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Talking Points regarding TFA & PFAS

Talking Points

- It is important to note that TFA, trifluoroacetic acid, is a natural occurring substance. Man-made TFA can come from multiple sources such as, pharmaceutical and agriculture industries and F-gas atmospheric decomposition.

- Only some F-Gases degrade into TFA and only if released into the atmosphere, which is not their intended use. National and international regulations (such as EU 517/ 2014 on F-Gases, German Circular Economy Act KrWG, WEEE and the USA EPA Clean Air Act) are in place to prevent emissions, and we support further regulations to promote leak reduction and proper end of life disposal for F-Gases and all other refrigerants.

- The UNEP Environmental Effects Assessment Panel has stated "There is still no indication that exposure to current and projected concentrations of salts of TFA in surface waters present a risk to the health of humans and the environment."

- A new peer-reviewed study published in Atmospheric Chemistry and Physics affirms that TFA from HFO-1234yf refrigerants has a negligible effect on human and ecosystem health. This is consistent with findings of previous studies and addresses that even in scenarios envisioning the largest emissions of HFO-1234yf through 2040, TFA rainwater concentrations remain orders of magnitude below the no observable effect concentrations (NOECs) in ecological and mammalian toxicology studies.

- HFOs are critical to enabling our industry to achieve necessary and ambitious climate and sustainability goals. Industry associations have recently highlighted that not all applications can transition to CO2, hydrocarbons and ammonia.

- Our Opteon™ portfolio of high-performance products with low GWP solutions are essential to creating a better future and meeting the needs of today and tomorrow in a sustainable way. Our research has shown that Opteon™ solutions provide the greatest balance of performance and cost versus other technologies for the markets we serve. Third-party studies show that Opteon™ solutions can provide the lowest 10-year total emissions compared to other technologies by reducing both direct and indirect emissions due to their low GWP and ability to enable substantial system energy efficiency gains.

Q&A

- **What is TFA?**

  TFA is an abbreviation for trifluoroacetic acid. TFA is a naturally occurring substance that is found in seawater and soil. More than 95% of TFA found in oceans today is from natural sources. Man-made sources of TFA include manufacturing where it is used as an intermediate in many chemical processes, including pharmaceutical production, agriculture, specifically from the breakdown of certain fertilizers and herbicides, as well as sewage treatment where it is formed during the breakdown and ozonation of some effluents.

- **What is the relationship between F-gases and TFA?**

  Degradation of some F-gases can produce TFA as an inert and non-bioaccumulative by-product.

- **What are PFAS?**

  PFAS are a diverse group of chemicals that contain carbon-fluorine bonds, which are the strongest chemical bonds in organic chemistry. Due to their unique and useful properties, particular PFAS are widely used and critical to many product applications that are necessary to the functioning of modern society.

  "PFAS" means non-polymeric perfluoroalkyl and polyfluoroalkyl substances that are a group of man-made chemicals that contain at least 2 fully fluorinated carbon atoms, excluding gases and volatile liquids. "PFAS" includes PFOA and PFOS.

- **Is TFA within the scope of the proposed EU PFAS Restriction under REACH?**

  Yes. TFA (trifluoroacetic acid) falls within the current scope of the proposed PFAS restriction under REACH because F-gases are within scope, and degradation of some F-gases can produce TFA (trifluoroacetic acid) as an inert and non-bioaccumulative by-product.

- **Are R-134a and R-1234yf within the scope of the proposed US EPA's PFAS Strategic Road Map?**

  The National PFAS Testing Strategy does not include R-134a and R-1234yf within the scope of its PFAS definition. This testing strategy will be used for EPA's TSCA program and was developed as part of EPA's PFAS Strategic Roadmap.

  As part of the definition scope, EPA mentions a degradation product, TFA, as part of their science-based approach in to the National PFAS Testing Strategy. EPA clarifies that trifluoroacteic acid "is a well-studied, non PFAS." This statement supports our understanding of this substance.

- **Is TFA dangerous?**

  Numerous independent studies conducted over the past two decades have concluded that TFA from manmade sources does not pose a risk to the environment or human health (UNEP, 2021)[1].

- **Is there a relationship between TFA and acid rain?**

  Acid rain consists of NOx and SOx molecules in the atmosphere deposited as nitric acid and sulfuric acid in rainwater. TFA is a much weaker acid at much lower concentrations and is not expected to have any significant contribution to acid rain.

- **Can TFA end up in our rivers and surface waters and ultimately our drinking water? Is TFA in drinking water dangerous?**

  A large body of published field measurements, toxicological studies, modelling studies and environmental assessments point to the clear conclusion that the current and estimated future

concentrations of TFA and its salts resulting from degradation of HFCs and HFOs do not pose any known significant risk to human or ecosystem health (Solomon et al., 2016)[2].

Substances that degrade to TFA in the atmosphere result in widely dispersed very low concentrations of TFA in river and surface waters. Based on a study on *Future emissions and atmospheric fate of HFC-1234yf from mobile air conditioners in Europe*[3] , the projected growth in use of HFO-1234yf and the resulting emissions of TFA is expected to have only a small contribution to the quantities of TFA found in rivers, due to the expected average values of 0.6 – 0.8 µg/L of TFA in European rainwater (Henne et al., 2012). This is well within national health limits in drinking water for several EU member states, including <10 µg/L for Germany and Denmark. It is estimated that the annual emissions to European surface waters are of the order of 0.01% relative to the total 200 million tons of TFA found naturally in the oceans.

- **How does the chemical industry respond to TFA emission projections by the UBA?**

Only some F-Gases degrade into TFA and only if released into the atmosphere, which is not their intended use. National and international regulations (such as EU 517/ 2014 on F-Gases, German Circular Economy Act KrWG, WEEE, and the USA EPA Clean Air Act) are in place to prevent emissions and we support further regulations to promote leak reduction and end of life disposal for F-Gases and all other refrigerants.

In addition, other industry publications do not support the UBA claim that TFA concentrations have risen sharply since the 1990s. In 1999, *Jordan et al* reported that TFA in rainwater measurements for Germany in 1995 were typically < 250 ng/L (ppb). The median TFA rainwater value reported by *Freeling et al* for Germany in 2020 for 2018 was 200 ng/L. This would indicate that there has not been a significant change in TFA levels in rainwater between 1995 and 2018.