

## Controversial refrigerant

*Air conditioning systems in new cars are increasingly filled with the refrigerant HFO-1234yf. The substance is considered environmental friendly because it has only a very small global warming potential. Yet it has been said repeatedly that this substance "could pose a risk to rescue staff when it comes to accidents". Is that true?*

To date, car air conditioning systems are filled with the refrigerant R1234a. This substance is generally seen as a true climate killer. Its relative global warming potential (GWP) – a measure that indicates whether a substance that contains components with global warming potential is considered environmental friendly – is over 1,300. In 1997, the signatories to the Kyoto protocol committed to reducing the emission of greenhouse gases. Under an EU directive, air conditioning systems of new car types must be filled with more environmental friendly refrigerants after 1 January 2011. After 1 January 2017, this applies to all new cars. Substances are considered environmentally friendly if their GWP is below 150. HFO-1234yf has a GWP of 4. HFO-1234yf is an organic fluoride compound (2,3,3,3 tetrafluorpropene) and has been developed by the companies Honeywell and Dupont especially as a refrigerant for passenger cars. The chemical substance is also called HFO-1234yf or R-1234yf.

"HFO-1234yf is a near drop-in solution", says Tim G. A. Vink, Director Regulatory Affairs at Honeywell. "As a result, it requires no meaningful changes to the air conditioning system." It also comes with the same operating pressure which makes it highly attractive to the automotive industry, of course. No surprise, then, that almost all manufacturers across the world want to switch to HFO-1234yf – or have already done so. By the way, we are talking about some 500g of the refrigerant per passenger car.

### The Firefighter Association commissioned tests of the new refrigerant

Over the past months, speculation was rife in the Internet suggesting that the new substance would be a serious threat to rescuers on the site of a car accident, that there was an increased risk of fires and the related release of dangerous concentrations of hydrofluoric acid. In AutoBild, Prof Andreas Kornath from the University of Munich explained that even if a part of the body no larger than a palm was exposed to hydrofluoric acid (which can be released in car fires) the person could die.

The German Firefighter's Association wanted to fully understand the issue. It urged the Associations of the Automotive Industry to run special test series. The main results are as follows:

- Like all flammable gases HFO-1234yf is classified as highly flammable. But it will only ignite at a very high temperature (approximately 25,000 times higher than gasoline). After reviewing the data on the substance, the TÜV Süd therefore concluded that the gas is in practice of low flammability.
- Low flame speed when HFO-1234yf is burned (30 times smaller than that of gasoline). As a result, there is no explosion in the sense of a gas flashover.
- The gas hydrogen fluoride can escape in burning cars or by thermal decomposition on hot surfaces. In extreme cases, it can react with water to become hydrofluoric acid. "However, the same is also true for R1234a which has been in use for the past 30 years. There has never been an incident, though, in which hydrofluoric acid actually developed", Director Vink says.

The tests performed by the car manufacturers support these findings. Fiat for instance performed crash tests in which a Fiat 500 was driven against an obstacle at 65 km/h. Neither did the car erupt in flames nor were toxic substances set free. Peugeot came up with the same results in crash tests with its 308 model. They are even more telling because the engine had been kept running for a very long time and was therefore extremely hot.

Conclusion: "We looked very carefully into the dangers of the new refrigerant together with experts from the firefighters", says Rudolf Römer, vice president of the German Firefighter's Association. "We are convinced that the substance poses no additional risks if rescue staff is equipped with the

appropriate gear including self-contained respiratory protective devices and personal protective gear and if the rescue staff abides by the applicable incident regulations and the rules for the prevention of accidents.

Caption:

Going forward, the air conditioning systems of passenger cars will be increasingly filled with the refrigerant HFO-1234yf. Substances can leak after car accidents. For firefighters wearing the complete protection gear, however, there is no increased risk from the new substance even if the car is on fire.