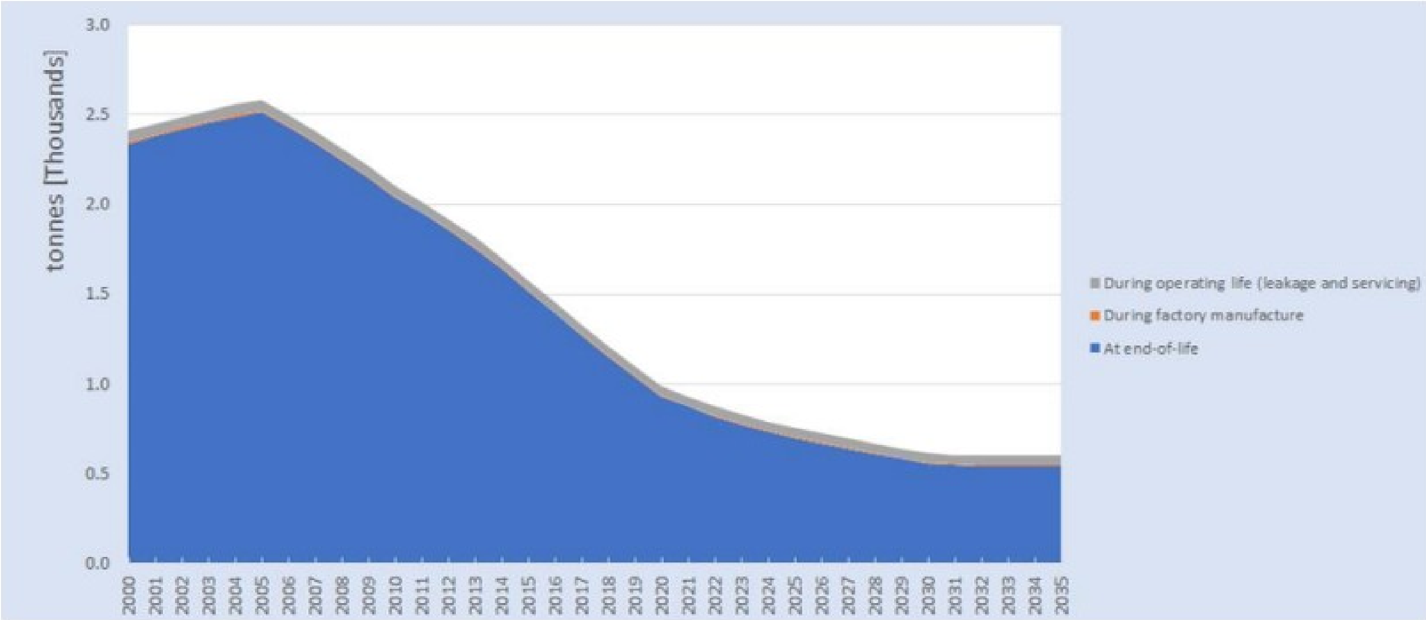

Figure 6 - Source of emissions of F-gases, small factory sealed refrigeration systems from year 2000 to 2035 in metric tonnes

The modelling, which is backed up by supporting proprietary data, shows that emission rates are falling. This is due to the improvement of the components used for the tightness of the equipment and to the legal requirements related to containment measures in the F-gas Regulation. Such improvement was already noted for HFCs when first requirements applied.

The model provides data specifically on F-Gas emissions by fluid type in all 50 subsectors. We have chosen to present this data for 10 indicative HFCs, HFOs and blends below.

	HFCs						HFOs				Total
	R125	**R134a**	**R143a**	**R227ea**	**R245fa**	**R365mfc**	**R1233zd(E)**	**R1234yf**	**R1234ze(E)**	**R1336mzz**	
2020	10.016	19.071	3.653	200	72	114	1	1.546	94	0	**34.766**
2025	8.503	16.099	2.424	169	-	-	15	3.617	384	6	**31.218**
2030	4.809	9.703	187	81	-	-	29	6.022	670	12	**21.512**
2035	2.654	4.301	20	-	-	-	43	8.686	999	17	**16.720**

Table 2 – Modelling of emissions of refrigerants by molecule in tons between 2020 and 2035

When comparing the total refrigerants emissions with the emissions figures in the PFAS Restriction Proposal (which presents all applications of fluorinated gases), the EPEE data shows significantly lower emissions values. We are concerned by these differences and have been raising them with the proposing countries since the first public consultations in 2020 for the ROI.

In addition, the global amount of refrigerant emissions is largely decreasing year by year and will be cut by more than half by 2035 compared to 2020. We are concerned that the Dossier Submitters have made this conclusion with incorrect emission figures.[15]

Degradation products

The restriction proposal includes degradation products of PFAS substances. More specifically, according to the Dossier Submitters, the rationale behind the inclusion of F-gases in the restriction scope is that some F-gases (HFCs and H(C)FOs) degrade to trifluoroacetic acid (TFA), which is known to be a persistent substance according to the REACH Annex XIII criteria.

We know from the F-gas value chain that:

- All the F-gases themselves had been registered under REACH and have not been found to be PBT substances.
- Emissions of TFA-yielding F-gases only lead to increases in TFA concentrations that remain safely at orders of magnitude below scientifically established DNEL/PNEC levels and/or food intake or water quality standards for TFA[16]. This results in a *de minimis* risk to human health and the environment, as also highlighted by UNEP: "The margin of exposure between the distribution of No Observed Effect Concentrations (NOECs) and the observed and expected concentrations in the oceans and endorheic basins is several orders of magnitude and is indicative of de minimis risk" (REF: UNEP EEAP Report, pg. 290)
- According to the trifluoroacetic acid (TFA)[17] REACH registration dossier and Chemical Safety Report (CSR), this substance does not fulfil the criteria for a PBT or vPvB substance under Annex XIII REACH. Neither does it raise equivalent levels of concern under Article 57(f) REACH.[18] In this respect, ECHA already reviewed/evaluated the TFA dossier without concluding that further regulatory actions were needed.

If we look beyond this information, received from the F-gas supply chain we note the independent and expert views of 'The Environmental Effects Assessment Panel' of the Montreal Protocol under the United Nations Environment Programme (UNEP) – See below.

This eminent panel consists of scientists working in photobiology and photochemistry, mainly in universities and research institutes[19]. The EEAP has been making comment on the topics of TFA for almost a decade now. Therefore, **the opinion of such experts needs to be strongly considered in this REACH restriction proposal.**

[15] Please refer to the EFCTC submission for more details on this point.

[16] See recent *Mammalian toxicity of trifluoroacetate and assessment of human health risks due to environmental exposure*, Dekant *et al.,* 17 February 2023; and all relevant previous UNEP (EEAP and SAP) reports.

[17] Trifluoroacetic acid, EC no: 200-929-3, CAS no: 76-05-1, Molecular formula: C2HF3O2

[18] See e.g., *Mammalian toxicity of trifluoroacetate and assessment of human health risks due to environmental exposure*, Dekant *et al*, 17 February 2023.

[19] Current EEAP Members come from numerous universities and research institutes, such as Loyola University New Orleans (U.S.), Murdoch University (Australia), Institute of Wood Science and Technology (India), Finnish Meteorological Institute (Finland), National Center for Atmospheric Research (U.S.), Swiss Federal Institution of Aquatic Science and Technology, Eawag (Switzerland), University of Gothenburg (Sweden), U.S. Environmental Protection Agency (U.S.), Kings College London (UK) and many other scientific organizations and universities.

Below is a summary of key comments the EEAP has made on TFA over the last decade:

"UV-driven photodegradation of some of the compounds controlled by the Montreal Protocol (e.g., hydrofluorocarbons (HFCs)) produce contaminants such as trifluoroacetic acid (TFA), but **concentrations of these breakdown products in the environment are currently deemed too low to be a concern for human health or the environment**."	Page 8 Environmental Effects Assessment Panel of the United Nations Environmental Programme, 2021
"Solar UV radiation also plays an important role in the breakdown of contaminants and plastics in aquatic and terrestrial ecosystems (SDG 14.1), but the ecological and human health consequences of these transformations are not yet well understood. The current low concentration of trifluoroacetic acid (TFA) produced by the degradation of several hydrofluorocarbons (HFCs) and hydrofluoroolefins (HFOs), is currently **judged not to pose a risk to human health or to the environment**."	Page 9, Environmental Effects Assessment Panel of the United Nations Environmental Programme 2020
"Trifluoracetic acid (TFA), a substance regulated under the Montreal Protocol, is produced naturally and commercially. There are multiple anthropogenic sources that will release trifluoroacetic acid (TFA) into the environment. Sources relevant to the Montreal Protocol include the substitutes for CFCs, the HCFCs, HFCs, and HFOs. These chemicals are known to degrade to TFA in the atmosphere (Fig. 3; Box 5) but contribute to only a slight increase in TFA concentrations in surface water. This is **not expected to pose a risk to humans or the environment**."	Page 9, Environmental Effects Assessment Panel of the United Nations Environmental Programme 2018
"Although TFA has been observed in in surface- and drinking-water in Europe and other regions, it remains at concentrations that are **well below those of toxicological concern**."	Page 56, Environmental Effects Assessment Panel of the United Nations Environmental Programme, 2017
"Trifluoroacetic acid (TFA) is the main degradation product of HCFCs, HFCs, and HFOs in the atmosphere. A recent review confirms that amounts of TFA from these halocarbons are small relative to other sources and therefore currently **unlikely to pose a risk to humans and the environment**."	Page 37, Environmental Effects Assessment Panel of the United Nations Environmental Programme, 2016
"Based on current data, the amount of trifluoroacetic acid (TFA) formed from HCFCs and HFCs in the troposphere is **too small to be a risk to the health of humans and the environment**."	Page 32, Environmental Effects Assessment Panel of the United Nations Environmental Programme 2015
"Projected future increased loadings of TFA to playas, land-locked lakes, and the oceans due to continued use of HCFCs, HFCs, and replacement products are still judged to present **negligible risks for aquatic organisms and humans**."	Page 198, Environmental Effects Assessment Panel of the United Nations Environmental Programme 2014

Table 3 - Quotations of the EEAP Assessment reports since 2014

The most recent **EEAP 2022 Assessment Report**[20] unequivocally cites a common agreement among the majority of experts that *"all PFAS should not be grouped together, persistence alone is not sufficient for grouping PFAS for the purposes of assessing human health risk, and that the definition of appropriate subgroups can only be defined on a case-by-case manner"* and that "*it is inappropriate to assume equal toxicity/potency across the diverse class of PFAS*".[21] According to the same report, this same argument applies to the inclusion of TFA, with a two-carbon chain and a single CF3 group, in a

[20] *Environmental Effects of Stratospheric Ozone Depletion, UV Radiation, and Interactions with Climate Change*, 2022 Assessment Report, Environmental Effects Assessment Panel (EEAP), available at - http://ozone.unep.org/science/eeap
[21] *Grouping of PFAS for human health risk assessment: Findings from an independent panel of experts*, J.K. Anderson, et al., 2022

class with longer chain PFAS (e.g. PFOS).[22] The Report concludes that *"Trifluoroacetic acid has biological properties that differ significantly from the longer chain polyfluoroalkyl substances (PFAS) and inclusion of TFA in this larger group of chemicals for regulation would be inconsistent with the risk assessment of TFA"* (page 25).

The Report also concludes that *"based on projected future use of these precursors of TFA [incl. HFC/HFO], no harm is anticipated"* and that TFA *"is unlikely to cause adverse effects out to 2100"*.[23]

The EEAP has indicated that TFA is not considered an issue in terms of impact on human health and the environment; however we are providing calculation data in full transparency, using the modelling to extract data for TFA-degradation for each molecule for which direct emissions were modelled.

This calculation is done referencing the estimates given in the Montreal Protocol Environmental Effects Assessment Panel Report, 2023. To obtain the emitted TFA tons for each molecule, it was required to multiply the tonnes of HFC molecule emitted by the molar TFA yield and by the ratio of molecular weights. Again, the impact of TFA is negligible so it shall not be a reason for the inclusion in F-gases.

The TFA emissions resulting from our model are shown by refrigerant in the following table:

	tonnes of TFA from HFCs						tonnes of TFA from HFOs			
	R125	**R134a**	**R143a**	**R227ea**	**R245fa**	**R365mfc**	**R1233zd(E)**	**R1234yf**	**R1234ze(E)**	**R1336mzz**
TFA multiplier (Wt %)	**0,0190**	**0,1565**	**0,0407**	**0,671**	**0,0170**	**0,0231**	**0,0262**	**0,9998**	**0,0300**	**0,0348**
2020	190	2.984	149	134	1	3	0	1.546	3	0
2025	162	2.519	99	114	-	-	0	3.616	12	0
2030	91	1.518	8	54	-	-	1	6.020	20	0
2035	50	673	1	-	-	-	1	8.684	30	1

Table 4 - TFA degradation emissions based on the HFC Outlook EU Model for each refrigerant in metric tonnes

We, as EPEE, share these figures to be transparent but would like to underline that we do not consider that the TFA concern, as presented in the proposal, is a sufficient reason to include F-gases in this future PFAS restriction. These figures reflect the different yield rates and the fact the market is moving to low GWP products. All this must be seen in the context of full emission numbers which are following a trend of reducing over time; further improvement of emission control measures will also contribute to a reduction of the indirect TFA degradation.

[22] See pages 278 and 279 of the 2022 Assessment Report.

[23] See pages 5 and 259 of the EEAP 2022 Assessment Report.

D. Use of F-gases by RACHP Sector applications

As mentioned previously, the RACHP sector is already regulated under the F-gas Regulation in order to minimise emissions and to strengthen the measures to contain refrigerants and to avoid leakages. Thus, F-gases used for Refrigeration, Air-Conditioning and Heat Pump applications should be exempted from this Restriction. The F-gas Regulation aims to tackle the emissions of F-gases from a climate and environment perspective. Nevertheless, if F-gases should be kept in the scope of this restriction, a time-unlimited derogation should be granted to the F-gas applications for the RACHP sector.

The RACHP sector is a very diversified sector with many different technologies, sectors, sub-sectors, applications. That is why, in the framework of this Public Consultation, EPEE wants to give more details on the granularity of the applications. The below Table 5 aims to give some quantitative and qualitative data on the different RACHP sectors and their applications. Those sectors have been divided into eight RACHP applications plus the MAC sector and the other non RACHP applications like MDIs, aerosols and foams. The below explains for each sector: the gases that are usually used; the emissions in metric tonnes; the share of PFAS emissions for each sector compared to the total of PFAS emissions of the 10 sectors; and some explanation on the need to still use F-gases for each.

In this exercise, it is also crucial to note that some non PFASs could be used for several applications as alternatives; nevertheless, the negotiations of the ongoing revision of the F-gas Regulation are likely leading to the ban of several refrigerants due to high GWP in several applications. For instance, R-32 (GWP 675), which is used for new air-conditioners, could be banned in the next F-gas Regulation for several applications. This would lead to numerous cases and sub-applications where no alternative is available.

Sub-sector	Application	Gases used, PFAS and non-PFAS (blend or no blend)	PFAS emissions in metric tonnes	% of PFAS emissions for the sector compared to total PFAS emissions of all 10 main sectors	Justification for use of F-gases
Sealed refrigeration systems	Domestic refrigerators and freezers, retail stand alone systems	R125; R134a; R143a; R600a; R290	586	2%	Small and medium size factory made units. Often hermetically sealed, already using ultra-low GWP HC-600a and HC-290. Already phasing down F-gases for this sector for the future.
Commercial refrigeration	Condensing units and multicompressor central systems	R32; R125; R134a; R143a; R1234yf; R1234ze(E); R744; R600a; R290	5.246	15%	Usually located in general occupancy areas. Widespread use of CO_2 in central systems and CO_2 condensing units becoming available. Efficiency during warmer outdoor temperatures is a challenge. New A2L HFO/HFC blends with GWP < 150 are well suited to condensing units and small central systems.
Industrial refrigeration	All chilled and frozen industrial sectors including DX, flooded and chillers	R32; R125; R134a; R1234yf; R1234ze(E); R744; R600a; R717	7.170	21%	Most industrial equipment can be in authorised occupancy locations, giving scope for the use of flammable refrigerants. Ammonia is safety class B2L. It is used in large systems in factory locations – the 2L flammability is not a constraint. The size spectrum for industrial systems is very wide. Small food processing operations often use several small DX systems. These are not suited to ammonia. CO_2 is a possibility, although due to the wide range of sizes and temperatures required, there is not much suitable CO_2 equipment available for small and medium DX industrial applications. New A2L HFO/HFC blends with GWP < 150 are well suited to small and medium sized industrial applications.

Transport refrigeration	Small trucks and van; large trucks and iso-containers	R32; R125; R134a; R143a; R1234yf; R1234ze(E); R744	530	2%	R-452A (GWP 2140) has become widely used in place of R-404A (GWP 3922). There is relatively slow progress towards other lower GWP options. Special rules related to flammable refrigerants and cooling performance apply to transport e.g. (UN ATP rules).
Small air-to-air AC and heat pumps	Stand-alone units; small, medium and large split systems: small RTUs	R32; R125; R134a; R1234yf; R1234ze(E);	3.566	10%	Usually located in general occupancy areas. Significant size range for single split and small multi-split systems. There will be some use of HC-290 (propane) in small systems, but HFCs and HFC/HFO blends will be needed to maximise efficiency and meet safety requirements in small, medium and large systems. For small systems energy efficiency is an important consideration – the charge limitations for A3 refrigerants like HC-290 are likely to restrict efficiency improvements.
Large air-to-air AC and heat pumps	Small and large VRFs; large RTUs	R32; R125; R134a;	1.432	4%	Usually located in general occupancy areas. RTUs and VRFs are too large to allow direct use of A3 refrigerants. A2Ls are already being used in small RTUs and small VRFs. There is significant on-going development work to extend the size range for using A2Ls through the use of "additional safety measures" that are defined in safety codes. Switching to water chillers leads to a loss of energy efficiency in this size range. Chillers are more appropriate for larger cooling loads.
Water chillers	All sizes of air-conditioning water chiller	R32; R125; R134a; R1233zd(E); R600a	1.441	4%	Chillers are usually located in authorised occupancy areas. There are 3 different technologies used for chillers. Small chillers and some medium chillers currently use high pressure refrigerants such as R 410A. Use of HFC-32 and HFO/HFC blends is now common. Large chillers use medium pressure refrigerants and very large chillers can use low pressure refrigerants. A range of ultra-low GWP refrigerants are already used in chillers including HFOs, ammonia and propane.

Hydronic Heat Pumps	Residential and small, medium and large commercial	R32; R125; R134a; R1234yf; R1234ze(E); R290; R717	776	2%	Some hydronic heat pumps (e.g. air source monobloc domestic sized systems) are located outdoors. Monobloc ground source heat pumps are mostly located indoors. Other hydronic heat pump types are of a split design, with an outdoor unit and an indoor refrigerant condenser in what is usually a general occupancy area. HCs are becoming used in air source monobloc designs and rarely in ground source monoblocs. A2L blends are suited to ground source monobloc and split systems.
Mobile air-conditioning	Car air-conditioning; bus and train air-conditioning	R32; R125; R134a; R1234yf;	9.139	26%	Not in EPEE’s scope
Non-RACHP Applications	Aerosols, MDIs, Foams (only HFCs are modelled)	R134a; R152a; R227ae; R245fa; R365mfc	4.881	14%	Not in EPEE’s scope

Table 5 - Table of PFAS emissions by RACHP sub-sector (2020 data, HFC Outlook EU Model)

IV. The RACHP Sector in the U-PFAS Restriction Proposal

A. How the Restriction proposal impacts the RACHP Industry on refrigerants

This universal PFAS Restriction Proposal impacts in different ways the RACHP Industry on the refrigerants side:

- Restrictions on refrigerant choice
- Maintenance and refilling of refrigerants
- Recovery, reclamation and reuse of refrigerants
- Threshold for PFASs
- Exports of RACHP equipment

There would be a significant impact for RACHP equipment in the current proposal:

The majority of HFC and HFO refrigerants and their blends fall under the PFAS definition as proposed. The F-gas Regulation already mandates the containment of F-gases and includes detailed provisions on the use, recovery and destruction of these gases, as well as the labelling and disposal of products and equipment containing them. These controls have already led to a significant and well documented reduction of the direct F-gas emissions from RACHP equipment; a revised third version, to be finalised in the coming months by the EU institutions, will further tighten these rules.

The sector uses a full range of refrigerants including non-fluorinated refrigerants, such as carbon dioxide, ammonia, and hydrocarbons; however, these are not always the optimal refrigerant choice. Low GWP HFCs, HFOs and blends provide the highest levels of efficiency in numerous key applications, whilst meeting the required safety standards and considering the technical limitations (e.g. location of installation). The sector needs to continue to be able to choose the best refrigerant to guarantee the safety and energy efficiency of the devices – whether the fluid is fluorinated or non-fluorinated. As mentioned earlier, energy efficiency is a key principle in EU legislation, now embedded in the revised Energy Efficiency Directive.

A broad ranging PFAS ban, without any fully considered derogations[24], would impede the optimal refrigerant choice for new equipment, likely hindering the ongoing and future R&D towards the development of even safer and more energy-efficient devices.

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[24] The proposal contains circa 50 derogations: most are proposed but some are labelled as Potential Derogations ‘for reconsideration after public consultation’. For the RACHP sector they are the following:
Proposed Derogations for fluorinated substances (refrigerants only):

- refrigerants in low temperature refrigeration below -50°C - 6.5 years
- refrigerants in laboratory test and measurement equipment - 13.5 years
- refrigerants in refrigerated centrifuges - 13.5 years
- maintenance and refilling of existing HVACR equipment put on the market before [18 months after EiF] and for which no drop-in alternative exist - 13.5 years
- refrigerants in HVACR-equipment in buildings where national safety standards and building codes prohibit the use of alternatives – time unlimited
- refrigerants in mobile air conditioning-systems (MAC) in combustion engine vehicles with mechanical compressors - 6.5 years
- refrigerants in transport refrigeration other than in marine applications - 6.5 years

Potential Derogations for reconsideration after public consultation:

This is why, we want to address some concerns on the impacts of this restriction Proposal on maintenance, impurities thresholds and export of RACHP equipment.

1. Maintenance and refilling of systems

The proposed derogation in the PFAS proposal, which allows for the maintenance and refilling of existing RACHP equipment, is a crucial provision.

However, it is important to consider extending this derogation beyond a specific, limited time-frame and basing it on the entire lifecycle of the product. To ensure circularity and align with the sustainability goals of the EU, it is necessary to take into account the lifetimes of RACHP equipment, which can extend from 12 to 20 years for certain applications even if the maximum can go until 30 years. By limiting this derogation in time only, there is a risk of premature obsolescence and replacement of RACHP units that could otherwise be repaired and maintained.

On average, air conditioning units have a lifetime of 12 years, but it can be up to 15 years for VRF and 20 years for chillers (see Figure 7[25]).

Technology	Average lifetime (years)
Movables + Window Units	10
Small Split (<5 kW)	12
Big Split (>5 kW, incl. ducted)	12
VRF	15
Rooftop + Packaged	15
Chillers (A/W) < 400 kW	15
Chillers (A/W) > 400 kW	20
Chillers (W/W) < 400 kW	15
Chillers (W/W) > 400 kW	20

Figure 7 - Average lifetime of units per product type, air-conditioners and comfort fans

The repair and maintenance of existing equipment is an essential aspect of the Circular Economy. It reduces waste, conserves resource, saves CO_2 emissions and minimizes environmental impact. In conclusion, extending the derogation beyond a specific time frame to align with the sustainability goals of the EU means that a time-unlimited derogation is necessary for the specific case of servicing and maintenance, to avoid early decommissioning of equipment and to be in accordance with EPEE's recommendation to derogate F-gases from this Restriction Proposal.

This derogation needs also to take into account the spare parts if the refrigerants are understood as consumable goods.

- foam blowing agents in expanded foam sprayed on site for building insulation - 6.5 years
- refrigerants and for mobile air conditioning in vehicles in military applications - 13.5 years

[25] Extracted from Commission, Review of Regulation 206/2012 and 626/2011, Air conditioners and comfort fans, Task 2 report, 2018 (table 23).

2. Threshold for PFAS

The Restriction Proposal foresees a ban on manufacture, use and placing on the market of PFAS if they are part as a constituent or if they are present in a mixture or in an article.

The thresholds proposed use extremely low values. It is crucial to assess their direct impacts and the precautions that such a strong ban requires.
The PFAS impurity limits indicated within the restriction proposal do not consider the procedures and processes for the manufacturing, supply chain, recovery and recycle processes and procedures of HFCs, HFOs and HCFOs. The analytical methods included in the restriction proposal are not relevant to the practical analysis of these F-gases and their impurity levels.

Several F-gases are not, due to their chemical structure and properties, within the restriction proposal, for example, HFC-32 and HFC-152a ("excluded F-gases"). However, they may contain very low concentrations of short chain PFAS (that is, other HFCs and HFOs that are contained within the proposal) and that may be formed during the manufacture of the excluded F-gases. Furthermore, it cannot be ruled out that excluded F-gases could become contaminated with low concentrations of short chain HFCs/HFOs/HCFOs in scope of the restriction, since F-gas impose the obligation of using refillable & returnable containers.

It is recommended that a specific concentration limit for fluorinated impurities is established for the virgin and reclaimed excluded F-gases, which, for consistency, should be based upon the AHRI 700 2019 Standard for Specifications for Refrigerants, with allowable fluorinated impurities in F-gases of up to a maximum of 5000 ppm, without any individual limits.[26]

For other substances including fluoropolymers, the proposed threshold values will make the recycling process almost impossible. Taking into account the Circular Economy objectives, it is crucial to put more realistic thresholds[27], otherwise, only virgin materials will be authorized for production.

3. Secure competitiveness by allowing export

The proposed use prohibition will affect the export (outside EU to third countries) position of producers (equipment, components,…). To secure global competitiveness, the export should be exempted, otherwise the prohibition will result in a technical barrier for trade. Over the last years there was clear investment in EU based R&D centres and manufacturing plants. These investors also have the clear intention to discover other parts of the world with their highly energy efficient equipment. Their export positions need to be secured with a derogation when exporting solutions. An eventual export restriction will result in a rapid delocalisation and drastically affect the direct and indirect employment rate. For F-gases, such a restriction for exports would immediately impact the export of pre-charged equipment from Europe to third countries.

4. Review clause to guarantee future innovations

A review clause of ten years the Restriction's after entry into force is necessary to reassess the state-of-the-art of the techniques in the RACHP sector, the availability of alternatives and their different impacts.

[26] See the submission of the EFCTC in alignment with this recommendation on impurities thresholds.
[27] See for the perspective of the waste sector, the submission of the Confederation of European Waste-to-Energy Plants (CEWEP).

EPEE firmly believes that such a review clause that extends to all the recommendations made by EPEE in this document including the time unlimited derogation for all the RACHP applications, is the best way for European society to ensure the availability and functionality of RACHP equipment while granting the possibility for future innovations.

B. End-of-Life/EPR schemes

At the regulatory level, the current F-Gas Regulation (EU/517/2014) partially covers the End-of-Life (EoL) of F-gas, including through recovery, reclaiming and disposal. Operators of "stationary equipment or of refrigeration units of refrigerated trucks and trailers that contain fluorinated greenhouse gases not contained in foams" must ensure that the recovery of those gases is carried out by certified natural persons, and either recycled, reclaimed or destroyed (Article 9).

Recycling and reclamation activities of F-gases have significantly increased since the second F-gas Regulation and the HFC phase down entered into force. These activities were driven by the increased value which came with the reduced amounts available on the EU market. Wider EU provisions are under discussion in the ongoing revision of the Regulation, specifically:

- *"setting out minimum requirements for producer responsibility schemes [through the adoption of Delegated Acts] for the recovery, recycling, reclamation or destruction of certain fluorinated greenhouse gases, including on collection, reclamation, recycling, disposal facilities, equipment provision to certified technicians, reporting and awareness raising", and for producers and importers of F-Gas to cover the costs of both collection and recycling;*
- Improving "*Waste electrical and electronic equipment schemes in Member States" to "better facilitate the recovery, recycling and reclamation of refrigerants, including from residential heat pumps".*

The other legislation in place at EU level is the Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU). The WEEE Directive includes a provision for the removal and "proper treatment" of HFCs and F-Gas (with a GWP over 15) but with no specificities on how to do this, and no mention of PFAS as in this proposal – however the Directive in application will be reviewed by the Commission and likely revised from early 2023.

Under the F-Gas regulation, Member States are encouraged to develop Extended Producer Responsibility (EPR) schemes and several Member States already have respective national regulations in place (e.g. Germany: Chemikalien Klimaschutz Verordnung, France: Decret n°2007-737 du 7 mai 2007). In France specifically, manufacturers are under obligation to provide empty packaging to users of refrigerants, collect all polluted fluorinated gases for free, and recover them fully. Those obligations are then reported annually to French authorities.[28] Data shows that French stakeholders recovers more than 1000t/year of fluorinated refrigerants.[29]

On the processes themselves, recycling and reclamation are two different procedures requiring different equipment and investment. For recycling, a simple cleaning process (e.g. removal of moisture and oil by drying and filtering) is done by installers and contractors, while reclamation requires more technology and includes a final laboratory analysis to confirm the quality of the reclaimed product and is carried out by companies with the appropriate expertise and infrastructure. Concerning the quantities of recycled HFCs in the EU, there is basically no official data available because installers/ contractors are not required to report on the quantities they recycle and reuse. This is also a process very difficult to control.

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[28] Code de l'environnement.

[29] ADEME, *Fluides frigorigènes fluorés*, 2010, available : https://presse.ademe.fr/wp-content/uploads/2012/01/7429_fluides-frigorige%CC%80nes-fluore%CC%81s_interactif_ok.pdf

Concerning reclamation, reporting was required under the second F-gas Regulation, but only for undertakings, which included either producers, importers or exporters of HFC. Therefore, the quantities of undertakings only active in reclamation are not included in the European Environmental Agency (EEA) data.

In spite of this, EEA's latest figures still show a significant increase from 2014 onwards (the drop between 2020 and 2021 can be explained by the UK figures being no longer included in 2021) with 1026 tonnes being reclaimed in the EU27 in 2021 (see Figure 8 below[30]). We expect this figure to be higher once all undertakings active in reclamation are obliged to report.[31] It is also necessary to indicate that data on the reclamation of F-gases (including HFCs and HFOs) is not always complete or fully available due to the lack of mandatory reporting under the first and second F-gas Regulation, as illustrated by the comparison between the by French data mentioned above and the one reported by the EEA.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Gas group								**Tonnes**							
HFCs	C	C	100	C	C	460	C	377	647	1 314	1 659	1 829	1 478	1 590	1 026
PFCs	-	-	-	-	-	C	-	C	C	C	C	C	C	-	-
SF6	C	C	77	C	C	C	C	C	C	C	69	C	C	C	C
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	C	C	C	C	C	C	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	-	-	-	-	-
NF3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	C	-	-	-	-
Total fluorinated gases	**417**	**398**	**177**	**326**	**508**	**487**	**484**	**416**	**679**	**1 364**	**1 751**	**1 934**	**1 523**	**1 619**	**1 100**
average GWP	*4 919*	*4 860*	*10 963*	*3 961*	*3 498*	*3 321*	*2 555*	*4 250*	*3 527*	*3 033*	*3 145*	*3 223*	*3 313*	*2 837*	*3 057*

Notes: '-': no data reported, 'n.a.': not applicable, C: Confidential: Annex II gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) were not subject to reporting for the years 2007-2013. The geographical scope of presented data is EU-28 except Croatia for 2007-2008, EU-28 for 2009-2019, EU-27+UK for 2020, and EU-27 for 2021.

Figure 8 - EU reclamation of F-gases (tonnes), EEA, 2022

Currently, recycling and reclamation are mainly focused on HFCs because of the HFC phase down and because equipment reaching end-of-life mainly contains HFCs. However, HFOs – although still relatively new – are already being recovered today.

Following the restriction proposal on the use prohibition and more specifically on the prohibition to place it on the market in articles, this results in a prohibition for proper waste treatment at end of life.

In addition, it is key to ensure that activities for the recycling and reclamation of refrigerants is still allowed. The RRR (Recovery, Reclamation and Reuse) market is already an important one which is developing further. This is already the case in several European countries where EPR schemes have recovered and reclaimed major quantities of recovered and reclaimed fluorinated gases. This is for instance the case in France where more than 20.000 tons of F-gases have been recovered since 1990[32].

[30] See in EEA, *Fluorinated greenhouse gases 2022*, ETC CM Report 2022/3, https://www.eionet.europa.eu/etcs/etc-cm/products/etc-cm-report-2022-03
[31] This requirement will enter into force with the third F-gas Regulation.
[32] Réalisation d'un scénario tendanciel 2050 - Récupération des gaz fluorés des secteurs du froid et de la climatisation, ADC3R rapport Citepa, octobre 2022

V. Conclusion

The proposed universal PFAS restriction now under review by ECHA would have a significant impact on the RACHP sector and especially on F-gases and fluoropolymers. Due to the deep impacts on F-gases the proposed restriction could cause for society, EPEE is making the following recommendations:

- Since the F-gas Regulation is already covering and regulating the use of F-gases, the Universal PFAS Restriction **shall exempt the use of F-gases for Refrigeration, Air-Conditioning and Heat Pump (RACHP) applications**.
- Alternatively, the Universal PFAS restriction should **include a full time-unlimited derogation for F-gases used in RACHP applications, with a review clause 10 years after the entry into force of the Restriction to assess the availability of alternatives**.
- A full time-unlimited derogation for:
  - maintenance and refilling of equipment to avoid premature obsolescence;
  - reclamation and recycling of refrigerants; and
  - and export of pre-charged equipment containing F-gases.
- A reconsideration of the thresholds used in the Restriction Proposal and of their feasibility, as they may jeopardize the efforts to recover, reclaim and reuse refrigerants to achieve a Circular Economy. In the case of F-gases, standard distillation and purification methods used for F-gases (virgin and recycled) allow impurities in the range of 0,5%.

Those recommendations are made on strong evidence shared by EPEE within this reply to the Public Consultation. Thus, EPEE would like to reiterate:

- The societal benefits achieved by EPEE's members thanks to the technologies using fluorinated and non-fluorinated refrigerants: the food chain, medicines cold chain and the decarbonization of the EU heating sector, among many others.
- The RACHP sector is already extremely regulated with several regulations and directives ruling on energy efficiency, control of emissions… the double regulation for F-gases via the proposed universal REACH restriction contradicts the existing and successful Remote Management and Monitoring for these substances. It would immediately, on entry into force, overly restrict the choice of refrigerant on the markets for new equipment and the maintenance and repair for existing systems. Access to a full selection of refrigerants, including F-gases, is required to allow for best choice for the many and different applications and systems. This allows for the optimum, most efficient delivery of heating and cooling solutions for various circumstances (home, commercial and industrial) and locations from Finland to the South of Italy.
- With its HFC Outlook EU Model that has been used for many years, EPEE has shared its findings on the emissions of F-gases which are PFASs, showing the PFAS emissions will decrease by more than half by 2035 compared to 2020, confirming the clear improvements in terms of leak checks that the different F-gas regulation revisions have allowed.
- On the degradation of F-gases to TFA, EPEE has also shared data within this reply while reminding the numerous findings from the EEAP report showing the "*unlikely[hood] to pose a risk to humans and the environment*".
- While some derogations are included; they do not cover the granularity of the sector so there will be unintended consequence for society that currently benefits from the use of RACHP applications across daily life. It will also limit the sector's ability to leverage the latest science and innovation.

September 2023

EPEE'S REPLY TO THE PUBLIC CONSULTATION ON THE UNIVERAL PFAS RESTRICTION PROPOSAL

Part II - Fluoropolymers

Executive Summary

Fluoropolymers are essential to the optimal performance of equipment and products that contribute to the decarbonisation of the energy system and buildings, and provide efficient heating and cooling solutions for domestic, industrial, commercial, and medicinal applications, as well as many others. The definition of PFAS given by the Restriction Proposal covers all fluoropolymers, and a potential ban would have a detrimental impact on all those crucial applications.

There are no viable, existing alternatives to fluoropolymers today that could fulfil the same criteria with the same level of efficiency and safety, and new components are likely to take years if not decades to be developed properly. Fluoropolymers are used for their sealing capacity, but also resistance to pressure and temperature, persistence, electrical properties and low friction. Fluoropolymers are also the safest way to transport refrigerants and avoid leakages of toxic and flammable gases.

The process of inventing, testing, certifying and scaling up the production of alternatives requires at the very least 10 years. In the shorter term, fluoropolymers would have to be replaced with older solutions and technologies, which would represent a significant loss in the efficiency of the equipment. Existing systems also have to be maintained and repaired with spare parts, meaning that a ban could reduce the lifecycle of products and create a massive amount of waste that would have to be treated properly in an environmentally sound manner.

To avoid a significant loss of efficiency for key products in heating and cooling and drastically slowing the deployment of decarbonisation solutions such as heat pumps, while allowing for safety requirements and citizens' health and well-being, **a full time unlimited derogation must be granted to fluoropolymers in RACHP applications, with a review clause after 10 years to assess the availability of alternatives**.

Table of content

I. Introduction

Disclaimer: Throughout this document, the term 'RACHP' shall be considered synonymous with the term 'HVACR' which is often used globally to represent the same or very similar industry sector as RACHP.

The European Partnership for the Energy and the Environment (EPEE) welcomes the opportunity to participate in the consultation by providing evidence and data on the RACHP sector to the ECHA responsible committees to support them in their review of the restriction proposal.

EPEE is the European association representing the entire value chain of the Refrigeration, Air-Conditioning and Heat Pump (RACHP) Industry since 2000. EPEE's membership is composed of over 48 member companies, as well as national and international associations covering three continents (Europe, North America, Asia).

As an expert association, EPEE supports safe, environmentally and economically viable technologies; works to ensure a better understanding of the sector in the EU; and proactively contributes to the development of effective European policies, regulations, and standards. EPEE and its members ensure that refrigerants are responsibly used in RACHP equipment, in an energy efficient, safe, environmentally sound, affordable, and reliable manner, over their entire lifecycle, including the equipment's End-of-Life (EoL). EPEE is presenting here its experience as a down-stream user, and not as an expert of fluoropolymers.

The applications that EPEE members cover can be divided by:

- Market types: residential, commercial, transport, industrial;
- Sector types: refrigeration, comfort cooling and heating, heating and/or steam production for industrial processes;
- Technology sub-types: stand-alone, direct expansion, chillers, flooded systems.

All applications are beneficial to society and operate in homes, industrial sites, office buildings and public buildings, including hospitals, airports and train stations. The magnitude of the sector is reflected in the 20% ratio of the entire global consumption of electricity. Heat pumps also improve the energy system via its demand side response and storage features.[1]

- **Heat pumps[2] and air-conditioning systems**
    - For residential purposes: space heating and cooling, and sanitary water heating with hydronic (air-to-water and ground-to-water) or air-to-air heat pumps;
    - For services: commercial and public sector buildings, space heating and cooling, and sanitary water heating, large systems for offices (chillers, variable refrigerant flow systems (VRFs), rooftop units…);
    - District heating and cooling;

[1] See for instance COM(2020)299, *Powering a climate-neutral economy: An EU Strategy for Energy System Integration.*

[2] 'A heat pump is a device that can provide heating, cooling and hot water for residential, commercial and industrial use. Despite the name, all heat pumps can provide both heating and cooling. They work well in nearly all types of climate. Heat pumps take energy from the air, ground and water and turn it into heat or cool air. This works due to what is known as the refrigerant cycle.' [About heat pumps – European Heat Pump Association (ehpa.org)](ehpa.org)

- Industrial uses: low temperature process heating (below 130°C) and high temperature water and/or steam for industrial processes, industrial building space heating and cooling, and industrial drying;
- Air-conditioning for cars, vans, trucks or large vehicles like buses, trains or marine vessels and ships;
- Waste heat recovery, with the purpose of enhancing circularity and to reduce energy consumption from industrial and commercial activities;
- For data centres where efficient cooling is key, but also heat pumps that recover waste heat.

- **Refrigeration**:
  - For residential purposes including refrigerators and freezers;
  - For food retail and food service refrigeration including standalone units, chillers, condensing units and centralized refrigeration systems;
  - For industrial cooling in applications such as food and beverage production, processing and packaging, chemicals, pharmaceuticals, oil and gas, etc;
  - For transport of goods in vans, light trucks or larger systems like trailers and containers such as shipping containers (reefers). Those systems are essential for securing the cold chain for perishable food products, medical products (e.g., medicines, vaccines, blood, and plasma), sensitive electronics, and other critical products that rely on specific controlled temperatures for preservation.

This part of the submission covers specifically fluoropolymers. For the part related to F-gases, please refer to Part I: F-gases/refrigerants.

II. Essential functionalities in RACHP equipment – Fluoropolymers

A. Missing Use in the PFAS Restriction Proposal

The PFAS Restriction Proposal does not specifically mention or consider the use of fluoropolymers containing parts inside the components of RACHP equipment. All fluoropolymers fall under the proposed chemical definition of PFAS in the restriction proposal. **The use of fluoropolymers in components is essential for the functionality and tightness of RACHP systems.** The criticality of fluoropolymers and their unique properties is described below, alongside a list of their different applications.

B. Harsh operating conditions within RACHP equipment

The environment inside RACHP systems is harsh because of the pressurized refrigerants and oils interacting, and potential degradation of the materials-of-construction. The materials used in components must therefore be able to tolerate and operate in these conditions while retaining sufficient mechanical and physical properties over time (often greater than 15 years of use-life). While some metals and ceramics work well in these environments, polymers are particularly susceptible to break down in these conditions.

This challenge makes it very difficult – perhaps impossible – to find alternatives with the necessary endurance for long-term use in the RACHP industry. Fluoropolymers have the necessary properties and have been widely used for many decades. The fluoropolymers provide an unmatched multitude of high-performance properties to deliver the required functionality to the components used in RACHP. It is important to understand that many alternative materials may be acceptable for just one or two of the required properties of a specific component, but not all the required properties for that component. **Fluoropolymers satisfy several needed properties for the RACHP sector simultaneously.**

The following critical functional properties are required of the fluoropolymers during RACHP equipment operation:

1. Sealing

Fluoropolymers are used in sealing applications in the RACHP industry to prevent the release of refrigerant into the atmosphere, e.g. into rooms that may be occupied by people. Leakage is a safety concern from both an asphyxiation and flammability perspective. Most modern-day low global warming potential refrigerants are mildly flammable, so the sealing provides an extra safety function.

The ability to remain conformable (i.e. not become brittle) at low temperatures is critical to the effectiveness of RACHP seals. The seals must remain resilient so that they conform to the mating surface and seal effectively. The same requirement is necessary for high temperatures, where the seals must not excessively soften or thermally degrade, which would adversely affect the seal.

2. Temperature and Pressure Resistance

Compression of the refrigerant in the system causes high gas pressure, temperature swings, and phase changes of the refrigerant (both liquid and vapor states of the refrigerant may exist). Temperatures can range from -50°C to 175°C and pressures can range from near a vacuum and up to 45bar (R410A), or up to 120 bar for CO_2 systems. Under these conditions, the refrigerant can react with or be absorbed by the polymeric materials and cause rapid gas decompression, which often causes catastrophic blistering of the plastic RACHP component.

Figure 1 below is a bar chart that compares many non-fluoropolymers with two fluoropolymers (i.e., PTFE and PVDF) in terms of their acceptable service temperature range. The darker shaded upper bar denotes longer-term use, and the lighter shaded lower bar denotes short-term use. For the RACHP sector, only the upper bar should be considered, given the long operational lives of products.

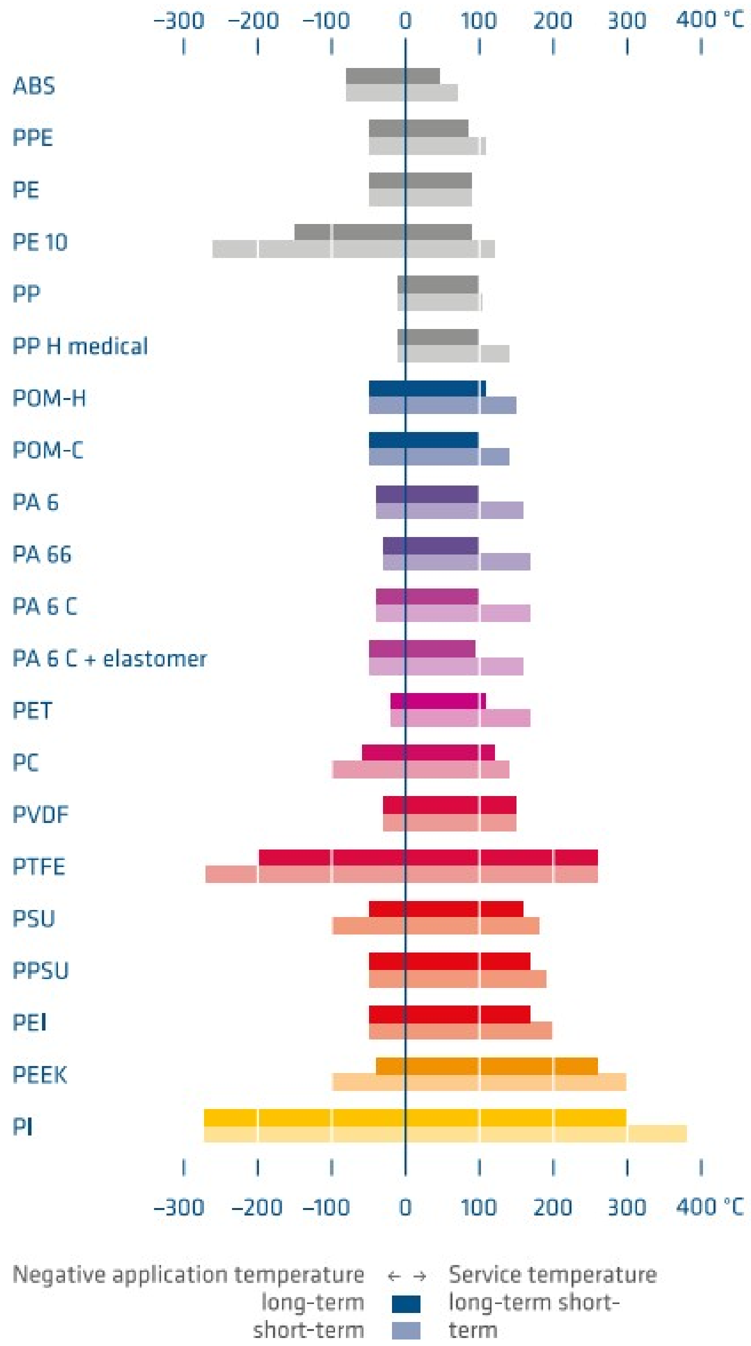

Figure 1: Service Temperature Range of Polymers for Short- and Long-Term Use[3]

[3] Plastics with low temperature properties. Ensinger. (n.d.). https://www.ensingerplastics.com/en-us/shapes/plastic-material-selection/low-temperature

Although this chart only shows a single property (i.e., temperature resistance), the advantage of the fluoropolymer PTFE over most non-fluoropolymers is clear. The fluoropolymer PVDF has less temperature resistance, but in RACHP products is mainly used for electrical applications when the specific use temperatures are not as extreme.

Most RACHP applications require more than one property to be present simultaneously. For example, from Figure 6, the service temperature range of PI (polyimide, a non-fluoropolymer) is superior to PTFE. However, PI has other deficits: it is harder (i.e., less physically compliant) and would therefore have sealing application limitations; the frictional properties relative to PTFE are not equivalent; and it is known to exhibit higher average friction than PTFE.

3. Persistence/Longevity and Chemical Inertness

Persistence is viewed negatively in reference to fluoropolymers, however, persistence is why the industry uses fluoropolymers. Persistence is the general descriptor that also encompasses many positive attributes, such as chemical inertness and temperature resistance. Persistence is what allows the products to have long useful lives, and product longevity reduces waste. The chemical inertness due to the strong carbon/fluorine bonding of fluoropolymers enables them to be compatible with the environment in RACHP systems where they must stand up to metals, oils, and refrigerants in liquid and gas phases.

Any alternative material selected would also need to be persistent whether it is a fluoropolymer or not. Any polymeric material must be very resistant to aging to be able to hold up to that many years of use, especially when exposed to refrigerant, oil, high temperatures, and high pressures which tend to accelerate aging in polymers. The overall combination of these operating conditions can cause several destructive events to the non-fluoropolymers, such as: brittleness (hardening), softening, swelling and cracking.

4. Electrical Properties

Fluoropolymers likely permeate almost every electronic and electrical device within the RACHP sector. The electronic devices have several important functions, many of which are safety related. They also provide monitoring and control functions, such as thermostats, fans, safety leak detection sensors and variable speed drives for Heat Pumps and Cooling applications. Fluoropolymers are found in the following RACHP products (please note this is not an exhaustive list):

- Safety pressure protectors
- High temperature safety cutoff protectors
- Motor materials-of-construction (for compressors and actuators)
- Wire and cable insulation
- PCB as a component (these are used as a fiber-reinforced fluoropolymer layer)
- LCDs and displays manufacturing
- Film capacitors
- FPs are also used in semiconductor manufacturing, including all populated components like transistor, diode and power module

The electrical functional properties required of fluoropolymers in these RACHP applications are the following (again, this is not an exhaustive list):

- Low dielectric constant
- Low intrinsic flammability

- Water and general corrosion resistance
- Stable in terms of physical and mechanical property retention in the presence of the RACHP working environment (no blistering, no softening, no hardening, tensile strength, compressive strength, ductility/flexibility, etc.)
- Ability to function and remain durable over time in the presence of high pressure and temperature gradients

5. Low Friction

Relation to oil and refrigerants

There are many moving parts inside a RACHP system (compression mechanism, valves, etc.) and a certain oil content within the circulating refrigerant is needed to avoid friction-based riveting and system malfunction. Fluoropolymer components are uniquely qualified to maintain low friction even during times of oil dilution and viscosity reduction. Low friction is important because it prevents wear, increases product life, and lowers friction-induced power losses (less energy use). Hence, one of the key reasons why RACHP products last so long is because of the use of fluoropolymer bearings and seals which have intrinsically low friction. The low friction inherent in fluoropolymers compensates for the reduction in the oil viscosity. Figure 2 shows the complex interdependencies of temperature pressure and oil solubility versus the viscosity of the oil. If the viscosity becomes too low the friction will become too high, potentially damaging the system. As the system operation by definition has high temperature gradients, steep pressure drops and often cut in and out of operation, the friction between component parts is not constant but variable and complex. Fluoropolymers mitigate the changing conditions and ensure stability.

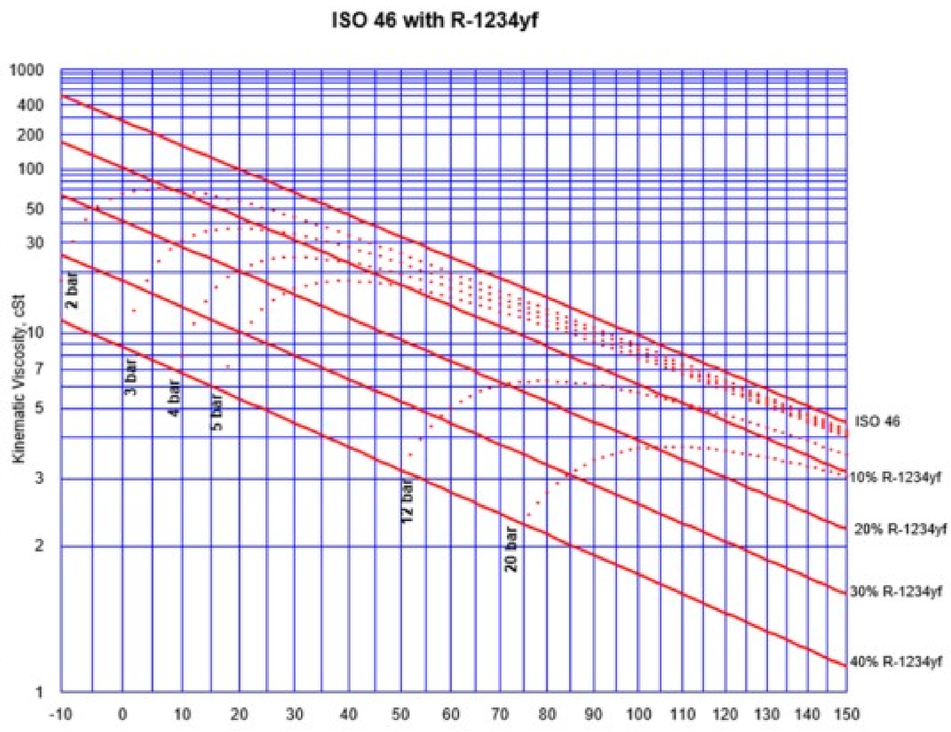

Figure 2: Viscosity of ISO 46 Centistoke oil with different amounts of R1234yf at different pressures and temperatures[4]

[4] Shrieve Chemical Co. Shrieve Chemical, 1442 Lake Front Circle Suite 500 The Woodlands Texas 77380 USA.

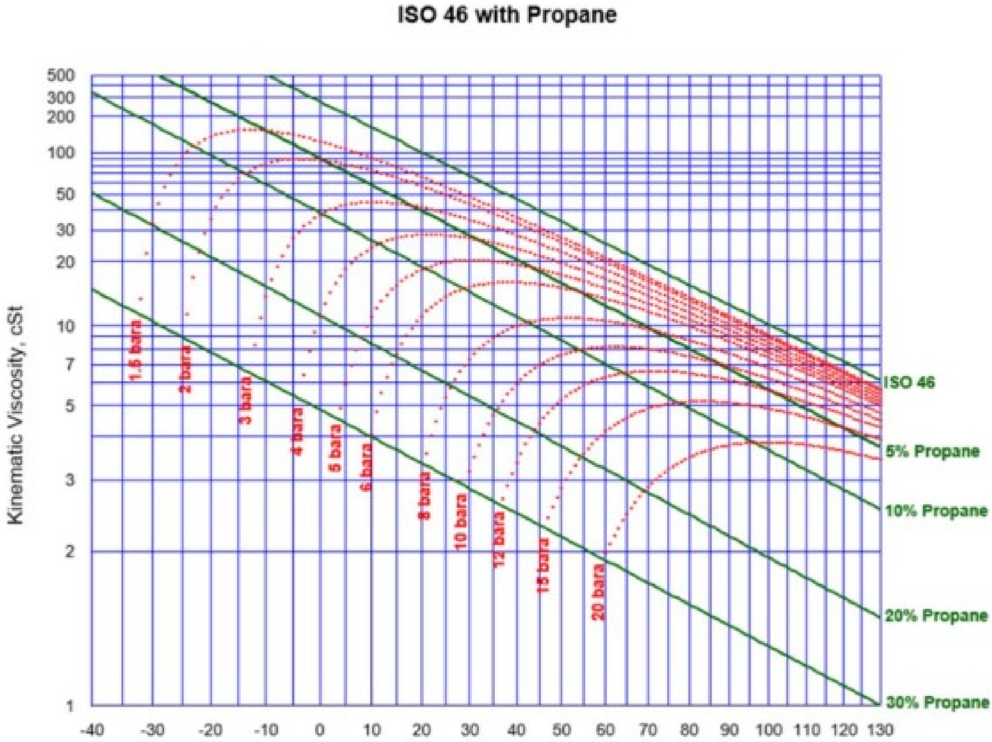

Figure 3: Viscosity of ISO 46 Centistoke oil with different amounts of propane (R290) at different pressures and temperatures.[5]

A third-party bearing company[6] did independent tribological testing. Four types of common bearing materials were tested, including one that is used in the RACHP industry. The testing was performed both with and without lubricant (dry). The 'dry' testing was used to simulate oil washout due to liquid refrigerant, which periodically occurs with certain applications or operating conditions. These tests were performed on a bench tribometer. The testing conditions are shown in the graphs. The ordinate axis for both charts is the percentage of friction increase relative to the normal PTFE-containing bearing (called 'PTFE-basis' on the chart). The three other bearing materials were engineered composite polymers (PVDF and PEEK) and one aluminium alloy.

The following graph (Figure 4) from a third-party bearing supplier shows the results for lubricated testing. Note the dramatic increase in friction of the other three bearing materials relative to the PTFE containing (PFAS) bearing material. Lower friction is preferred for several reasons within the RACHP industry, including lower power requirements and better system performance/efficiency and reliability.

[5] Shrieve Chemical Co. Shrieve Chemical, 1442 Lake Front Circle Suite 500 The Woodlands Texas 77380 USA
[6] Rheinmetall AG, Rheinmetall Platz 1, 40476 Dusseldorf in Germany

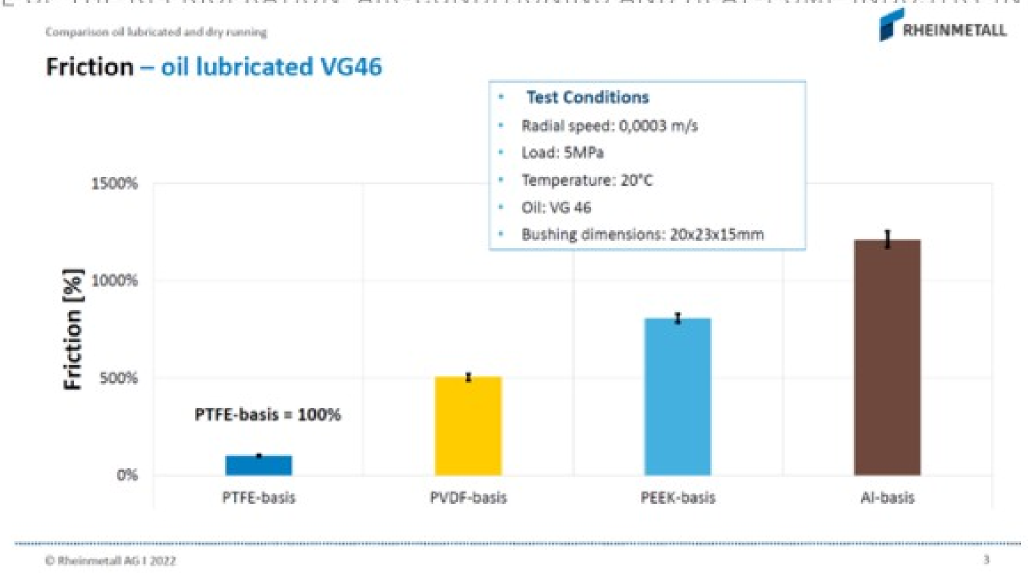

Figure 4: Amount of friction when lubricated compared to PTFE

The next graph (Figure 5) shows the results for the dry running conditions. Here again, the PTFE bearing material (often used in the RACHP industry), performed the best (lowest friction). Also note the aluminium bearing alloy did not complete the test because it seized due to very high friction.

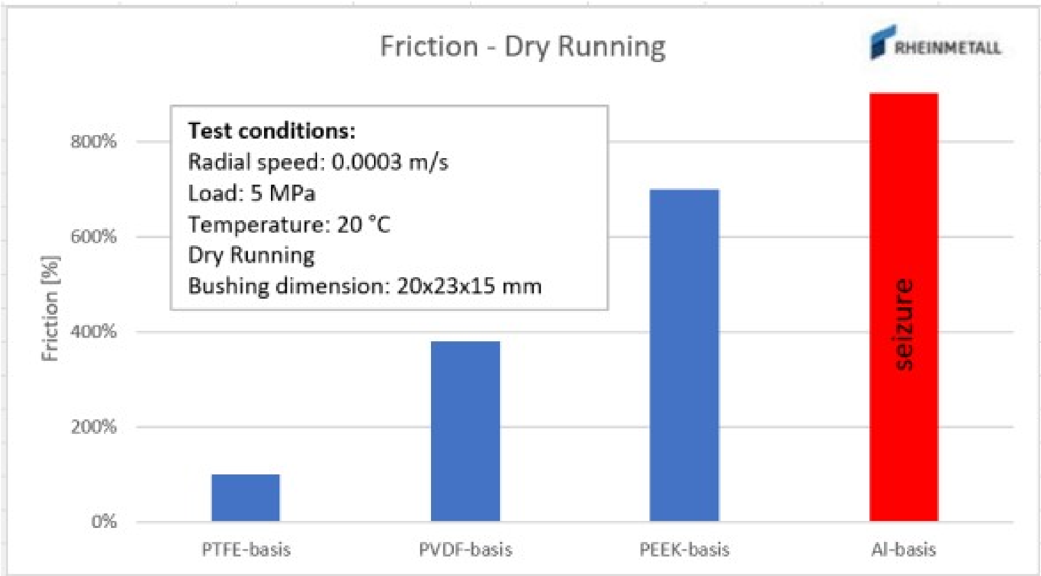

Figure 5: Amount of friction without lubrication compared to PTFE

C. Components usage of fluoropolymers – results of a survey among EPEE members

EPEE conducted an internal, anonymous survey of its members on the usage of fluoropolymers in RACHP systems. The survey is summarised in Annex A (Table 1 and 2, below) and tells in which components the main fluoropolymers are used, the reasoning for their use, the possible substitution implications and the justification of a REACH derogation. Components referred to in the tables are shown in Figure 6.

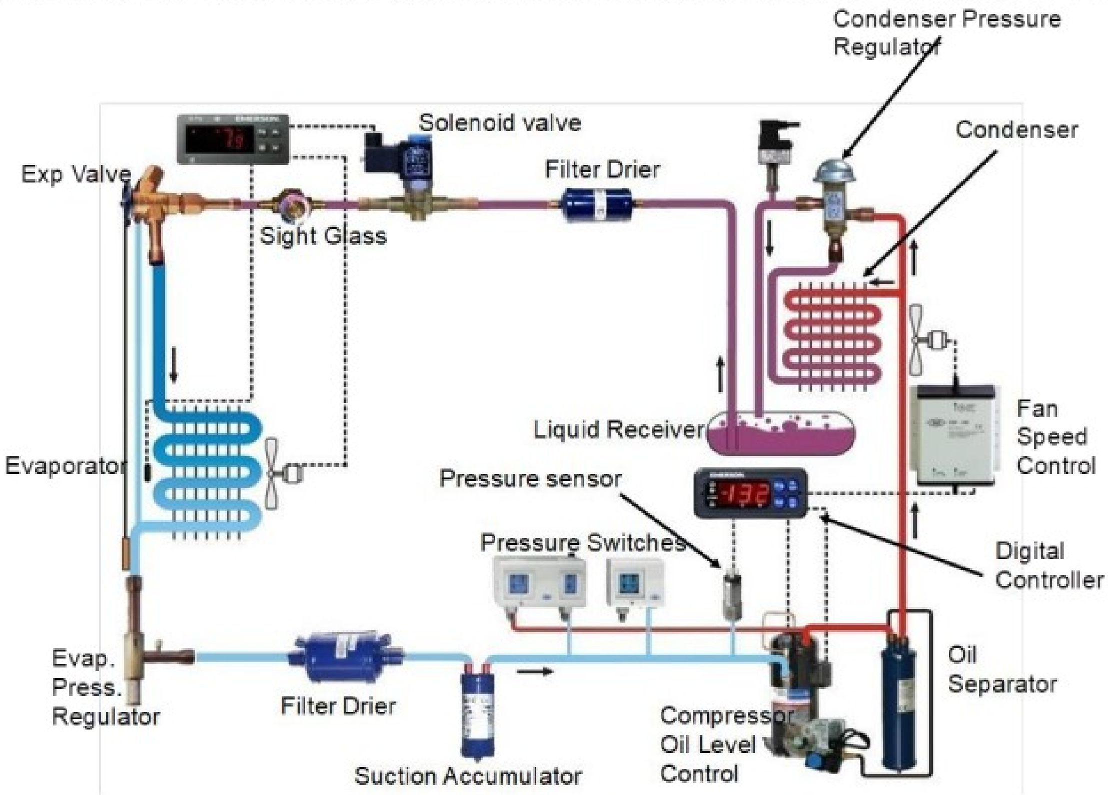

Figure 6: Outline of a simple vapor compression system with related components (Copeland)

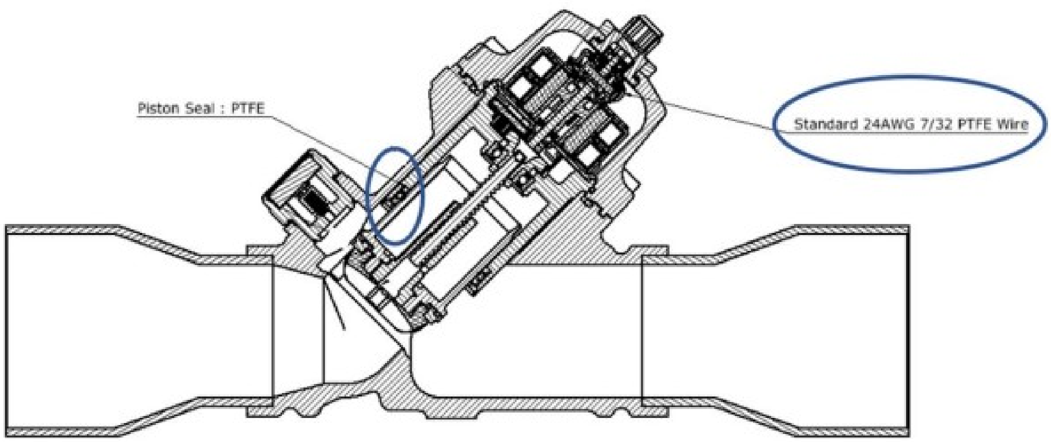

Figure 7: Electronic expansion valve (Danfoss) with PTFE seal and wire (Danfoss)

Figures 7 and 8 are examples of usage of PTFE in an expansion valve where the piston is subject to big variation of pressure gradients and temperature shifts. At the same time, it needs to move the piston while ensuring zero leakage from high to low pressure. Figure 9 shows two common types of valves for refrigeration systems. The Solenoid valve[7] on the right uses a variety of different fluoropolymers.

[7] A Solenoid valve is a type of valve controlled by an electric current. When electrically energized or de-energized, it will either shut off or allow fluid flow.

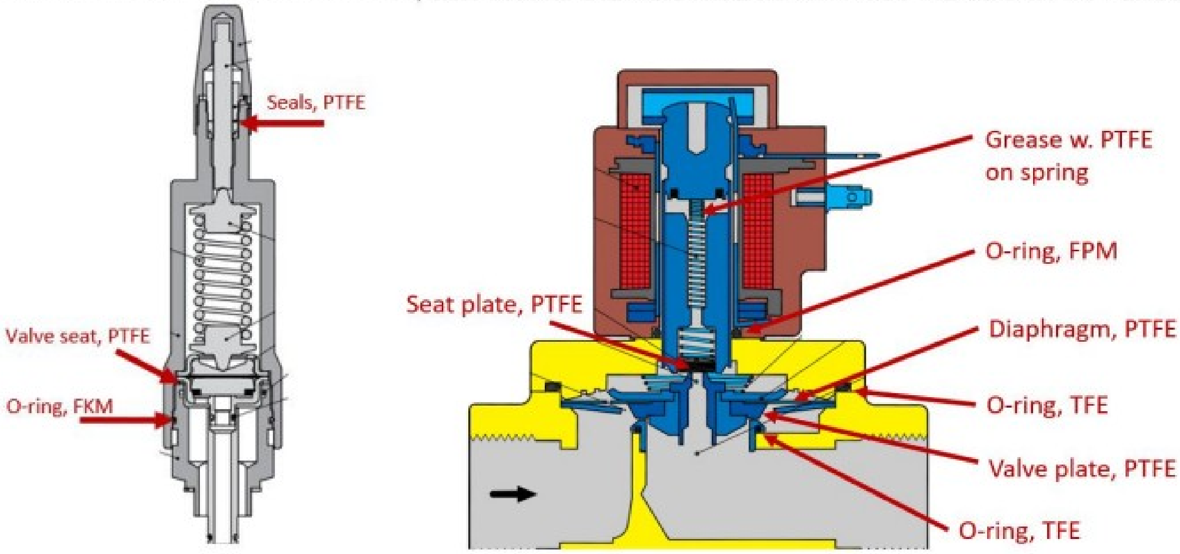

Figure 8: Pilot valve (left) and Solenoid valve with numerous fluoropolymers. (Danfoss)

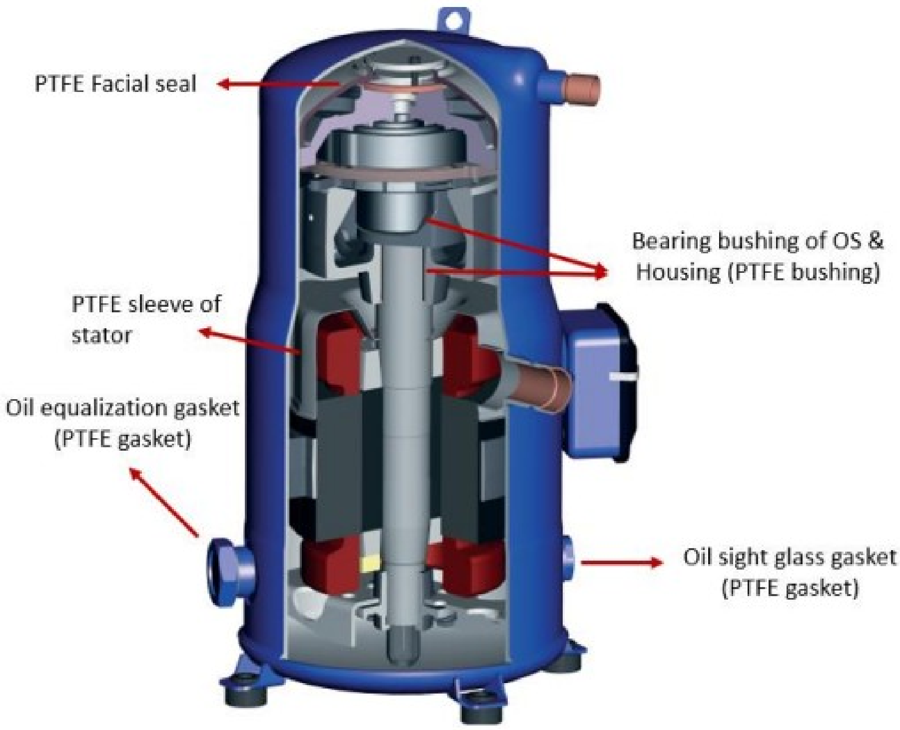

Figure 9: Scroll Compressor with multiple PTFE parts. (Danfoss)

The Compressor in Figure 9 is a mainstream scroll compressor used for many applications ranging from refrigeration to air conditioning and heat pumps. In the past, scroll compressor technology used to apply bearings were made from aluminium. In general, its performance was quite poor, with limited compressor lifetime and limited ability to support big loads. Some years ago, the bearing technology evolved to use material with PTFE in the composition. There is no other technology available to replace this material in the short/mid-term, except to move back to aluminium with all its drawbacks.

Consequently, the compressor lifetime would be reduced, with an estimated 80,000 additional compressors to be replaced in the field from 2024-2034, creating a significant impact on sustainability. In addition, there would be limited operational envelope and ability to support load, which would create limitations for heat pumps to achieve necessary temperatures for sanitary water without a complementary electrical heater. Efficiencies would decrease and many products would not meet EU Ecodesign requirements.

Before the use of fluoropolymer, previous components included substances such as lead and were eventually banned. An exemption for leaded bearing for "bearing shells and bushes for refrigerant-containing hermetic scroll compressors" for RACHP applications was in place up until July 2021, and then fully banned.[8] This led to an increase in the use of fluoropolymer (here, specifically PTFE) in the sector as an alternative to lead.

6. Transport of Refrigerants

To stock, transport and handle any kind of refrigerants (including non-fluorinated ones), the gas industry needs to pack refrigerants in tanks and cylinders (under-pressure equipment). Tanks and cylinders have accessories such as manometer, valves and safety valves fixed on the under-pressure equipment.

To avoid any leakage during the service life of the under-pressure equipment, accessories like joints need to be appropriately fixed. The service life of such equipment is 10 years (five years for ammonia). The better-known way to fix accessories on under-pressure equipment is PTFE (commonly known as Teflon), which can resist any type of refrigerant and condition (temperature, humidity, pressure).

Figure 10: example of a joint with PTFE.

There are alternatives such as pastes, but they are not technically equivalent to PTFE. Without PTFE or other specific fluoropolymers joints, the gas industry may face leakages on gas tanks and cylinders, which may affect the safety of installations in terms of flammability and toxicity, as well as the risk of environmental damage.

To be sustainable and reliable, the gas industry needs fluoropolymers, in particular PTFE, to be able to keep gas tanks and cylinders safe for everyone (whatever the type of gas).

[8] Under the Directive 2011/65/EU, on Restriction of Hazardous Substances, see the latest update with the Commission Delegated Directive 2017/1010: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32017L1010

III. The RACHP Sector in the U-PFAS Restriction Proposal

A. The potential impact of a ban on the RACHP applications

As shown previously, a universal ban would have a significant impact for RACHP equipment from the current proposal:

- Fluoropolymers that fall under the PFAS definition in the proposal are widely used in RACHP components such as compressors, valves, controls, variable speed drives, leak detection electronics, etc. These systems require sealing materials and bearings that can withstand high pressures, and a wide range of temperatures to operate at their best. This specifically includes PTFE, PFA, FEP, FKM FEPM, ETFE, PVDF, PFPE…
- These fluoropolymer materials are highly resilient and provide excellent sealing and frictional properties that are required to minimise leakage of refrigerants and provide energy efficient (low friction) bearings. Such leakage leads to both direct greenhouse gas (GHG) emissions and to reduced energy efficiency and therefore increased energy-related (indirect) GHG emissions.

Therefore, banning the use of fluoropolymers in RACHP systems would likely lead to increased GHG emissions (as alternative sealing materials have inferior properties) and would require significant re-engineering – redesigning of thousands of different components used in and specific to the RACHP sector. While there is a time unlimited derogation proposed in the Restriction Proposal for "refrigerants in RACHP equipment in buildings where national safety standards and building codes prohibit the use of alternatives", this derogation does not cover fluoropolymers, making it pointless as equipment will not properly function without fluoropolymers.

A broad ranging PFAS ban without any fully considered derogations would impede the optimal refrigerant choice for new equipment, likely hindering the ongoing and future R&D towards the development of even safer and more energy-efficient devices.

1. The lack of alternatives to fluoropolymers

Against the above background, the RACHP industry would face several innate constraints on the component side. Fluoropolymers work in complex conditions and with inherent operating limitations such as very high pressure, high temperature, oil resistance and refrigerant resistance. Without fluoropolymers proper operation of the equipment would not be possible. This is why the ongoing use of fluoropolymers is absolutely crucial.

There is no viable, existing current alternative to fluoropolymers for the majority of its applications and uses in the RACHP sector. A transition to alternative solutions would require in any case extensive development and testing. These processes (as shown below in Figure 11) ensure that the alternatives meet safety, performance and efficiency standards while maintaining compatibility with existing infrastructure and equipment. A sufficient timeframe is necessary to conduct comprehensive research, design and testing phases.

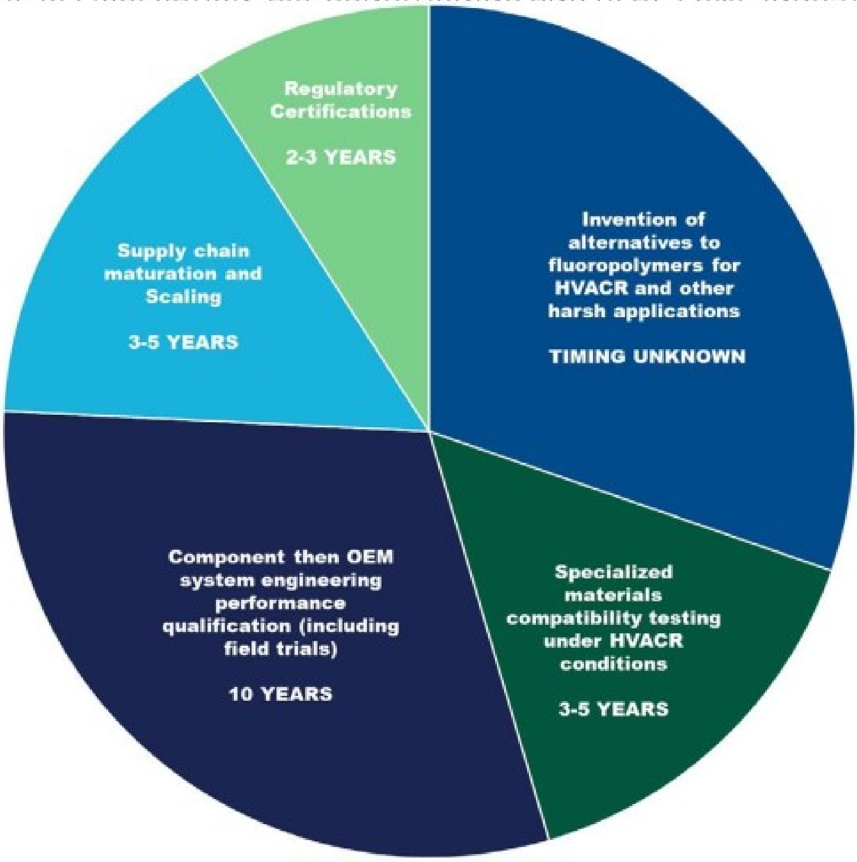

Figure 11: Internal estimation of time for developing alternatives to fluoropolymers, based on experiences conducted by the industry.

Furthermore, considering the time and investment needed to find innovative components, a ban could mean reverting to older technologies and a loss of efficiency.

2. Recommendation for maintenance and spare parts

In coherence with our recommendation of providing a time unlimited derogation to fluoropolymers for the RACHP sector, we also recommend a **time unlimited derogation for the maintenance and repair of systems.**

Spare parts: Under the PFAS proposal, it is necessary to consider the inclusion of a derogation for spare parts in order to ensure the repairability and continuation of the lifecycle of products. Spare parts play a vital role in maintaining and repairing products, enabling their longevity and reducing the need for new product purchases. By allowing the availability of spare parts, we support a circular economy model where resources are conserved, and the lifecycle of products is extended while the environmental footprint of a product is reduced.

This is why a full time-unlimited derogation for spare parts from the PFAS ban is the most viable solution to ensure that existing spare parts can continue to be utilized without unnecessary waste.

Threshold for PFAS: The Restriction Proposal foresees a ban on manufacture, use and placing on the market of PFAS if they are part as a constituent or if they are present in a mixture or in an article.

For fluoropolymers, the proposed concentration values will make the recycling process almost impossible and hamper the principle of circular economy in the RACHP sector[9], but are also impractical to assess due to current measurement and sampling limitations[10]. More realistic thresholds that would be aligned with existing REACH concentration limit thresholds are needed.

3. Exemption for export of equipment

The proposed use prohibition will affect the export (outside EU to third countries) position of producers (equipment, components,….). To secure global competitiveness, the export should be exempted, otherwise the prohibition will result in a technical barrier for trade.

B. End-of-Life of fluoropolymers

The Waste Framework directive (2008/98/EC) strengthened the waste prevention principle, including for electrical and electronic equipment, and the proper separation of waste. However the End-of-Life (EoL) treatment of electrical and electronic waste and their components is more precisely covered by the Waste Electrical and Electronic Equipment (WEEE) Directive.

The WEEE Directive and its treatment standards are setting the conditions for an environmentally-conscious treatment of Electrical and Electronic Equipment (EEE) at EoL. The WEEE Directive even requires producers to disclose treatment information to treatment operators and recyclers for each type of EEE placed on the market. A central online platform was established (the Information for Recyclers Platform (i4R)). The recycling information is linked to presence and location of materials and components requiring separate treatment.

Following the restriction proposal on the use prohibition and more specifically on the prohibition to place it on the market in articles, this results in a prohibition for proper waste treatment at EoL.

In view of safeguarding the principles of circular economy and avoiding massive future landfill a complete derogation from the restrictions is required for fluoropolymers, in alignment with a full-time unlimited derogation for the placing on the market of fluoropolymers. Activities for the recycling and reclamation of fluoropolymers also must still be allowed.

Regarding the end-of-life of fluoropolymers, there is no specific regulation applicable to the RACHP sector. Fluoropolymers can be either disposed of in landfills (as fluoropolymers are inert it can be a solution if the separation from other materials of the unit is not practical), re-used/repurposed or incinerated. Almost 84% of all fluoropolymer applications (beyond the use in the RACHP sector) were treated with incineration with energy recovery (72%) and thermal destruction (12%), and only 3% was recycled.[11]

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[9] See the submission of the EFCTC in alignment with this recommendation on impurities thresholds.

[10] See for the perspective of the waste sector, the submission of the Confederation of European Waste-to-Energy Plants (CEWEP).

[11] *Fluoropolymer waste in Europe 2020 - End-of-life (EOL) analysis of fluoropolymer applications, products and associated waste streams.* Conversio Market & Strategy GmbH, https://www.ft.dk/samling/20222/almdel/euu/spm/49/svar/1951975/2698345.pdf

C. Fluoropolymers Are Different to Other PFAS, and Consideration of Non-fluoropolymers

PFAS that have traditionally been shown to be of concern are those that have low molecular weights and are likely to be mobile, bio-accumulative, and toxic. Fluoropolymers have high molecular weight, are non-mobile (not water soluble), non-bio-accumulative, non-toxic and pose little risk to human health and the environment. Based on the physicochemical, biological and (eco)toxicological properties of commercial fluoropolymers, >96% of major fluoropolymers are considered to meet the Organisation for Economic Cooperation and Development's (OECD) Polymer of Low Concern (PLC) criteria per existing and on-going studies. A total of 38 fluoropolymers are commercially available out of 4700+ PFAS.[12]

The following schematic shows the 13 criteria that the OECD has identified to define Polymers of Low Concern:

Figure 12: Criteria for a polymer to be a polymer of low concern[13]

Non-fluoropolymers are also used in many industries, including the RACHP sector, and are also important to the good functioning of equipment. PFHxA, BPAF and HFEs are not mentioned in detail in this submission due to a lack of sufficient data at this stage, but are also key substances whose utility cannot be overlooked. HFEs, for instance, are used by industries as a solvent.

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[12] Buck, R. C., Korzeniowski, S. H., Laganis, E., & Adamsky, F. (2021). Identification and classification of commercially relevant per- and poly-fluoroalkyl substances (PFAS). *Integrated Environmental Assessment and Management*, *17*(5), 1045–1055. https://doi.org/10.1002/ieam.4450

[13] Korzeniowski, S. H., Buck, R. C., Newkold, R. M., kassmi, A. E., Laganis, E., Matsuoka, Y., Dinelli, B., Beauchet, S., Adamsky, F., Weilandt, K., Soni, V. K., Kapoor, D., Gunasekar, P., Malvasi, M., Brinati, G., & Musio, S. (2022). A critical review of the application of polymer of low concern regulatory criteria to fluoropolymers II: Fluoroplastics and fluoroelastomers. Integrated Environmental Assessment and Management, 19(2), 326–354. https://doi.org/10.1002/ieam.4646

D. Recommendation for a Review Clause

As indicated and justified previously, EPEE recommends a time-unlimited derogation for fluoropolymers as they are essential to the efficiency and safety of the RACHP equipment, but **with a review clause after 10 years** to assess the availability of alternatives and their efficiency. The RACHP sector will likely innovate and there is potential for new technologies and components, but this process could take a significant amount of time as indicated previously in Figure 1.

IV. Conclusion

The proposed universal PFAS restriction now under review by ECHA would have a significant impact on the RACHP sector, if it goes ahead as proposed. In light of the green transition and the fundamental societal dependence on the deliverables like cooling, heating and refrigeration of food, <u>EPEE recommends:</u>

- A full **time-unlimited derogation for the RACHP sector for fluoropolymers, with a review clause after 10 years to assess the availability of alternatives;**
- A full time-unlimited derogation for spare parts, waste treatment (especially as fluoropolymers are inert) and export;
- Setting realistic concentration thresholds that would not hamper the circularity of the components.

In light of the above, EPEE would like to emphasise that:

- Alternatives to fluoropolymers, in the short- and medium-term as innovation will take time, would be older solutions and technologies that would decrease efficiency, reduce the lifetime of the products and generate more waste.
- All fluoropolymers fall under the proposed definition in the proposal. These substances, such as PTFE and FPM, among others, are critical to most of the components which make these systems run efficiently and at best performance. This includes vapour compression systems which ensure the smooth, efficient and optimal performance of RACHP equipment and systems, including key applications such as comfort heating and cooling, refrigeration, air conditioning, etc.
- Fluoropolymers are pivotal in their embedded design of the components and cannot be replaced by drop-in materials. The consequence of the possible ban as proposed would therefore be a forced, immediate need to completely redesign most platforms, while it is unclear when (or even if) efficient alternatives to fluoropolymers will be invented.

More broadly, EPEE believes the current proposal is not proportional and the risk associated with our uses is not unacceptable. For us as users, the benefits of fluoropolymers (intrinsic safety for fluoropolymers) together with their socioeconomic value (such as their sealing properties that avoid leakages) outweigh the concerns of regulators related to risk from their manufacture, use and end of life.

Annex A

Tables extracted from an internal EPEE survey among its members (2023): Main Fluoropolymers and their usage, potential replacement, and derogation justification.

Table 1. PFAS Fluoropolymers (simplified list)

PFAS fluoropolymer	Location in RACHP products (including parts)	Approx. timeline for its substitution (in n° of years)	Circumstances that justify a REACH derogation (*see also table 2 for overview summary)*
PTFE Polytetrafluoroethylene	**Filters**	PTFE used for a wide range of applications in HVACR systems, each would require a comprehensive evaluation of potential non-PFAS alternatives. At present, there are no non-PFAS alternatives available with the same properties as PTFE. If alternatives can be identified with the required properties for each application, then testing, OEM qualification, supply chain conversion, and codes and standards approvals are all necessary. At least 10 to 15 years estimated to be required for a comprehensive substitution **BUT** depending on the application.	For filters, PTFE provides low pressure drop, low energy consumption, high mechanical stability, high chemical resistance, risk reduction during operation. Fiberglass-based filter media are inferior for pressure drop (energy consumption), mechanical stability and chemical resistance.
	O-rings, seals, washers and gaskets: in compressors, thermal expansion valves **(**TXVs**)**, other system valves, heat exchangers, pumps, filter driers; thrust washers, ball gaskets		More generally PTFE is extremely difficult to replace because of the following properties that are simultaneously present: Low friction, high temperature capability, good low temperature ductility, chemically inert- necessary due refrigerants and refrigerant/lubricant mixtures, compressible bearing surface, ability to transfer to the tribo-counterface and inherent flame retardance and lifetime reliability. See comment on PFAS lubricant derogation
	Bearings and bushings: in compressors and filter driers		
	Diaphragms: in valves		
	Seat plates: in valves		
	Caps: in heat exchangers and valves		
	Grease and oil: in valves		
	Paint: such as silverpaints (important for the function of scratch and weather resistance)		
FEPM (TFE/P) Propylene-tetrafluoroethylene copolymer elastomer	**O-rings, seals**	At least 10 years estimated to be required, for a comprehensive substitution, which includes supply chain conversion, OEM qualification and conversion, and codes and standards approvals	

Table 1. PFAS Fluoropolymers (simplified list)			
PFAS fluoropolymer	**Location in RACHP products (including parts)**	**Approx. timeline for its substitution (in n° of years)**	**Circumstances that justify a REACH derogation** (*see also table 2 for overview summary)*
PFA Perfluoroalkoxy alkane copolymer	**Bearings, O-rings**	At least 10 years estimated to be required, for a comprehensive substitution, which includes supply chain conversion, OEM qualification and conversion, and codes and standards approvals	
FEP Fluorinated ethylene propylene copolymer	**O-rings** **Cables**: for Heating and transmitters **Heating elements**	no timescale estimated	
FKM Vinylidene fluoride-hexafluoropropylene copolymer elastomer	**O-rings, seals, and gaskets**: in compressors, thermal expansion valves **(**TXVs**)**, other system valves, heat exchangers, pumps, filter driers; pressure regulators, sight glasses, switches, transmitters **Diaphragms**: in valves **Seat plates:** in valves	FKM is used for a wide range of applications in HVACR systems, each would require a comprehensive evaluation of potential non-PFAS alternatives. At present, there are no non-PFAS alternatives available with the same properties as FKM. If alternatives can be identified with the required properties for each application, then testing, OEM qualification, supply chain conversion, and codes and standards approvals are all necessary. At least 10 to 15 years estimated to be required for a comprehensive substitution **BUT** depending on the application	FKM is extremely difficult to replace because of the following properties that are simultaneously present: high temperature capability, good low temperature ductility, chemically inert- necessary due refrigerants and refrigerant/lubricant mixtures, inherent flame retardance and lifetime reliability.

Table 1. PFAS Fluoropolymers (simplified list)

PFAS fluoropolymer	**Location in RACHP products (including parts)**	**Approx. timeline for its substitution (in n° of years)**	**Circumstances that justify a REACH derogation** (*see also table 2 for overview summary)*
ETFE Ethylene tetrafluoroethylene copolymer or terpolymer with perfluoro-1-hexene	**Sensor**		
PVDF Polyvinylidene fluoride	**Cables**: Heating	Substantial time is required for suppliers to develop alternatives	
	Heating elements		
PFPE Perfluoropolyether (lubricant or grease)	**Valves** - oil, grease	Substantial time is required for suppliers to develop alternatives	PFAS lubricants have a derogation for harsh environments PFPE & PTFE discussed in A.3.15 From Restriction Proposal Documentation E.2.14.2.1. Description of the use and function of the restricted substance(s) "According to stakeholders, PFAS-based lubricants are used in many sectors in situations where they are superior in terms of technical performance under extreme/harsh conditions compared to other lubricants and/or where other types of lubricants would not be technically feasible." The proposed restriction derogation s. lubricants where the use takes place under harsh conditions or the use is needed for safe functioning and safety of equipment until 13.5 years after EIF; appears to be applicable to their use in HVACR.

Table 2 Fluoropolymers: Circumstances that justify a REACH derogation								
	PTFE	**FEPM**	**PFA**	**FEP**	**FKM**	**ETFE**	**PVDF**	**PFPE**
Technical Performance (a combination of some or all of these properties)								
Lifetime Reliability	yes	yes	yes	yes	yes		yes	no
High and/or low temperature performance	yes	yes	yes	yes	yes		yes	yes
Refrigerant/lubricant resistance	yes	yes	yes	yes	yes		yes	no
Electrical Insulation/dielectric performance	yes	yes	yes	yes	yes/no		yes	no
Dimensional stability	yes/no	yes	yes	yes/no	yes		yes/no	no
Other								
Alternatives technical performance								
Key performance limitations	yes	yes	yes	yes	yes		yes	yes
Lack of reliable long term performance information for alternatives	yes	yes	yes	yes	yes		yes	yes
Cost Efficiency								
Technical performance of equipment: e.g. higher power needed if friction increases	yes	yes	yes	yes/no	yes		yes/no	yes
Cost efficiency of components: e.g. if physical design changes needed to compensate for lack of material performance	yes	yes	yes	yes	yes		yes	yes
Safety implications of not using fluoropolymer: e.g. seals etc are critical to prevent leaks and especially relevant to flammable refrigerants	yes/no	yes	yes	yes	yes		yes	no
Survey response explanation: *requested to answer yes or no; yes/no indicates both responses in survey which may reflect different applications within the system, some answers only indicated yes, for some applications/fluoropolymers no additional information provided eg EFTE*								

Table 2: Summarising the main Fluoropolymers and the main functional parameters

EPEE Position on PFAS Universal Restriction Proposal: F-gases and Fluoropolymers

Summary

November 2023

EPEE, as the voice of the Refrigeration, Air Conditioning and Heat Pump (RACHP) sector in Europe, would like to highlight its key concerns and recommendations related to the Universal PFAS Restriction proposal, as submitted to ECHA. The definition given of PFAS covers a wide range of fluorinated gases (F-gases)[1]as refrigerants, and all fluoropolymers[2] in RACHP equipment. As currently proposed, the restriction proposal would have a detrimental effect on those crucial applications, which is why EPEE recommends a full –time-unlimited derogation, with a review clause 10 years after the date of the entry into force.

The importance of RACHP to society

Cooling and heating are a fundamental need for society, as:

- Refrigeration ensures healthy and affordable food supplies and reduces CO_2 emissions by avoiding food waste.
- Refrigeration helps to safely transport and store medicines and vaccines.
- Comfort cooling is necessary in areas where temperatures are increasingly becoming a threat to productivity and health, including in hospitals.
- Using heat pumps for comfort heating is key to achieving the decarbonisation of heating.

Heating and cooling directly impact the health and well-being of Europeans. For instance, for cooling, those direct benefits align with eight of the UN's Sustainable Development Goals.

Equipment operates in homes, office buildings, commercial and industrial sites, but also in airports, hospitals, schools, and many others places. Heat pumps offer flexibility and support district heating and cooling networks, as well as the recovery of waste heat. RACHP products comply with robust energy-efficiency requirements, and operate within strict safety codes and standards. At EU level, they are already regulated, especially by the F-gas Regulation.

In addition to the societal benefits of RACHP equipment, heat pumps are a key technology to decarbonise the building sector, which represents 36% of the GHG emissions[3]. By 2050, the roll-out of heat pumps will save more than 600 million tonnes of CO_{2eq}[4] annually.

[1] For the full reply provided to ECHA on f-gases, please see: https://epeeglobal.org/wp-content/uploads/2023/09/AEPEE-reply-part-I-PFAS-REACH-22.09.2023-F-gases.pdf
[2] For the full reply provided to ECHA on fluoropolymers, please see: https://epeeglobal.org/wp-content/uploads/2023/09/BEPEE-reply-part-II-PFAS-REACH-22.09.2023-fluoropolymers.pdf
[3] Energy performance of buildings: climate neutrality by 2050
[4] EPEE's HFC Outlook EU Model

1. **Justification for a time-unlimited derogation for F-gases**

The current legislative framework

The **F-gas Regulation** is the main piece of EU legislation that regulates the use of F-gases, as the transposition of the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, including the 2016 Kigali Amendment. These global commitments aim at implementing an HFC phase-down to reduce HFC production and consumption by more than 80% based on their greenhouse impact over the next 30 years. The first two Regulations (2006 and 2014) led to a significant decrease in emissions, and the third edition to be adopted in February/March 2024[5] will introduce stricter containment measures for HFCs, HFOs and blends. It also plans several new requirements including full F-gas product bans for several product categories with a review clause to assess via a report before 2030 the feasibility of those bans on split and self-contained air-conditioning and heat pumps below 12kW as well as on chillers below 12kW. Finally, a full phase out of virgin HFCs is planned by 2050 with a review in 2040 to assess the feasibility of this goal.

This shows that the F-gas Regulation already puts some stringent requirements for the use of refrigerants and especially of F-gases. By reducing the use and the emissions of F-gases, the Regulation has the same purpose than the PFAS restriction proposal, as it limits their environmental release and impact.

Aside from the F-gas Regulation, RACHP equipment falls within the scope of both the Ecodesign Directive and Energy Labelling Regulation, under which equipment complies with energy efficiency requirements. It also falls within the Waste Electrical and Electronic Equipment (WEEE) Directive, which covers equipment end-of-life, including by recovering and reclaiming refrigerants. Safety requirements also provide a framework for the use of F-gases.

Emissions of the sector

EPEE created and continues to update its *HFC Outlook EU* model to project pathways for the refrigerant transitions in view of the EU F-Gas Regulation, in collaboration with Gluckman Consulting. This is based on value chain data provided by members and it aims to forecast the refrigerant development in RACHP equipment in the years to come. Its projections are built bottom-up, providing an analysis of the stock of equipment in more than 50 F-Gas market sub-sectors. This includes the RACHP sectors but also non-RACHP HFC applications such as MDIs, technical aerosols and foams.

This modelling revealed that emissions and leakage rates are generally low but can vary between products. Many types of small RACHP equipment are factory built sealed systems, e.g. domestic refrigerators and standalone retail display cabinets. This type of system typically has refrigerant charge in the range of 0.05 to 0.5 kg. They have a very low operational leakage rate – well below 1% per year, see Figure 1 below.

[5] An agreement was reached in October 2023 for the third F-gas Regulation, with an entry into force expected in Q1 2024.

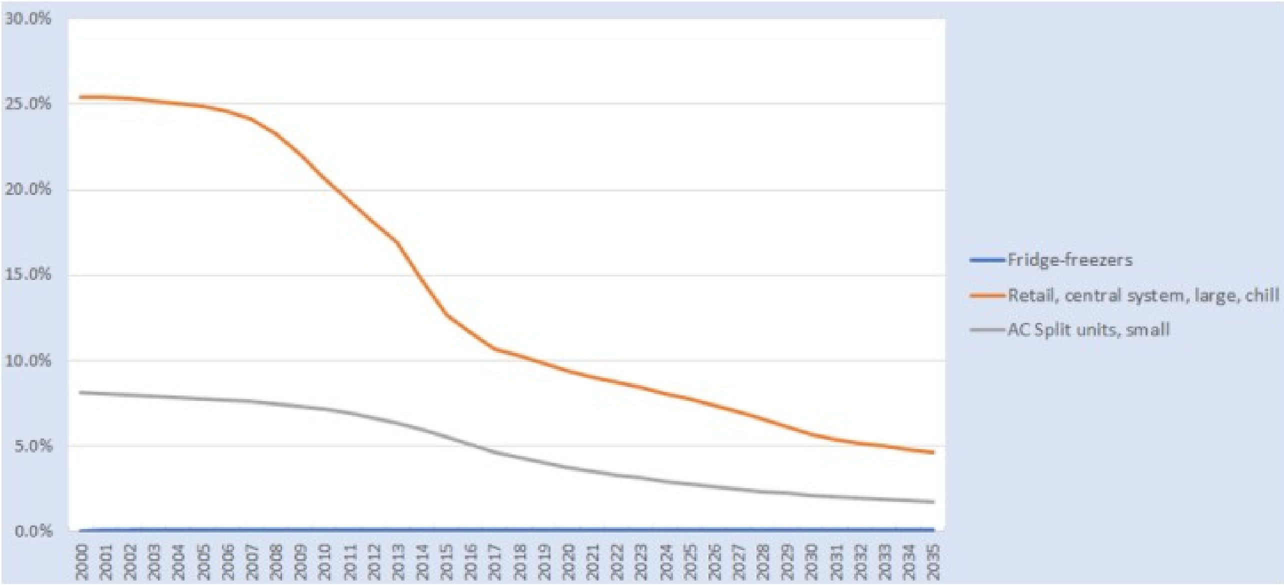

Table 1 - Modelling projections for operational leakage rates for 3 types of RACHP equipment until 2035

The global amount of refrigerant emissions is largely decreasing year by year and will be cut by more than half between 2020 and 2035 (see tables below for both HFCs and HFOs).

	HFCs						HFOs				Total
	R125	**R134a**	**R143a**	**R227ea**	**R245fa**	**R365mfc**	**R1233zd(E)**	**R1234yf**	**R1234ze(E)**	**R1336mzz**	
2020	10.016	19.071	3.653	200	72	114	1	1.546	94	0	**34.766**
2025	8.503	16.099	2.424	169	-	-	15	3.617	384	6	**31.218**
2030	4.809	9.703	187	81	-	-	29	6.022	670	12	**21.512**
2035	2.654	4.301	20	-	-	-	43	8.686	999	17	**16.720**

Table 2 - Modelling of emissions of refrigerants by molecule in tons between 2020 and 2035

Degradation products of F-gases

One of the main rationales behind the inclusion of F-gases in the restriction proposal of PFAS fluorinated greenhouse gases is the degradation in the atmosphere of some F-gases into trifluoroacetic acid (TFA), which belongs to the PFAS definition. However, many independent experts and scientists consider TFA to be of low concern for human health and the environment.

For more than a decade, the Environmental Effects Assessment Panel (EEAP) of UNEP has commented on the issue and concluded in 2022 that "*all PFAS should not be grouped together, persistence alone is not sufficient for grouping PFAS for the purposes of assessing human health risk*" and that "*based on projected future use of these precursors of TFA [including HFC/HFO], no harm is anticipated*".[6]

[6] See EEAP, 2022 Assessment report : https://ozone.unep.org/system/files/documents/EEAP-2022-Assessment-Report-May2023.pdf

Granularity of applications

It is important to highlight that the use of F-gases falling under the definition of PFAS is fairly diversified across RACHP applications. For instance, for sealed refrigeration systems (such as retail stand-alone systems) the use of ultra-low GWP refrigerants is common, while for industrial refrigeration (chillers, DX) some small equipment is not well suited for non-fluorinated gases.

The wide product variety and application specificity of the sector has to be taken into account.

Impact of a potential restriction

A broad ranging PFAS ban would have adverse consequences on the full value chain, including:

- The restriction would impede the optimal **refrigerant choice for new equipment**, likely hindering the ongoing and future R&D towards the development of even safer and more energy-efficient devices.
- Restricted system maintenance and refrigerant refilling could lead to **premature obsolescence** of equipment.
- The **circular loop enabled by the recovery, reclamation and reuse of refrigerants** could be hindered if the Restriction does not foresee an appropriate exemption.
- As the restriction foresees very low thresholds for manufacture, use and placing on the market, it does not take into account processes and procedures for the **manufacturing, supply chain, recovery and recycle of F-gases**. If some impurities are detected in gases that are not fundamentally PFAS, it could result in unintended consequences. It is recommended that a specific concentration limit for fluorinated impurities is established for virgin and reclaimed refrigerants (which should be exempted from this restriction). For consistency, should be based upon the AHRI 700 2019 Standard.
- To secure global competitiveness, the export for PFAS F-gases should be exempted, otherwise the prohibition will result in a **technical barrier to trade**.

Our recommendations for consideration

Considering the data and the impacts that EPEE has provided in its reply to the Public Consultation, we would like to make the following recommendations:

Since the F-gas Regulation already regulates the use of F-gases, the Universal PFAS Restriction **shall exempt the use of F-gases for Refrigeration, Air-Conditioning and Heat Pump (RACHP) applications.** Alternatively, the Universal PFAS restriction should **include a full time-unlimited derogation for F-gases used in RACHP applications, with a review clause 10 years after the entry into force of the Restriction to assess the availability of alternatives**.

- A full time-unlimited derogation for:
    - maintenance and refilling of equipment to avoid premature obsolescence;
    - reclamation and recycling of refrigerants; and
    - export of pre-charged equipment containing F-gases.
- A reconsideration of the thresholds used in the Restriction Proposal and of their feasibility, as they may jeopardize the efforts to recover, reclaim and reuse refrigerants to achieve a Circular Economy. In the case of F-gases, standard distillation and purification methods used for F-gases (virgin and recycled) allow impurities in the range of 0,5%.

2. Justification for a full time-unlimited derogation for fluoropolymers

Use of fluoropolymers

The use of fluoropolymers is essential for the functionality and tightness of RACHP products. Due to harsh conditions within the equipment, materials used need to withstand high pressure and high temperature. Fluoropolymers present key unique characteristics:

- Sealing to prevent the release of refrigerant into atmosphere, which also avoids leakages during transport of refrigerants;
- Temperature and pressure resistance facing differentials from -50°C to 175°C and from near vacuum conditions up to 120 bar;
- Persistence and chemical inertness, which allow the products to last for long and reduce waste;
- Unique electrical properties, like the low dielectric constant that does not break down when subjected to important electric fields;
- Low friction that enables components to be more sustainable and require fewer repairs.

While many alternatives may be acceptable for just one or two of these properties, there is no one alternative that fulfills these needs simultaneously. There is no viable, existing alternative to fluoropolymers today that could fulfil all the same criteria with the same level of efficiency and safety.

Impact of a potential restriction

A ban on fluoropolymers in RACHP products would likely lead to an increase of GHG emissions and would require significant re-engineering and redesigning of thousands of components. While there is a time-unlimited derogation proposed in the Restriction Proposal for “refrigerants in RACHP equipment in buildings where national safety standards and building codes prohibit the use of alternatives”, this derogation does not cover fluoropolymers, making it pointless as equipment will not properly function without fluoropolymers.

Lack of alternatives

Two alternatives would have to be considered for fluoropolymers:

- A return to previously used components, which were replaced for efficiency and/or safety reasons (for instance, lead)
- Development and implementation of innovative components.

Finding an alternative is a lengthy process. It requires time to ensure that it meets safety, performance and efficiency standards while maintaining compatibility with existing infrastructure and equipment. The derogation for the RACHP applications needs to cover the maintenance and refilling of equipment as well, for its full lifecycle, to avoid premature obsolescence. A similar consideration is needed for the treatment of waste containing fluoropolymers, to ensure circularity in the sector.

Figure 1 - Internal estimation of time for developing alternatives to fluoropolymers, based on experiences conducted by the industry

Key considerations

All fluoropolymers fall under the proposed definition in the proposal. These substances, such as PTFE and FPM, among others, are critical to most of the components that make these systems run efficiently and at best performance. This includes vapour compression systems, which ensure the smooth, efficient and optimal performance of RACHP equipment and systems, and key applications such as comfort heating and cooling, refrigeration, and air conditioning.

Fluoropolymers are pivotal in their embedded design of the components and cannot be replaced by drop-in materials. The consequence of the possible ban as proposed would therefore be a forced, immediate need to completely redesign most products, while it is unclear when (or even if) efficient alternatives to fluoropolymers will be invented.

EPEE's recommendations

EPEE recommends a full –time-unlimited derogation for fluoropolymers for the RACHP sector, with a review clause 10 years after the entry into force to assess the availability and viability of alternatives.

Considering the data and the impacts that EPEE has provided in its reply to the Public Consultation, we would like to further recommend:

- A full time-unlimited derogation for spare parts, waste treatment (especially as fluoropolymers are inert) and export;
- Setting realistic concentration thresholds that would not hamper the circularity of the components.

Til: P1 P2 (E1), P3 (E2), ' P4 ' (E3), DE (E4 (E4)
Cc: restrictiePFAS (E4), Peter Juhl Nielsen ([redacted]@mst.dk)
Fra: Sehbar Khalaf ([redacted]@mst.dk)
Titel: Vs: PFAS Restriction proposal - Meeting request with EPEE
Sendt: 27-11-2023 08:06
Bilag: EPEE - PFAS position to ECHA - Full submission 2023.pdf; EPEE - PFAS position to ECHA - Summary of submission 2023.pdf;

Good morning
we have received this meeting request. Did you also receive it and any thoughts from you?

Best regards,
Sehbar

Fra: P5 < E5 >
Sendt: 24. november 2023 11:58
Til: Charlotta Amalia Wallensten <[redacted]@mst.dk>
Emne: PFAS Restriction proposal - Meeting request with EPEE

Dear Ms Wallensten,

I hope you are doing well!

I am happy to contact you on behalf of EPEE, the voice of the Refrigeration, Air Conditioning and Heat Pump (RACHP) manufacturers in Europe, an association based in Brussels. In the context of the PFAS Universal Restriction proposal submitted to the European chemical agency ECHA, we would like to highlight to you and your ministry our concerns and recommendations.

Indeed, the proposal covers a wide range of fluorinated gases, used in our sector as refrigerants, and all fluoropolymers, used as essential components for the proper functioning of the equipment.

While we understand the importance of addressing issues related to PFAS emissions, the Restriction proposal raises for us many concerns that deserve to be taken into consideration.
The RACHP products provide essential heating and cooling services to society: refrigeration for food supplies, safe transport of medicines and vaccines, comfort to citizens in homes and offices, substitution of fossil fuels by heat pumps, etc. Our products show very low leakages rates and are treated trough their entire life cycle in an environmentally sound manner.

Please find in attachment a summary of our submission to ECHA, and our full submission for your information.

We would be happy to have an **online or in-person meeting with you in the coming weeks** to share our position and discuss the points that your ministry and that Denmark should consider when the Restriction proposal will be assessed by Member states.

Thank you for your kind consideration!

Kind regards,

P5
Policy Manager

EPEE – European Partnership for Energy and the Environment
The Voice of the Refrigeration, Air Conditioning and Heat Pump Industry in Europe
Avenue des Arts, 44, B-1000 Brussels
EU Transparency Register Nr. 22276738915-67

Miljøministeriet
Miljøstyrelsen

Den 12. juli 2024

Aktdetaljer

Akttitel: VS: Request for Meeting: Implications of ECHA REACH Proposal on PFAS as Medical Propellants in Metered Dose Inhalers (MDIs)
Aktnummer: 364
Sagsnummer: 2023 - 11008

Akt-ID:	9704426
Dato:	19-03-2024 22:54:45
Type:	Indgående
Dokumenter:	• [1] VS Request for Meeting Implications of ECHA REACH Proposal on PFAS as Medical Propellants in Metered Dose Inhalers (MDIs).eml • [2] IPAC IPAC-RS ECHA REACH Feedback FINAL Submission 20 September 2023.docx