CIBSE ASHRAE Group

Refrigerant Choices – Webinar
Presented by Andy Pearson
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These answers are an abbreviated response to the questions posed during the webinar. They should not be used as professional opinion or cited but should provide the starting point for the reader to research their own answers.

At what pressure is a refrigerant considered high or low pressure (for instance steam over 15psi may be high pressure) is there a threshold for refrigerants?
ANDY'S ANSWER: it used to be that R-22 was considered high pressure compared to R-12 (medium pressure) and R-11 (low pressure). Typical design pressure would be 17 bar for evap condensers and 21 bar for air-cooled. Then R-404A pushed design up to 25 bar, followed by R-410A and R-32 at about 35 bar, so 17 bar to my mind is now medium pressure. Of course anything over 0.5 bar is high enough to be considered by PED.

Can we mix 2 or more refrigerants and blend them to achieve the best possible parameters, thanks
ANDY'S ANSWER: this is regularly done to produce products that are tailored to a particular application. I would strongly recommend NOT doing it yourself because the performance characteristics, including pressure and flammability, are not always predictable.

Could systems be adapted to use sea water/brine for commercial applications to counter the low freezing issue of water?
ANDY'S ANSWER: I don't think this would help for two reasons:- the boiling point would remain the same and it's already 0.006 bar absolute (ie -0.994 bar gauge) at zero degrees C, and the freezing point of salty water depends on the salt content so it would shift about as the concentration changed. Also I suspect ice would form at the expansion orifice as it will when you get water in an HFC system so it would choke up.

Did your research consider oil type and miscibility with each refrigerant
ANDY'S ANSWER: I don't consider miscibility to be one of the trade off factors so it wasn't relevant. It is simply a factor that the designer has to include in his design, so it is sort of included in the price rating.

I can see attraction of HFO's like R1234yf with GWP below 500, however HFO blends like R449 have similar GWP's to R134a but have high glides, high cost & A2L safety classification. Why would an HFO blend such as this be used over R134a, which is lower cost, has no glide and an A1 safety classification?
ANDY'S ANSWER: as mentioned below the blend you mention is a replacement for R-404A and similar so the GWP is significantly lower. The compressor size for a given application would be much less than for R-134a and it is suitable for lower temperatures than R-134a.

If there were a leak on R1234ze do the components seperate out into their individual attoms ' thus requiring the entire charge to be replaced in the event of a leak.
ANDY'S ANSWER: when a 400 series blend leaks there is a risk of separation of the components causing a shift in composition but the molecules don't break down into atoms so a leak of R-1234ze would not cause a change of properties.
? Natural refrigerants are also chemicals, and are all produced synthetically (except H2O)!
ANDY'S ANSWER: I did mention this in the talk - ammonia is one of the most heavily manufactured chemicals with annual global production of 180 million tons. The commonly used label "natural" refers to the fact that the occur in nature, not that they are naturally produced.

R448A or R449A are HFC/HFO blends which are A1, not A2L. They are not flammable. Also, they can operate at low temperature in commercial refrigeration, while 134a cannot. They would be compared to 404A, which has more than double GWP.
What about R448A and R449A on supermarkets systems?
ANDY'S ANSWER: this point is correct - thank you - but they still suffer on the comparison charts in a similar way to R-32, albeit non-flammable, since they are more expensive, and generally less efficient than the CFC and HCFC substances that they replace. Also ultimately a lower GWP will be required so they are at best a Meitner term solution.

What alternatives are being considered for R410A for medium pressure commercial systems? R32 seems to be popular for split systems, however all other alternatives seem to have relatively high GWPs of around 600.
ANDY'S ANSWER: the preferred alternative is dependent on detail of the application - R410A is not medium pressure and R-32 has a higher GWP than 600. If the application can accommodate it I would always recommend looking at a hydrocarbon for low cost and high efficiency

What is the future of absorption chillers? Is lithium Bromide considered toxic - they have a place, LiBr is a salt (like NaCl or CaCl2) so "the dose makes the poison". In a LiBr absorption chiller the "refrigerant" is water so has the same limitations I mentioned earlier - don't go too close to freezing.
With a wider variety of refrigerants do you think we will see an increase use of personal gas monitoring devices as part of companies SSOW (safe systems of work), etc.
ANDY'S ANSWER: we already use them for ammonia and they are not expensive so why not, but what would you monitor? HFC or HF?

Can R1234yf be used in pumped liquid systems and can it be used in compound systems to get a lower evaporating temp. Regards Brendan Tyrrell.
ANDY'S ANSWER: yes to both questions but you'd still need a compressor 40% bigger than the equivalent R-22 or ammonia machine and it would be sub-atmospheric when operating below -30oC.

Can we mix 2 or more refrigerants and blend them to achieve the best possible parameters, thanks
ANDY'S ANSWER: all the 400 and 500 refrigerants are blends of this type but the results are not always obvious so it shouldn't be done ad-hoc as it can change the performance in bad ways unexpectedly

Do Refrigerant choice differentiate on split a/c,AHU or VRV system and on type of Environment?
ANDY'S ANSWER: yes, it can be difficult to get the best option and high ambient temperature is a particular problem
R449 GWP is 1397 v R134a is 1430 so not much difference -
ANDY'S ANSWER: except that it is a substitute for R-404A so about one-third of the GWP of the refrigerant it replaces.

The flammability of a refrigerant is based on ignition energy and flame propogation. The products of combustion are a completely different subject, and it is wrong to link the two.
ANDY'S ANSWER: I agree it is a different topic but it is absolutely wrong to ignore it or try to pretend that it is unimportant. Having said that, as I mentioned in the presentation, most HFCs and HFOs will burn and the products of combustion of R-32 are not worse than those of R-134a (and probably slightly "better" than R-12!). All of these products are far more toxic than ammonia so it is irresponsible to ignore them even in systems with A1 classification or small charge.

Any comments on the possibility of supermarkets moving to low charge ammonia chillers with pumped glycol for the chill andf freezer cabinets and cold rooms in the shop.
ANDY'S ANSWER: it is feasible and has been done successfully before but likely more expensive than some other options.

Do Refrigerant inhale causes harmful effects to human beings and limit?
ANDY'S ANSWER: it depends on the substance and the quantity. ISO817 gives more information and is a very useful reference.