



THE ALLIANCE FOR CO₂ SOLUTIONS

turning the problem into the solution

Dear Editor,

As a regular reader of JARN, I appreciate your efforts to offer relevant information and updates on the HVAC&R, based on objective reporting and hard facts. I would like, however, to express my concerns as to the deviation from these principles that your magazine seems to have been taking in the latest issues.

My worries refer to the reporting in some recent articles about the new refrigerant HFC-1234yf for automotive applications. In the last issues of JARN, there has been extensive coverage about this new refrigerant, from the side of chemical producers themselves, including feature interviews with both Honeywell and DuPont, automotive manufacturers and the public sector. On the other hand, another leading alternative for mobile air conditioning, CO₂ (R744), has hardly received any coverage except for the fact of claiming its disadvantages.

I therefore would like to take the opportunity to clarify some statements contained in your latest issues over this issue which I believe could be useful to all readers:

1. Life-cycle performance

According to your Dec 08 issue, page.21: "HFO-1234yf: New Alternative Refrigerant Superior to CO₂", Barbara Minor from Dupont Fluoroproducts is quoted: "*HFC-1234yf being a much more cost-effective replacement to HFC-134a than CO₂. Most automotive manufacturers consider HFC-1234yf to be their preferred candidate. They strongly prefer it to CO₂ because it's environmentally superior. Manufacturers have talked about the life-cycle.*"

In fact, CO₂ used as a refrigerant has the lowest Global Warming potential of all alternatives to HFC134a, reducing the direct emissions of a car air conditioning to zero. Moreover, regarding efficiency, CO₂-based systems can outperform R-134a in over 95% of driving conditions worldwide. Since estimations are that HFC1234-yf will, at best, match the performance of R134a, CO₂ is therefore a superior alternative to 1234yf also when it comes to reduce indirect emissions. Leading Automotive suppliers, such as Visteon, Modine, Behr, ixetic, and several car manufacturers have done extensive research and have solid evidence on this. Latest tests presented by the German Environmental Agency in September 2008 showed how a CO₂-based system installed in medium-sized Volkswagen offers up to 14% better efficiency at outside temperatures over 35 degrees Celsius. To defend its position, DuPont refers to the life-cycle analysis offered by the Green MAC LCCP Tool, under development, which would show a better performance of 1234yf over CO₂, as it assumes a significant decrease in performance of CO₂ systems over approximately 27 degrees Celsius. This tool, however, excludes all these results mentioned above, as they are based on bench test data which is not included in the model. Only when this model is improved accordingly should it be used as a credible source for comparing different refrigerants. In the meantime, there is overwhelming evidence about the superior environmental performance, in both direct and indirect terms, of CO₂ over 1234yf.

2. Safety

In your Jan 09 issue, page.8: "Government Policy on Refrigerant Choice": Zenta Senoo, Deputy director, Ozone Layer Protection Office (Japan) is quoted: "*CO₂ has strong acute toxicity and a person loses consciousness and dies when its concentration rises 6%, which also poses a challenge. As such, unless technologies capable of clearing both the energy efficiency and toxicity hurdles of CO₂ are developed, it may be difficult to utilize CO₂ refrigerant for wide-ranging purposes.*"

Carbon dioxide is a natural substance that we all exhale when we breathe out. At high concentrations, it displaces oxygen and has an effect on humans. However, out of all alternatives under discussion for mobile air conditioning systems, it is the safest refrigerant by far. The American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) in fact classifies CO₂ as A1 in terms of safety, which is the highest possible level. Applied in vehicles, it is important to bear in mind that the small charge needed (up to 400 grams in small or medium-sized cars), makes it virtually impossible to reach critical concentrations which would cause a problem to human beings. Even if all the charge of the refrigerant were to leak into the passenger cabin, which would be the worst-case scenario, several devices are available in the market, including sensors, to ensure a safe use of CO₂ as a refrigerant.

On the other hand, 1234yf is flammable and decomposes into highly toxic substances when it burns. This is clearly mentioned in Honeywell's material safety data sheet, that classifies this refrigerant as "extremely flammable", and lists its decomposition products, such as Hydrofluoric Acid (HF). Should car manufacturers choose this refrigerant, they would need to ensure that it can be used safely, and that probably would require a re-design of the system to avoid any risk of fire. In case of an accident, using this refrigerant would imply a higher risk for passengers and rescue personnel. Furthermore, long-term toxicity results have not been published yet. There is no guarantee yet that this product will be considered safe enough to be allowed in the market, as it is still awaiting approval both in the EU, under the REACH programme, and the US, under the SNAP approval system.

3. Technical development

In your issue from April 25, on the first page, with the title "HFO-123yf, New Dawn of Refrigerant Alternatives", part of your editorial introduction to the issue reads: "Besides, technical issues regarding the use of CO₂ in mobile air conditioning remain unresolved by the industry, despite years of development. As a result, it can be assumed that CO₂ systems will require more after sales service and higher warranty costs". The same issue of JARN contains a feature interview with Mr. David Diggs, from Honeywell, in page 24. The statement shown above as JARN editorial content is given, word by word, by Mr. Diggs in his interview published on page 24.

Nonetheless, answers to many of these technical questions can be provided by the German supplier Behr, which published results in August 2008 of extensive tests with a 100+ vehicle fleet equipped with CO₂ as a refrigerant.

I refer to the conclusions by Behr: "The successful fleet test and our product experience point to a smooth transition from R134a to R744. The new systems outperform today's R134a systems in terms of environmental friendliness, cooling performance and energy efficiency. Regarding operational safety, acoustics, packaging, vehicle integration, and durability they are at least at the same levels as today's systems. A smooth servicing of R744 refrigerant circuits is ensured."

I remain available for any further question about this important issue, with the hope to read a more balanced and objective reporting by JARN on it in the future, taking into account the points raised above.

Yours sincerely,

Olivia Amos
On behalf of the Alliance for CO₂ Solutions