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Alliance Froid Climatisation Environnement

Partenaire de la filière pour une utilisation responsable des fluides frigorigènes

22 septembre 2023

RÉPONSE DE L'AFCE À LA CONSULTATION PUBLIQUE SUR LA PROPOSITION DE RESTRICTION GLOBALE DES PFAS

Notre industrie est une histoire réussie d'innovation : élimination progressive des gaz fluorés appauvrissant la couche d'ozone (CFC, HCFC) dans les années 1990 et transition vers les gaz fluorés avec un potentiel de réchauffement planétaire (PRP) de plus en plus faible depuis 2010.

Plusieurs gaz fluorés de type HFC, HFO sont utilisés comme fluide frigorigène dans les systèmes de réfrigération, de climatisation et de pompe à chaleur. Certains de ces gaz sont inclus, dans le champ d'application de la proposition globale de restriction des PFAS.

Ces fluides frigorigènes sont utilisés dans une grande variété d'applications de la réfrigération, du conditionnement d'air et de la pompe à chaleur. Nombreuses de ces applications sont cruciales à notre société :

- Garantir la sécurité sanitaire de nos aliments tout au long de la chaine du froid de la ferme à la fourchette,
- Garantir la température de conservation de nos vaccins et blocs opératoire,
- Assuré les températures requises dans les process industriels,
- Garantir la production d'électricité de nos centrales nucléaire,
- Chauffage et rafraichissement de nos habitations et lieux de travail,
- …

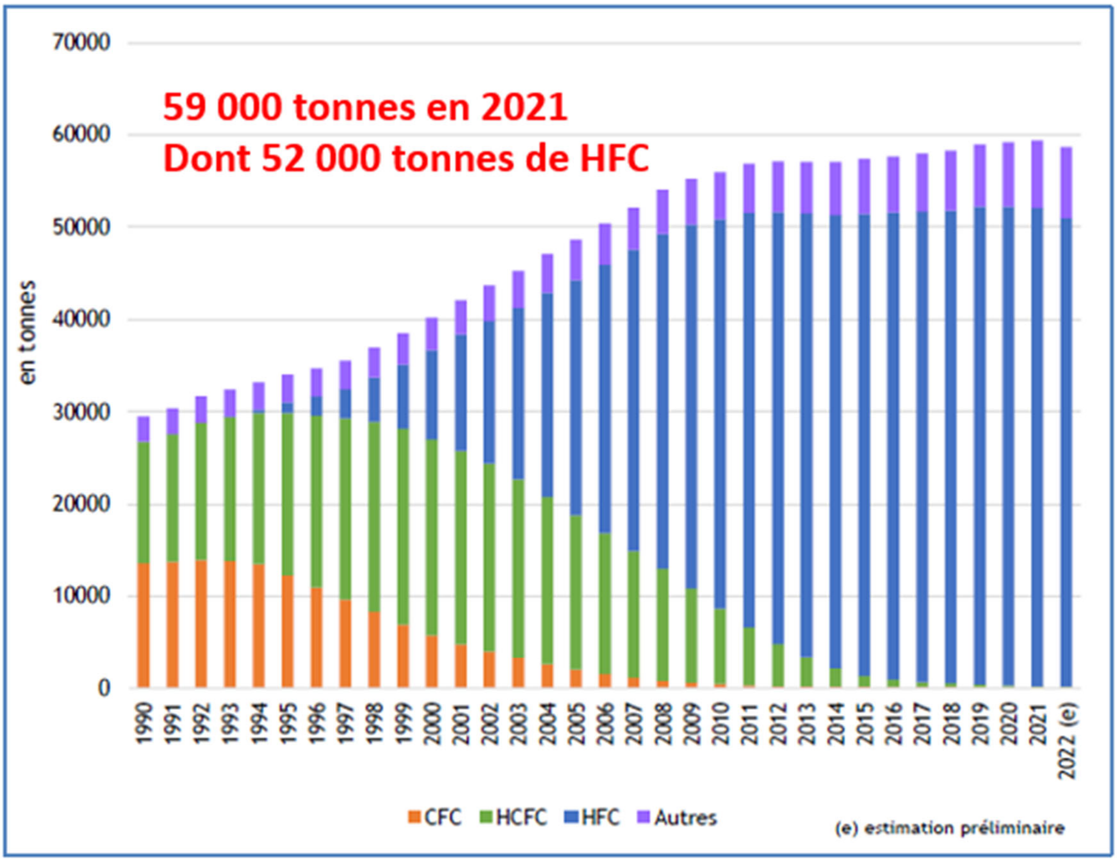
La proposition de restriction telle que proposée aurait un effet fatal sur ces applications vitales.

Ci-dessous une liste non exhaustive des applications la réfrigération, du conditionnement d'air et de la pompe à chaleur

Froid domestique	- Réfrigérateurs - Congélateurs - Caves à vin - Sèche linges thermodynamiques
Froid commercial	- Supermarchés - Hypermarchés - Petits commerces
Transport frigorifique	- Semi-remorques - Utilitaires - Part des conteneurs réfrigérés au niveau mondial - Part des navires réfrigérés
Climatisation à air	- Climatiseurs portables - Splits - windows - Multi-splits - Installations centralisées - VRV - Roof top - Autres équipements de climatisation
Pompes à chaleurs réversibles	- Air/eau - Eau/eau - Sol/sol - Sol/eau - Chauffe eaux thermodynamiques
Groupes refroidisseurs à eau	- A compresseur centrifuge - De forte puissance (> 350 kW) - De moyenne puissance (50 à 350 kW) - De faible puissance (< 50 kW)
Froid industriel	- Agroalimentaire - Procédés chimiques - Procédés pharmaceutiques - Production caoutchouc - Patinoires
Climatisation automobile	- Véhicules particuliers et utilitaires légers - Véhicules industriels - Cars et bus - Trains

Il est très important de noter que ces fluides sont également utilisés dans différents types de Pompes à Chaleur ; technologies de la Pompe à Chaleur qui a été identifiée comme essentielle pour atteindre les objectifs européens en matière de climat et d'énergie.

La banque de fluides frigorigènes en opération en France en 2021 représente 59 000 tonnes dont **88% sont des fluides fluorés** de type HFC,HFO. Voir ci-dessous (source CITEPA)



Evolution de la banque totale de fluides frigorigènes en France métropole

Nous continuons à innover et à accélérer la réduction du PRG des fluides frigorigènes de type HFC ou HFO, ainsi qu'aux gaz non fluorés tels que les hydrocarbures ou le CO2 ; lorsque cela est approprié et sécuritaire. Une solution techniquement réalisable ne signifie pas qu'elle est possible, autorisée ou énergétiquement la meilleure.

Les gaz fluorés sont déjà fortement réglementés et les exigences des différentes législations ont permis d'améliorer considérablement l'efficacité énergétique des systèmes, leur impact sur le climat et sur l'environnement. La diminution constante des émissions de gaz fluorés permet de souligner le bon fonctionnement des dispositions du règlement 517/2014/UE sur les gaz fluorés et sa révision en cours.

La prise en compte de l'étape de fin de vie est également essentielle pour engager définitivement une société d'économie circulaire où les fluides frigorigènes sont récupérés et réutilisés.

Nous recommandons par conséquent d'exclure de cette proposition de restriction les gaz fluorés de type HFC, HFO pour les applications de réfrigération, de conditionnement d'air et de pompe à chaleur.

AFCE soutient fortement et recommande une dérogation illimitée dans le temps avec une clause de révision après 10 ans pour évaluer à nouveau les impacts et la disponibilité industrielle de toute nouvelle alternative.

L'AFCE a collaboré avec l'EPPE (*https://epeeglobal.org/*), notre partenaire qui représente au niveau européen l'ensemble de la chaîne de valeur de la réfrigération, de conditionnement d'air et de pompe à chaleur, à l'élaboration d'une soumission détaillée concernant la restriction des PFAS.

Cette soumission que nous soutenons est jointe.

Depuis 1995, L'AFCE, Alliance Froid Climatisation Environnement est le groupement d'industriels, de membres collectifs et d'utilisateurs, représentant, du producteur à l'utilisateur final, la filière Française de la Réfrigération, du Conditionnement d'Air et la Pompe à Chaleur. Ensemble nous encourageons et soutenons une application volontariste, responsable, coordonnée et cohérente du règlement sur les Gaz Fluorés, le Green Deal Européen et la Convention Cadre sur les Changements Climatiques.

Les membres qui constituent l'association sont des spécialistes, tous issus de la filière du froid et du conditionnement d'air pour une représentativité la plus exhaustive possible. Ils travaillent ensemble, mettant en commun leurs compétences techniques et

September 2023

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

Part I – Fluorinated gases/refrigerants

Executive summary

The fluorinated gases are gases that can be used as refrigerants in the Refrigeration, Air-Conditioning and Heat Pump (RACHP) equipment. Some of them are included, per se, *in the scope of the universal PFAS Restriction Proposal submitted by the Dossier Submitters. They enable a wide variety of RACHP applications in different circumstances and environments. Such a restriction proposal as it is proposed would have a detrimental effect on those crucial applications.*

EPEE, as the European association representing the whole value chain of the RACHP sector with a coverage in 22 countries in the EU and more than 100 factories and R&D centres highlights the fundamental services that the society can benefit. These societal benefits are very diverse, from enabling the decarbonization of heating to ensuring the food cold chain and safe medicines.

Fluorinated gases (F-gases) are already heavily regulated and the requirements from the different legislations enabled to improve a lot the energy efficiency of those systems, their impact on the climate and on the environment. The constant decreasing emissions of F-gases reported in this document enable to underline the well-functioning provisions of the F-gas regulation and its ongoing revision.

*The issues related to TFA are also showing with data and reference to the recent EEAP report that the impact of TFA is limited since it is "*currently judged not to pose a risk to human health or to the environment*".*

Taking into account the end-of-life stage is also key to definitely engage a Circular Economy society where refrigerants can be recovered, reclaimed and reused.

As such, we recommend to exempt F-gases for RACHP applications from this restriction; this is why EPEE strongly ***supports and recommends a time-unlimited derogation with a review clause after 10 years to assess again the impacts and the availability of any new alternative****.*

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) [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.

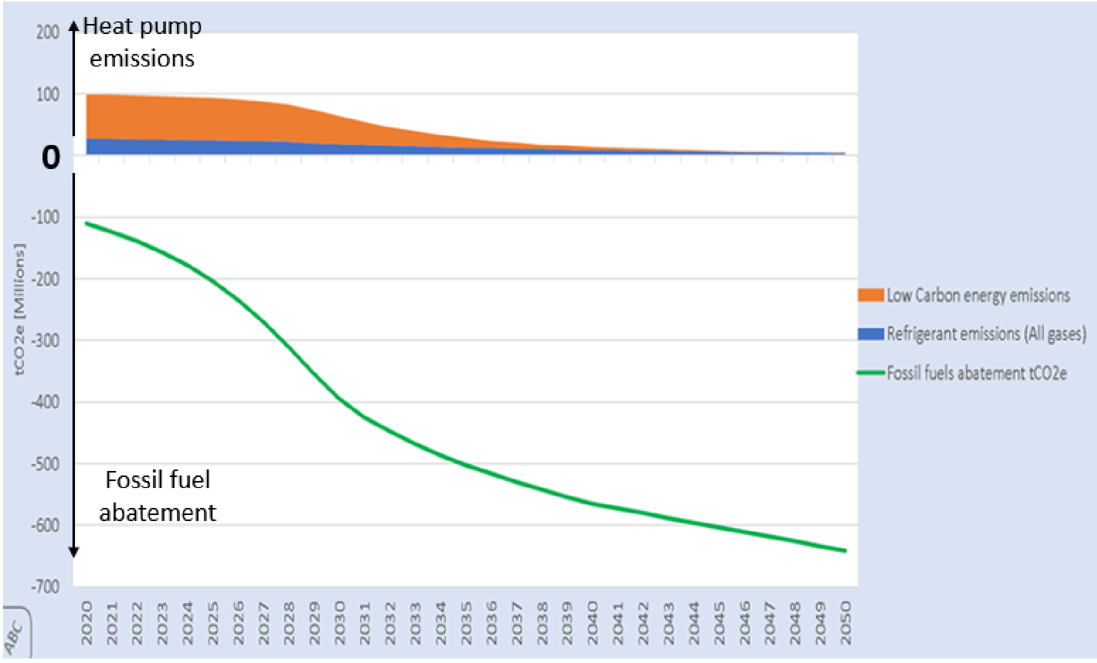


Figure 2 - Avoided GHG Emissions through use of Heat Pumps, HFC Outlook EU model[7]

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.

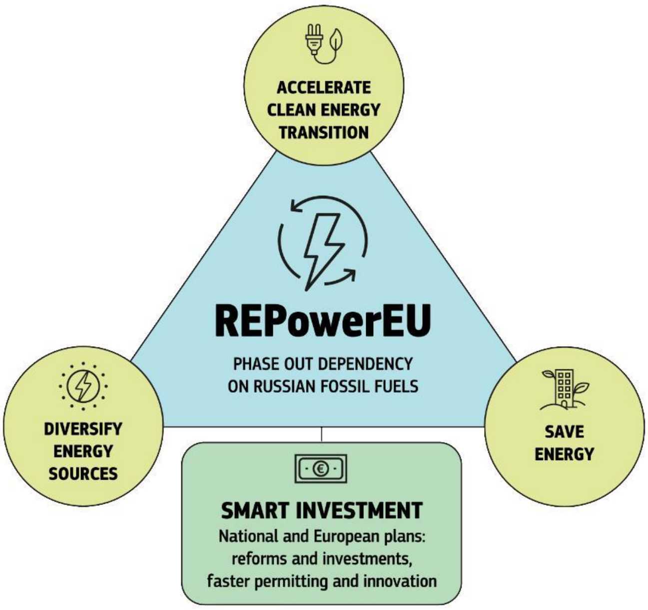


Figure 3 - Principles of the REPowerEU Communication

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%.

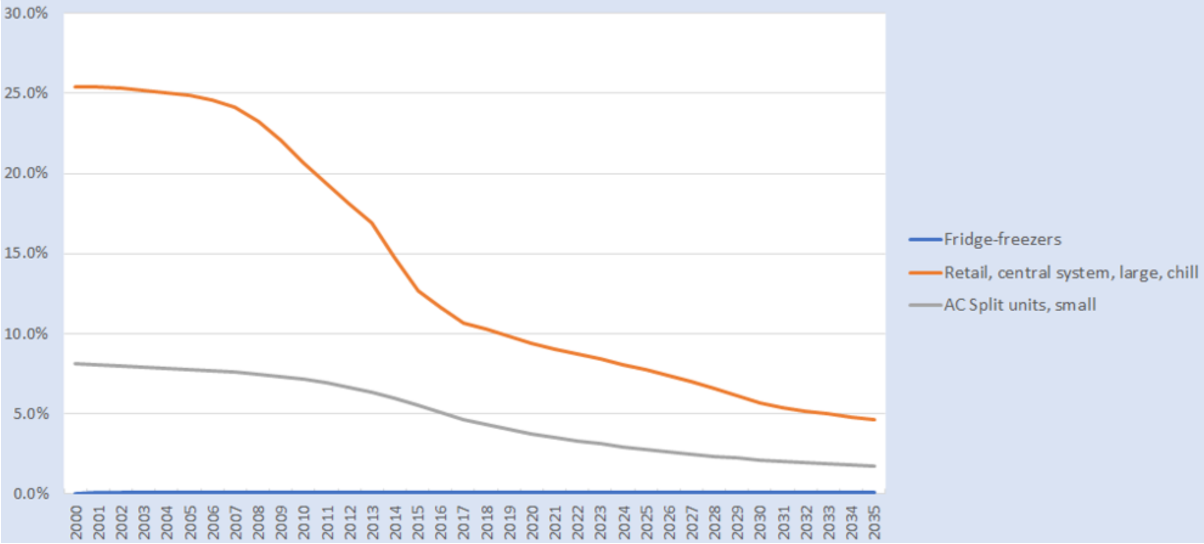


Figure 4 - Modelling projections for operational leakage rates for 3 types of RACHP equipment until 2035

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.

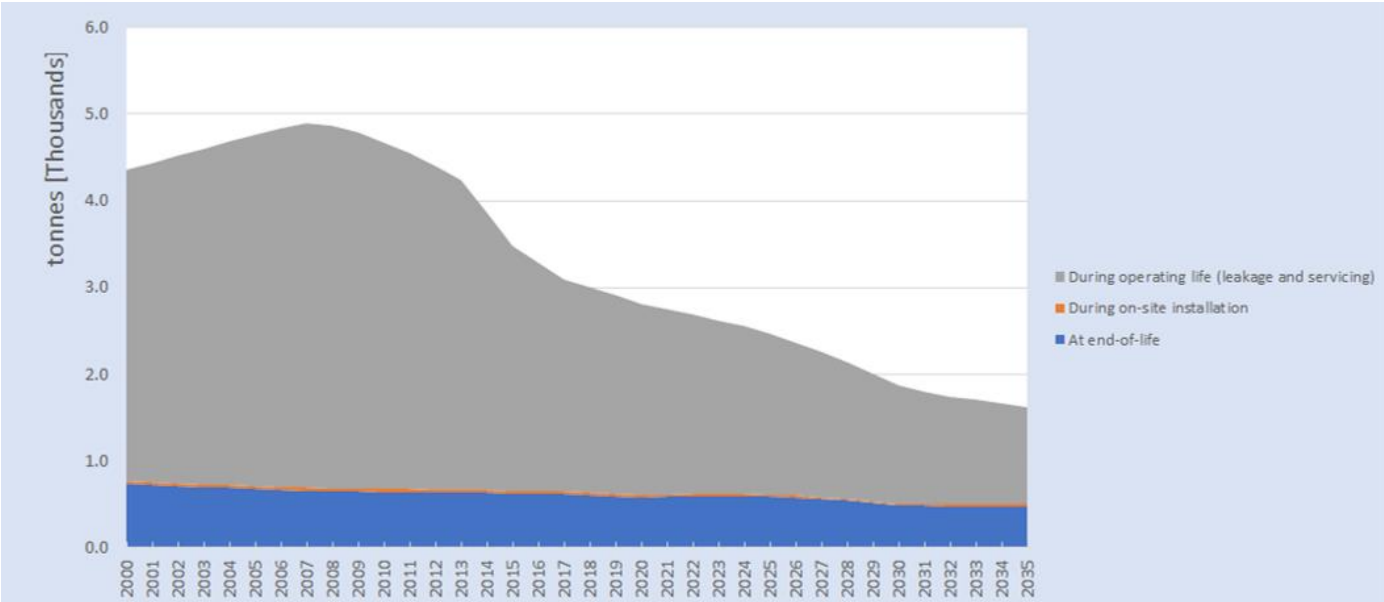


Figure 5 - Source of emissions of F-gases, large commercial refrigeration systems from year 2000 to 2035 in metric tonnes

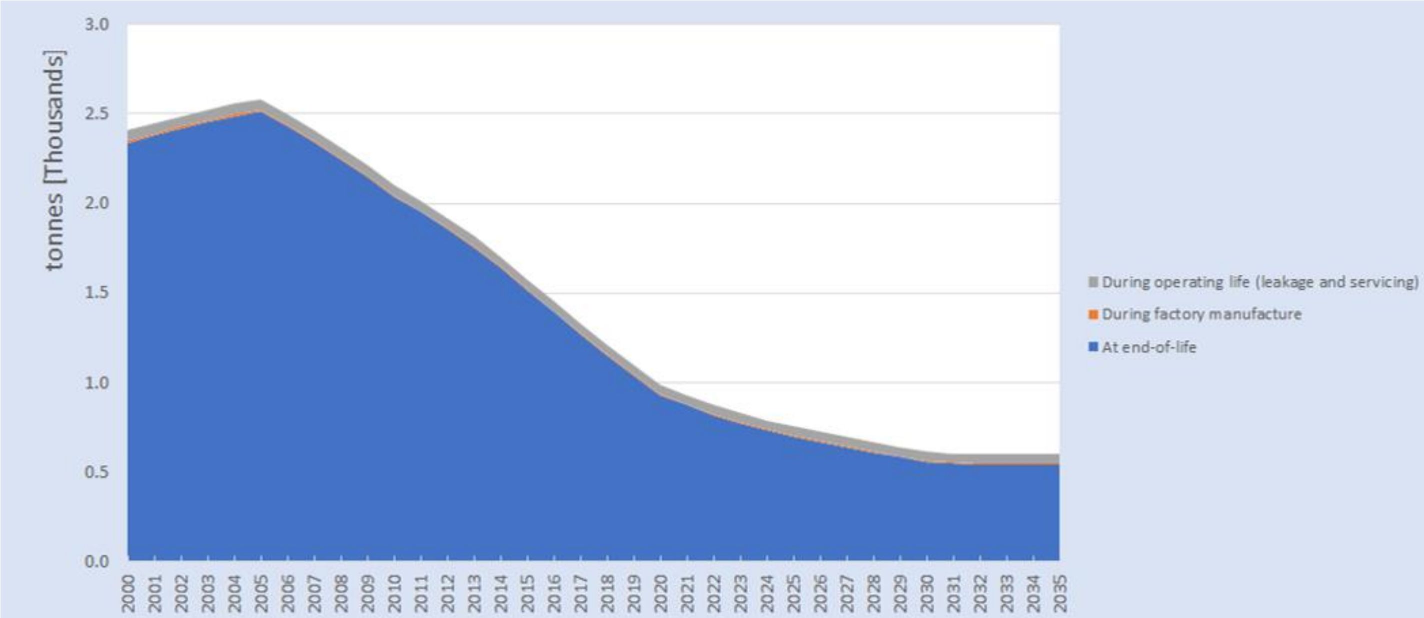


Figure 6 - Source of emissions of F-gases, small factory sealed refrigeration systems from year 2000 to 2035 in metric tonnes

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.**

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[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.