THE OFFICIAL JOURNAL OF AIRAH

AUGUST 2015 · VOLUME 14.7

Ecolibrium

Sun (master)stroke

Solar trigeneration in action.

AIRAH

PRINT POST APPROVAL NUMBER PP352532/00001

Barbara Minor was happy to answer questions at a Q&A panel session during AIRAH's recent Refrigeration 2015 Conference. Joining her on the panel were Kevin Lee, M.AIRAH, on the left of the picture, and Matthew Dadswell from the Department of the Environment on the right.

Q&A Barbara Minor

Employed by the US-based Chemours Company, leading engineer Barbara Minor has a wealth of knowledge when it comes to refrigerants. Recently making the trip down to Oz, she chatted with Ecolibrium about her keynote address at Refrigeration 2015, as well as the introduction of HFOs to Australia.

Ecolibrium: What did you speak about in your recent keynote address at Refrigeration 2015?

Barbara Minor: I spoke about several low-GWP refrigerants we have developed at the Chemours Company to address the phase-down of HFC refrigerants in some regions due to concerns about climate change.

We recently commercialised three new nonflammable refrigerants in Europe based on HFO-1234yf technology. OpteonTM XP40 (R-449A) is an alternative to R-404A and R-507A, with about 65 per cent lower GWP and up to 10 per cent improved efficiency in commercial refrigeration systems.

OpteonTM XP44 (R-452A) has slightly higher GWP than R-449A, but was designed to match the compressor discharge temperature of R-404A; it is particularly suitable for transport-refrigeration applications and for stationary refrigeration systems in high-ambient environments.

> "HFOs are unique refrigerants. While they are unstable in the atmosphere, they are very low GWPs, making them very stable in an operating system"

OpteonTM XP10 (R-513A) is a nonflammable alternative to R-134a, with 56 per cent lower GWP and azeotropic behaviour. It can be utilised in self-contained systems and hybrid cascade supermarket systems using CO_2 in low-temperature applications and R-134a in medium-temperature refrigeration circuit. It is also useful in air conditioning chillers to replace R-134a in new equipment or field retrofit.

We are also developing options to replace R-410A and R-22 in residential and commercial air unitary air conditioning. These include Opteon XL41 (R-454B), which is a mildly flammable R-410A replacement with a 78 per cent lower GWP than R-410A; as well as a new developmental R-410A replacement called DR-55, which has higher GWP than XL41 but optimised performance and flammability properties.

Barbara Minor says the unique properties of HFOs make them the most cost-effective options to replace HFCs.

To replace R-22, particularly in high-ambient environments, Opteon XP20, also known as DR-93, is being developed as a non-flammable option, which can be used in small and large systems.

> Their unique properties make them the most cost-effective option to replace the HFCs

Eco: What are the two or three takeaway message you'd like those in attendance to remember from your keynote?

BM: As the title of my presentation indicated "HFOs Refrigerants in Stationary: From Concept to Reality", HFO refrigerants are here and are viable options to significantly reduce the environmental impact of refrigerants.

Our refrigerants are based on HFO-1234yf, which we have already commercialised for automotive air conditioning. HFO-1234yf has an extremely low GWP at <1 (IPCC Fifth Assessment Report) and has excellent cooling performance.

When HFO-1234yf is used in blends with HFC refrigerants, GWP can be dramatically reduced, with equivalent – and sometimes improved – system performance.

We have also completed HFO-1234yf new chemical registration in Australia, which removes any restrictions on import in pure form or in blends.

Eco: In supermarket application the biggest competitor to HFO technology is R744. How will new equipment installed on HFOs compare to R744, based on capital cost and energy efficiency?

BM: It is difficult to generalise because the answer to this question depends on many factors, including the specific equipment design, the operating conditions, the ambient environment, and others.

We believe that both HFOs and R-744 will co-exist in the marketplace because there are design and condition scenarios where each will offer the best combination of capital cost and efficiency.

Based on our experience in Europe and elsewhere, we have seen reports that the hybrid system of R-744 low-temp and HFO medium-temp yield the optimal results for cost and efficiency. We are seeing the widespread adoption of this technology.

Eco: In Australia high compressor-discharge temperatures can be an issue in low-temperature refrigeration due to our high ambient conditions. Can you advise what HFO solutions will be suitable for us?

BM: Both Opteon(r) XP40 (R-449A) and XP44 (R-452A) are excellent options to replace R404A in low temperature refrigeration. For high ambient conditions where discharge temperatures are a concern, XP44 would probably be the better choice – it has slightly higher GWP than XP40, but it offers the lowest discharge temperature.

Eco: Some sectors of the Australian market have raised concern about the natural breakdown products of HFO refrigerants (i.e. trifluoroacetic acid) and are predicting a future phase-out of HFOs. Can you end this speculation and confirm if there is actually any concern based on the extensive research carried out by DuPont?

BM: Like R134a, HFO-1234yf does break down into trifluoroacetic acid (TFA), which is a naturally occurring chemical. TFA has been extensively studied and the information reviewed by the

> All things considered, HFO solutions are the best and most cost-effective choice

Assessment Panels under the Montreal Protocol. The latest report from the Environmental Effects Assessment Panel *(Environmental Effects of Ozone Depletion and its Interaction with Climate Change: 2014 Assessment*) includes the following statement on TFA.

"Hydrochlorofluorocarbons and hydrofluorocarbons (HCFCs and HFCs): As has been discussed previously, several of the hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting CFCs and a new fluorinated olefin (HFO) can break down into trifluoroacetic acid (TFA).

TFA is stable in the environment but is water soluble and accumulates in playas, land-locked lakes, and the oceans where it combines with cations such as sodium, potassium, calcium, and magnesium (Na+, K+, Ca++, and Mg++).

More than 95 per cent of the salts of TFA found in the oceans are naturally produced. These salts are inert and not of toxicological orenvironmental concern in the small concentrations (≈ 200 ng L-1) that are present in the oceans.

No new papers on the relevance of TFA to human health and the environment have been published in the literature since the date of the previous assessment (2010). Thus, projected future increased loadings of TFA to playas, land-locked lakes, and the oceans due to continued use of HCFCs, HFCs, and replacement products are still judged to present negligible risks for aquatic organisms and humans." ▮

Need to know

Barbara H. Minor was the keynote speaker at AIRAH's Refrigeration 2015 Conference, held earlier this year in Sydney.

The latest report from the Environmental Effects Assessment Panel (Environmental Effects of Ozone Depletion and its Interaction with Climate Change: 2014 Assessment is available online.

Go to http://ozone.unep.org/Assessment_Panels/EEAP/eeap_report_2014.pdf)