**Refrigerant Column, No. 6 2025, August/September**

# Report from Conference in Italy

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In June, the 21st conference on "The Latest Technology in Refrigeration, Air Conditioning and Heat Pumps" was held in Milan. The conference brought together university researchers, representatives from authorities, industry, and various trade organizations. Participants came from all over the world, although the Italians were the most numerous. Many major companies, as well as many organizations, presented their products or their analyses of developments during the conference. Presentations were given by Daikin, Chemours, A-gas, Shrieve, General Gas, Lu-Ve, Dorin, Bitzer, Carel, Danfoss, Embraco, ASHRAE, CAR, JSRAE, IIR, AREA, EPEE, ASERCOM, UNEP, TEAP-RTOC, DG-Clima, among others. From KTH we presented the work within IEA HPT's Annex 64 on safety with flammable refrigerants, which we are leading. This is not a purely scientific conference, but rather one that deals more with policy issues, adaptation to new regulations, and to some extent the presentation of new products. All presentations and accompanying articles are available online [1].

In summary, it can be noted that everyone is aware that natural refrigerants will take over a large part of the refrigerant market in the future. At the same time, parts of the industry and some trade organizations are resisting. ASERCOM's presentation, for example, was mainly about how to justify exemptions from the F-gas regulation when installing refrigeration systems and heat pumps. EPEE, which can be seen as the voice of the refrigerant manufacturers, questioned whether it is possible to phase out F-gases at the pace described in the F-gas regulation. Daikin, Chemours, and Nippon Gas presented the advantages of some of their latest HFO blends (R474A, R454C, R455A). At the same time, representatives from authorities, international organizations, and universities (TEAP-RTOC, DG-Clima, UNEP, EIA, NTNU) presented analyses showing the need for the transition to natural refrigerants, and how this should be done. It is impossible to provide a complete picture of everything discussed here, but those interested are strongly recommended to visit the conference website and take a closer look at the presentations, see the link below.

Of the refrigerants presented, R474A is probably the least familiar. This is a blend of R1132(E) and R1234yf with very low GWP, classified as A2L, see Table 1. The first component does not belong to the PFAS group, but like other HFOs it can, when broken down in the atmosphere, give rise to TFA, which is the most common PFAS substance in the environment. (According to recent research, TFA has no natural source in the environment). The vapor pressure is very close to that of propane, which also means that the capacity at a given compressor size is about the same. The glide is 7.4 K at atmospheric pressure [3]. As with other F-gases, the (liquid) density is about twice as high as for propane. According to Daikin's presentation, R474A is suitable for many different applications, from mobile cooling to small heat pumps and commercial refrigeration, perhaps especially in colder climates. However, it should be noted that it may be banned in the EU if the proposed general ban on PFAS goes through. In Fig. 1, the coefficient of performance, discharge gas temperature, and capacity for a cooling application are compared with the corresponding values for propane and R454C [2]. As can be seen, propane provides the highest coefficient of performance, while the two synthetic refrigerants are roughly equal. The discharge gas temperature, as well as the capacity, is somewhat lower for R474A than for the other two.

The refrigerant thus contains R1132(E), which is a rather untested component that is not yet produced in large quantities. Commercial quantities of R474A are expected to start being marketed only in 2027. As can be seen from the number, R1132(E) consists of two carbon atoms connected by a double bond, as well as two fluorine and two hydrogen atoms. Like other HFOs, the double bond makes the molecule reactive, which gives it a short atmospheric lifetime and thus low GWP. But it also means a potential risk of the molecule breaking down, or polymerizing, inside the system. According to some sources, work is underway to find stabilizers that can be added to systems to ensure the long-term stability of the refrigerant. Time will tell whether R474A will find a place in the refrigerant market of the future. Very low GWP and lower flammability than hydrocarbons are factors in its favor. Problems with stability and PFAS/TFA emissions, however, speak against it.

| | Refrigerant Characteristics | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | GWP | ASHRAE class | LFL | Boiling Point | Critical Temp. | Critical Pressure | Vapor Pressure (25degC) | Liquid density (25degC) |
| | AR4 | - | [kg/m³] | [degC] | [degC] | [MPa·A] | [MPa·A] | [kg/m³] |
| R-410A | 2088 | A1 | - | -51.4 | 71.3 | 4.90 | 1.66 | 1064.7 |
| R-407C | 1770 | A1 | - | -43.6 | 86.2 | 4.63 | 1.19 | 1137.5 |
| R-32 | 675 | A2L | 0.307 | -51.7 | 78.1 | 5.78 | 1.69 | 961.0 |
| **R-454B** | 466 | A2L | 0.297 *1 | -50.7 | 78.3 | 5.30 | 1.58 | 997.6 |
| R-454D | 293 | A2L | 0.294 *1 | -49.0 | 81.7 | 4.88 | 1.42 | 1013.2 |
| **R-479B** | <300 | A2L | 0.218 *1 | -51.9 | 78.1 | 5.23 | 1.61 | 1001.3 |
| **R-454C** | 148 | A2L | 0.292 *1 | -45.9 | 87.6 | 4.37 | 1.17 | 1068.3 |
| **R-479A** | 147 | A2L | 0.194 *1 | -50.5 | 80.5 | 4.81 | 1.46 | 1025.3 |
| **R-474A** | 3 | A2L | 0.207 *1 | -43.4 | 87.8 | 4.05 | 1.07 | 1066.7 |
| **R-474B** | 3 | A2L | 0.189 *1 | -45.8 | 85.2 | 4.22 | 1.18 | 1054.4 |
| R-1234yf | 4 | A2L | 0.290 | -29.5 | 94.7 | 3.38 | 0.68 | 1091.7 |
| **R-290** | 3 | A3 | 0.038 | -42.1 | 96.7 | 4.25 | 0.952 | 492.4 |

*1 Flammability is WCF composition

**Table 1:** Properties of R474A and some other refrigerants. From [2]

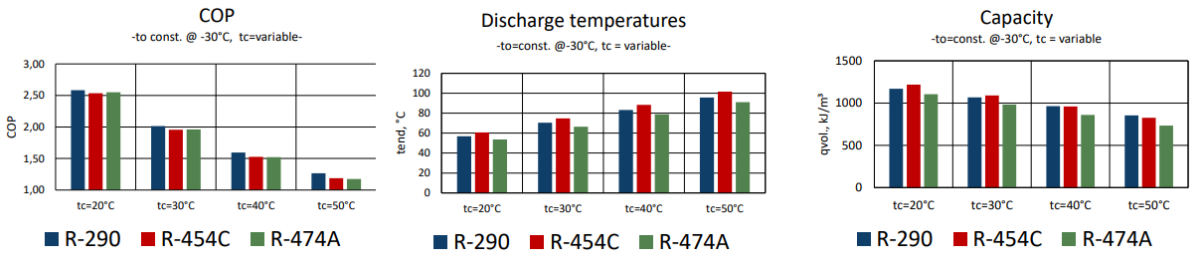


**Figure 1:** Performance of R474A compared to propane and R454C. [2]

**References:**


1. XXI European Conference, https://www.centrogalileo.it/informazioni/ATTI/CNV-XXI/index_eng.html
2. Macrì, C., Flohr, F., de León, Á., 2025, *R-474A: An Ultra-Low GWP and A2L Alternative for Stationary Applications*, #XXI EU conf on RAC, Milan, https://www.centrogalileo.it/informazioni/ATTI/CNV-XXI/doc/107E.pdf (for the presentation, see https://www.centrogalileo.it/informazioni/ATTI/CNV-XXI/doc/107P.pdf)
3. *R-474A: Daikin's new refrigerant for ultra-low GWP A2L applications* | Daikin Chemical Europe, https://www.daikinchem.de/blog/r-474-a/