

## Press Release No. 6/2010

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# Federal Environment Agency: Possible safety risks in mobile air conditioning systems?

## New tests with refrigerant HFC-1234yf confirm hazards associated with use

**The Federal Environment Agency (UBA) has spoken in favour of use of the natural refrigerant R744 and against the use of the perfluorinated hydrocarbon HFC-1234yf (tetrafluoropropene) as a refrigerant in mobile air conditioners. German manufacturers in particular have up to now shown preference for the natural refrigerant R744 (CO<sub>2</sub>), yet a clear and final decision taken by the automotive industry is still outstanding. Based on latest findings, UBA President Jochen Flasbarth has pleaded in favour of urging the German automobile industry to quickly establish the environmentally friendly CO<sub>2</sub> as the refrigerant of choice in mobile air conditioners. "It has never paid to hesitate as concerns environmental innovations in automotive engineering or not to take EU regulations seriously. Mobile air conditioners equipped with CO<sub>2</sub> as a natural refrigerant are ready to go into production. In contrast, studies prove that the use of the synthetic refrigerant HFC-1234yf in mobile air conditioning systems is associated with risks that have not yet been adequately assessed." If HFC-1234yf is ignited, for example in an engine fire, highly toxic and corrosive hydrogen fluoride (fluoric acid) is produced, which is associated with considerable additional risk.**

The EU already decided in 2006 to disallow refrigerants with global warming potential (GWP) of more than 150 (150 times that of CO<sub>2</sub>) to be filled in new automobile types and small commercial vehicles. UBA has long issued the recommendation to use CO<sub>2</sub>. CO<sub>2</sub> is non-toxic, inflammable and available at low cost everywhere. Since last year, an official vehicle with CO<sub>2</sub> air conditioning has been in reliable and daily use with the Agency fleet.

At the IAA Cars exhibition in September 2007, the German Association of the Automotive Industry (VDA) announced that German automobile manufacturers would be "the first worldwide to use the environmentally friendly refrigerant R744 (CO<sub>2</sub>)."

In October 2008, the VDA announced that HFC-1234yf, based on its own evaluations, was "not an option . . . for the majority of companies." However, cars fitted with air conditioning using CO<sub>2</sub> as refrigerant are still not in serial production, and evidence is gathering that this will not occur any time soon. Jochen Flasbarth commented, "The German automobile industry has invested heavily in the development of CO<sub>2</sub> engineering for many years. It would be fatal to squander the chance to be the global market leader in innovative CO<sub>2</sub> climate technology to the benefit of an unsafe

temporary solution with the synthetic refrigerant HFC-1234yf. The impetus for a global switch to natural refrigerants in the automotive industry ought to come from Germany."

HFC-1234yf is flammable and contains fluoride. In case of fire and upon contact with hot surfaces, highly corrosive and toxic fluoric acid is produced. Fluoric acid vapours pose an additional risk to vehicle passengers and firemen in accidents and through handling HFC-1234yf.

The combustibility and high fluoride content of HFC-1234yf were cause for the Federal Environment Agency to commission tests on HFC-1234yf, which were initially carried out to investigate the production of combustible (explosive) mixtures at room temperature. What is also relevant for its technical use as refrigerant is its explosiveness when other gaseous hydrocarbons are in the air. Possible sources of gaseous hydrocarbons are the refrigerant oil itself, petrol, engine oils or detergents—in brief, substances that are commonly present in automobiles.

In concentrations of 6.2 percent and higher HFC-1234yf forms mixtures that are potentially explosive upon contact with air alone. If low volumes of hydrocarbons are also present in the air (BAM - the Federal Institute for Materials Research and Testing used ethane for its tests), the HFC-1234yf mixture is already explosive in far lower concentrations. Very small volumes of HFC-1234yf (two percent and up) with hydrocarbon concentrations of a mere 0.5 - 1.3 percent are sufficient to produce explosive mixtures in the air.

Other BAM tests focused on the degradation and combustibility of HFC-1234yf. First findings already reveal that safety issues associated with the use of HFC-1234yf as a refrigerant in mobile air conditioning systems have not been resolved.

Testing results from BAM are available here:

[http://www.umweltbundesamt.de/produkte/dokumente/test\\_report\\_hfo1234yf.pdf](http://www.umweltbundesamt.de/produkte/dokumente/test_report_hfo1234yf.pdf).

For more information on mobile air conditioning systems see

<http://www.umweltbundesamt.de/produkte-e/fckw/touran.htm>.

Dessau-Roßlau, 12 February 2010