

Choosing the right refrigerant for the environment in line with EU MAC Directive requirements

Dear Mr. Watanabe,

Public authorities worldwide are looking at ways to establish regulations to minimize emissions of greenhouse gases from the different sectors and applications that are key contributors to global warming. Refrigerants from Mobile Air Conditioning (MAC) are one of these key contributors.

Today, MACs as well as other cooling and air conditioning equipment globally contribute approximately 3% of the total manmade CO₂ equivalent greenhouse gas emissions. It is very likely that this share will proportionately increase over the next decades.

As a result, the European Union, under its 2007 MAC Directive, has moved to ban refrigerants with global warming potential (GWP) over 150, like the HFC-134a (see background attached), from new vehicles from 2011 onwards, and from use in all vehicles by 2017. The objective: to cut direct emissions from MAC systems.

Greenpeace is aware that your company is considering the chemical HFO-1234yf (Tetrafluorpropene – see background attached) as a potential replacement of HFC-134a in MACs.

Our concern is that HFO-1234yf is not yet a proven entity and, despite the fact that it may not be commercialized for at least three years, it is nevertheless promoted by the chemical industry as the alternative to HFC-134a, which the car industry should wait for – and switch to.

This is effectively blocking the uptake of currently available, safe, environmentally friendly, efficient and low-GWP, non-fluorocarbon alternatives such as CO₂ mobile air-conditioning systems, or the commercialization of hydrocarbon MAC systems.

The German Association for the automaker industry, the VDA, whose members include BMW, Daimler, Volkswagen, Audi and Ford Germany, has already agreed that it will not only take up this CO₂ technology, but it will be doing so ahead of the 2011 deadline set by the EU legislation.

The European Union is currently preparing further legislation to reduce the indirect emissions caused from MACs. This will establish minimum fuel efficiency requirements. Greenpeace has been, and will continue to, support governments around the globe in putting this, and similar legislation, in place.

Greenpeace is urging the EU to put in place car efficiency standards of 120gm/km – a standard which is both possible and necessary for the climate.

Greenpeace urges you, as a responsible vehicle manufacturer wishing to contribute to global solutions to stop climate change, to act now to eliminate the use of HFC-134a by immediately deciding to replace HFC-134a with the most suitable, low GWP and non-fluorinated alternative

presently available. To this end, Greenpeace supports the VDA position to phase-out f- gases as a refrigerant and supports VDA's decision to switch to carbon dioxide technology.

R744 is a safe refrigerant. It prevents current refrigerants which are environmentally unfriendly from being re-introduced to MACs later. R744 is more efficient in over 95% of the driving conditions worldwide.

Part of your vehicles over years, CFCs, and HFCs in MACs have proved devastating for the ozone layer and the world's climate. You have now a historic opportunity to:

- Avoid past mistakes and invest in environmentally benign refrigerants – refrigerants that are available right now.
- Set an example for other industries to follow.
- Consider that adoption of HFO1234yf would effectively consign developing countries to stay with R134a, therefore prolonging MAC contributions to climate change.

The reduction of at least 3% of the world's Greenhouse Gas Emission is at stake.

Given the importance of this issue to Greenpeace, we will send a representative to the SAE MAC Symposium and MAC Summit, next week in Phoenix, Arizona.

Yours sincerely,



Dr Gerd Leipold
Executive Director, Greenpeace International

Background attached.

Background: HFC134a

HFC-134a currently dominates the HFC market, accounting for almost two-thirds of all HFCs in use. HFC-134a has (according to findings by the IPCC in 2005) a GWP of 1410 times that of carbon dioxide. Under a business as usual scenario HFC-134a emissions by 2070 could be as high as 1.5 billion tonnes of CO₂ equivalent, which would equal the annual emissions of about 280 million cars¹. Current HFC-134a production is nearly 250,000 a year. Over 50% of all HFC-134a produced is for mobile air-conditioning. The leakage rate of HFC-134a is very high, with atmospheric concentrations of this very potent greenhouse gas rising at the alarming average rate of 20% a year. According to a 2006 AFEAS (Alternative Fluorocarbons Environmental Acceptability Study)² more than half of the entire HFC-134a refrigerant ever produced has already been emitted in the atmosphere. Mobile air-conditioning is a major source of HFC- 134a leakage.

Specific concerns regarding HFO-1234yf include:

1) Unknown effects: The impact of HFO-1234yf is insufficiently known. The influence of the decomposition product Trifluoroacetic acid, CF₃C(O)OH or TFA (a herbicide), on biodiversity is not understood. As a result, the long-term consequences for the environment are uncertain. Furthermore, it is not clear whether the substance has toxicity effects. The fact that certain refrigerants were creating the Ozone Hole, and later contributing to Global Warming, was discovered only years after these refrigerants were on the market.

2) Poor efficiency: Extensive tests carried out by JAMA³, as well as by GM⁴, across entire vehicle fleets, proved that the substance has lower efficiency than R-134a and therefore leads to higher indirect CO₂ emissions. Yet, tests by Visteon⁵, one the world's leading suppliers, presented at VDA's "Winter Meeting" in Saalfelden last year, already demonstrated that CO₂ outperforms current 134a systems and reduces fuel consumption by between 0,3L and 0,5L, depending on ambient temperature, and reduces tailpipe emissions of 7 Grams/ km.

Thus, implementing HFO-1234yf in new cars would decrease the efficiency of MAC systems by about 5-7% compared to today's standards. This will increase a vehicle's overall fuel consumption by around 7%. As a result, greenhouse gas emissions will increase instead of decreasing. It should be undisputable to introduce a new system which is a retrograde step in efficiency and in emissions. We should remind you that for the past 5 years promoters of HFC- refrigerants continuously have been saying that energy efficiency is more important than direct emissions (i.e. leaks) to protect the environment. We now ask you to take your own arguments seriously and accept the system with better energy- efficiency: CO₂.

3) Retrograde step: It is claimed that HFO-1234yf facilitates the industry transition to new MAC systems. In reality, it will do the opposite. HFCR-134a costs approximately 5 €/ kg, whilst it is expected that HFO-1234yf will cost 50€/KG, ten times more. Consequently, after the first charge of refrigerant HFO-1234yf has been expended, consumers are highly likely to refill their MACs with R-134a as a cost saving measure. The prohibitively high cost of HFO-1234yf will prove to be an even greater impediment in developing countries where the car market is exponentially growing. HFO-1234yf supposedly has a global warming potential (GWP) of 4, whilst R-134a has a GWP of 1410. The use of HFC-134a will be unnecessarily prolonged by the introduction of HFO-1234yf into the global market, therefore undermining the ultimate goal of reducing greenhouse gas emissions.

1 AFEAS Alternative Fluorocarbons Environmental Acceptability Study, 2006

2 ibid

3 New Refrigerants Evaluation Results, JAMA- JAPIA Consortium, as presented at VDA Alternative Refrigerant Winter Meeting, Saalfelden, Feb 13th/ 14th 2008

4 Risk Assessment and Performance Evaluation of HFO-1234yf, William Hill, SAE CRP 1234, VDA Winter Meeting 2008

5 Improved Efficiency for Small Cars with R 744, Wieschollek/Heckt /Visteon, VDA Winter Meeting 2008