Latest technologies in using Hydrocarbons as a refrigerant and importance of training and certification for the success of the sector for the future

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AREA

The indisputable voice of European RACHP contractors

- Funded in 1988 in Brussels, Belgium
- Represents RACHP contractors
- AREA in figures:
  - 20 national member associations
  - 17 countries from EU and beyond
  - > 13,000 companies (mainly SMEs)
  - +/- 110,000 work force
  - +/- € 23 bn annual turnover

Design, installation, maintenance and repair of all **Refrigeration, Air Conditioning and Heat Pumps** RACHP systems

AREA Vision and Strategies

General mission statement

"*support and initiate activities to promote the industry and its high standards of quality, in order to serve users' interest in a safe and uninterrupted usage of efficient refrigeration, air conditioning and heat pump equipment, and to create and maintain a favourable business climate for European refrigeration, air conditioning and heat pump contractors, in terms of quality, safety, employment, fair competition and profitability*".

Key issues

Regulatory aspects

- F-Gas Regulation implementation and review
- Monitoring of Ozone Depleting Substances
- Energy efficiency - Climate change
- Eco-design of energy-related products

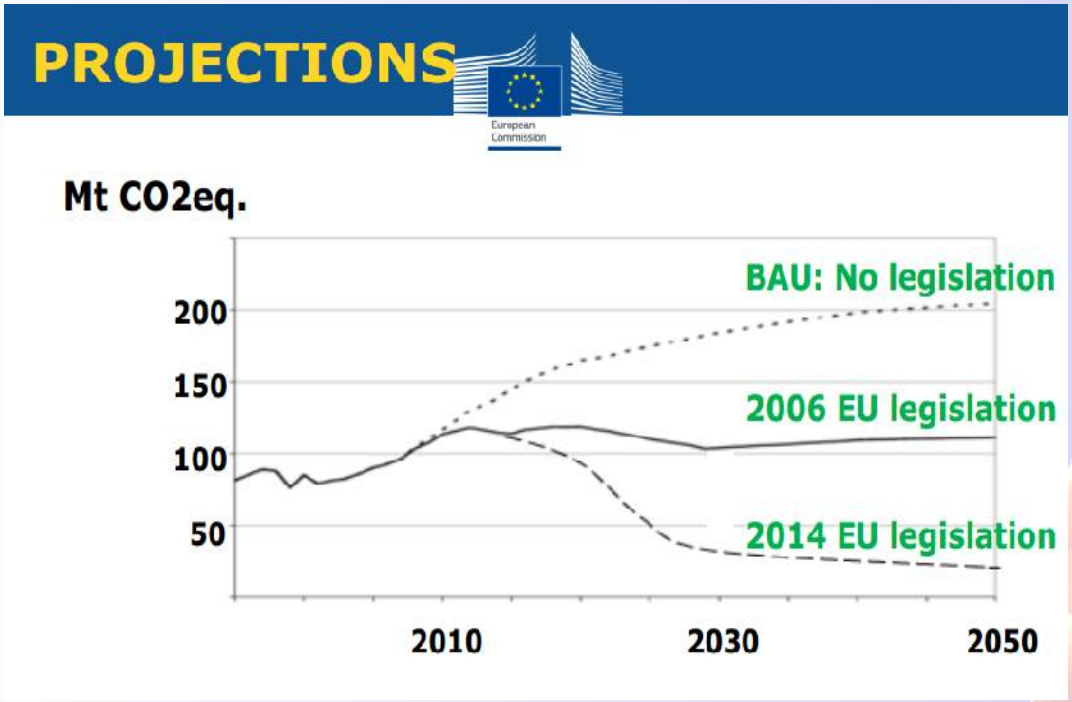
Professional standards

- Heat pump installation
- F-gas certification and education

Professional guidance

- Low GWP refrigerants, certification and education

European HFCs emissions present and future



- phase-down of HFCs will lead to a higher use of alternative refrigerants / low GWP refrigerants.
- the new Regulation creates new business opportunities and will accelerate innovation and economies of scale in producing such technologies

Pros / Cons refrigerants

	HFC	Natural			HFO
Refrigerant		HCs	Ammonia	CO_2	1234yf
GWP (100 years)	✗✗ R134a 1300 – R410A 1900	✓ 3 - 5	✓✓ 0	✓✓ 1	✓ 4
Toxicity	✓✓	✓✓	✗✗	✓	✓✓
Flammability	✓✓	✗✗	✗	✓✓	✗
Materials	✓	✓	✗	✓	✓
Pressure	✓	✓	✓	✗✗[1]	✓
Availability	✓✓	✓	✓	✓	✗✗
Familiarity	✓✓	✓	✓	✗	✗

Very poor ✗✗ **Poor** ✗ **Good** ✓ **Very Good** ✓✓

Source: F-gas support Information Sheet - RAC7 alternatives

Every refrigerant will have his own application

Some Technologies with Low GWP alternatives – Hydrocarbons

Applications	Refrigerant
Industrial Refrigeration	HFO 1234ze (?)*
All kind of Industrial Ref.	Ammonia
Cascade systems	Carbon Dioxide + Ammonia
Secondary fluids	Carbon Dioxide
Commercial Refrigeration	HFO 1234ze*
Cabinets	Hydrocarbons
Bottle coolers	Hydrocarbons
Supermarkets	Carbon Dioxide
Domestic Refrigeration	
freezers	Hydrocarbons
Air Conditioning	R32
Heat Pumps Hot Water	Carbon Dioxide Trans-critical
Large Chillers	Ammonia
Small Monobloc Air Conditioning	Hydrocarbons
Automotive	HFO 1234yf

no refrigerant represents the ideal solution in all cases and for every equipment – each cooling application has to be looked at in its own merits and a professional choice must be made

From AREA guidance on LOW GWP refrigerants (www.area-eur.be)

*more applications for HFOs and HFO blends will probably be developed with full commercialisation of the refrigerants

Application of Hydrocarbons

Source: Real Alternatives - EU Leonardo da Vinci project, 2014

Refrigerant	Central plant	VRV, VRF	Split AC / heat pumps	Chillers	Remote condensing units	Integrals
R744						
R717						
R32						
R1234ze						
R600a						
R290 and R1270						

Suitability @ High-Ambient Temperatures*

Source: Oeko-Recherche et al., 2014

Alternatives → / Equipment sector ↓		Hydrocarbon GWP<10	Ammonia GWP<10	HFO GWP<10	R32&HFO blends GWP=200-400 R32 GWP=675
private fridges		🟢	🔴	🔴	🔴
commercial plug-ins		🟢	🔴	🟡	🔴
condensing units	< 5kW	🟢	🔴	🟡	🟡
condensing units	> 5 kW	🔴	🔴	🟡	🟡
centralised system supermarket		🟢	🔴	🟡	🟡
large industrial refrig.		🔴	🟢	🔴	🔴
AC plug-ins		🟢	🔴	🔴	🟡
AC Single split	< 7kW	🟢	🔴	🔴	🟡
AC Single/Multi split	> 7kW	🔴	🔴	🔴	🟢
AC cars		🔴	🔴	🟢	🔴
displacement Chillers		🟢	🟢	🔴	🟡
centrifugal Chillers		🔴	🔴	🟢	🔴

* High-Ambient Temp are the most discussed applications at International level due to few availability of alternatives

To prevent HFCs emissions In EU:
→ F-gas regulation and certification

REGULATION (EC) 517/2014

In synthesis the Refrigeration, Air Conditioning and Heat Pumps systems with HFCs should have:

- Logbook
- Periodical inspections
- Installation, repair only by certified craftsmen

Mandatory Certification to handle refrigerants

Refrigerant to be withdraw

→ **only by certified craftsmen**

Certification of technicians in servicing sector how it runs (1)

Theoretical Exam

→

Probably the More difficult part of the exam

Certification of technicians in servicing sector how it runs (2)

Practical Exam

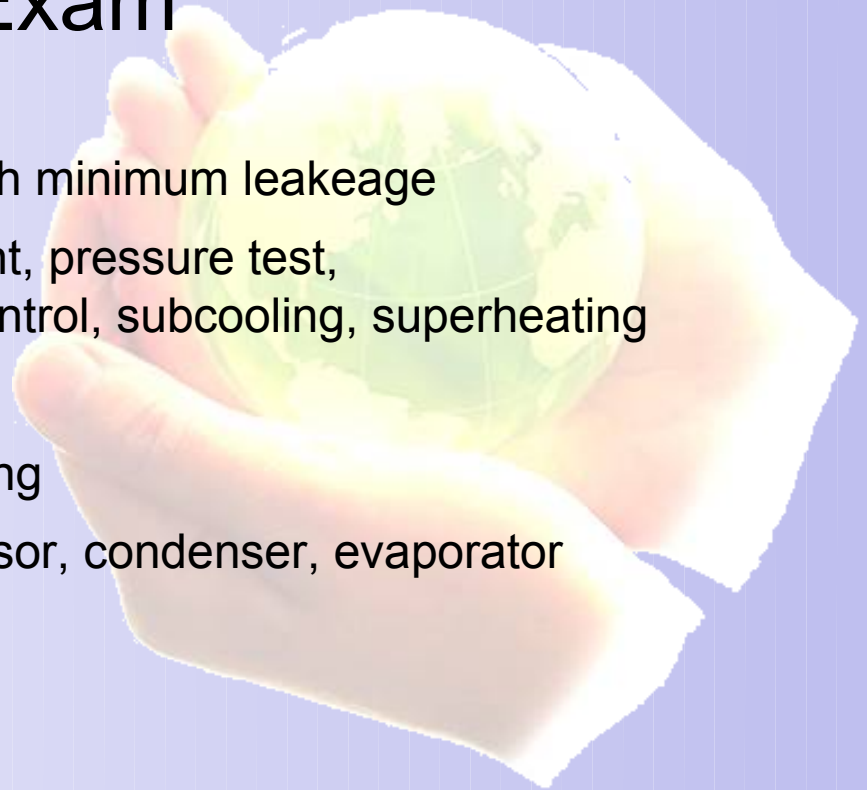
Charge, Vacuum, Recovery with minimum leakeage

Leak Check with equipment, pressure test,
Parameters temperature, Pressure control, subcooling, superheating

Brazing

LogBook filling

Simulation of installation of compressor, condenser, evaporator



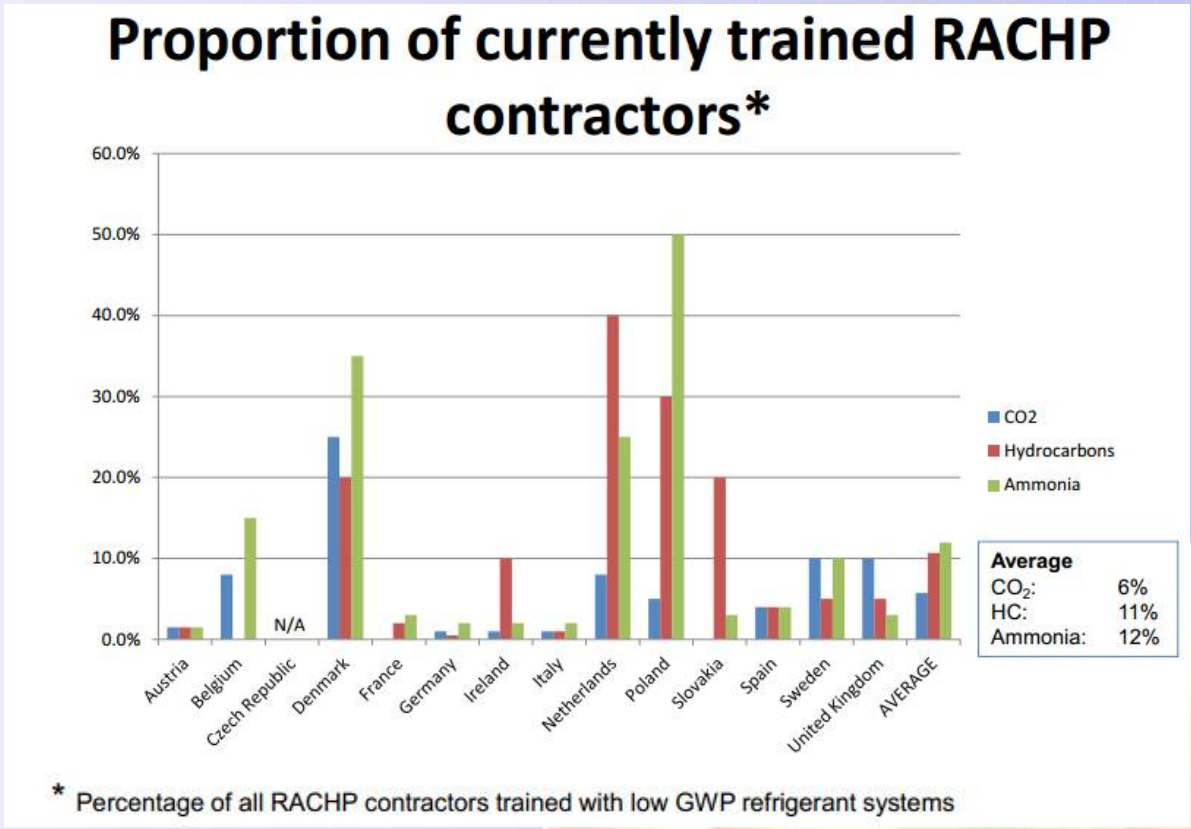
Certification of technicians in servicing sector how it runs (3)

Brazing

Temperature, Pressure, Subcooling, Superheating

Vacuum, Charge, Recovery

Contractors' training with low GWP refrigerants: mind the gap!

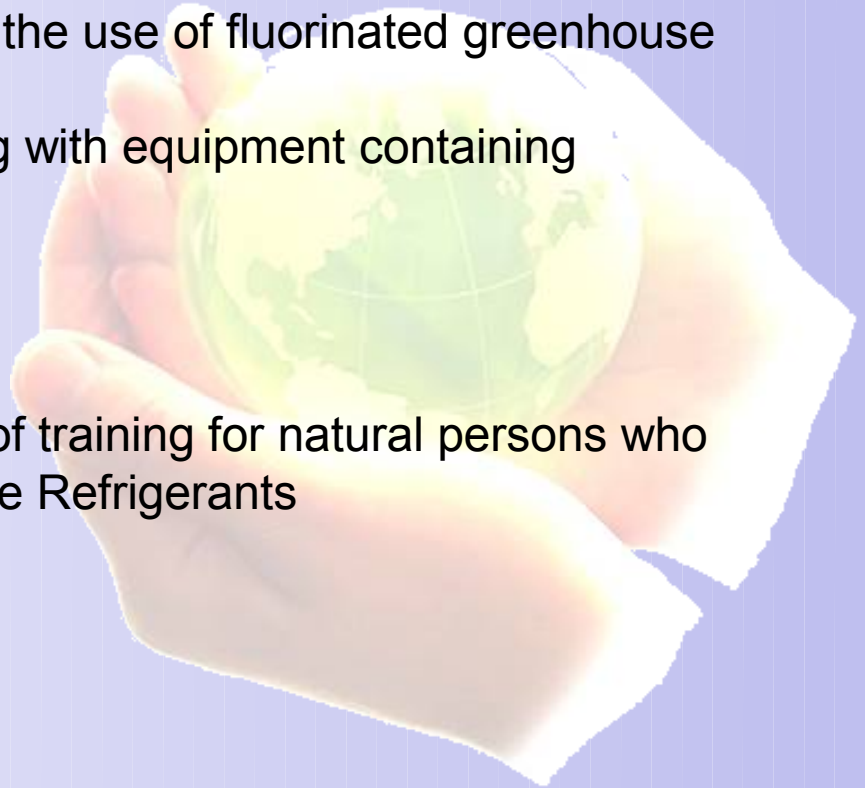


In European Union, whilst these percentages are at the moment commensurate with the market share of these refrigerants, it is very likely that contractors could not cope with a legislatively pushed development of natural refrigerants (see latest AREA Guidance on certification in Low GWP refrigerants for list of training providers in Europe)

EU Fgas Revision EU 517/2014 : Low GWP refrigerants Certification and Trainings

Certification and training programmes must now include information on relevant technologies to replace or reduce the use of fluorinated greenhouse gases and their safe handling.

Certified operatives must have access to information on:
•Relevant technologies to replace or reduce the use of fluorinated greenhouse gases and their safe handling, and
•Existing regulatory requirements for working with equipment containing alternative refrigerants

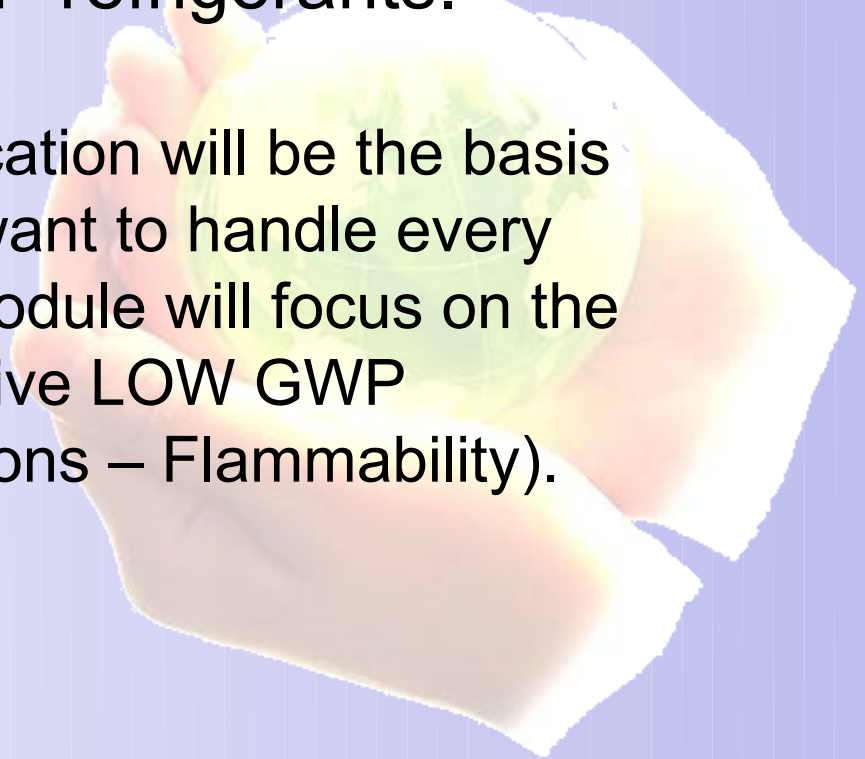


Member States shall ensure the availability of training for natural persons who wish to update their knowledge on Alternative Refrigerants

AREA position on training and certification of LOW GWP refrigerants

- AREA would like to recommend to worldwide and European decision-makers minimum requirements for training and certification of contractors handling low GWP refrigerants.

→ Solution while HFC certification will be the basis for every contractor who want to handle every refrigerant, each added module will focus on the specificities of the respective LOW GWP refrigerant (i.e. Hydrocarbons – Flammability).

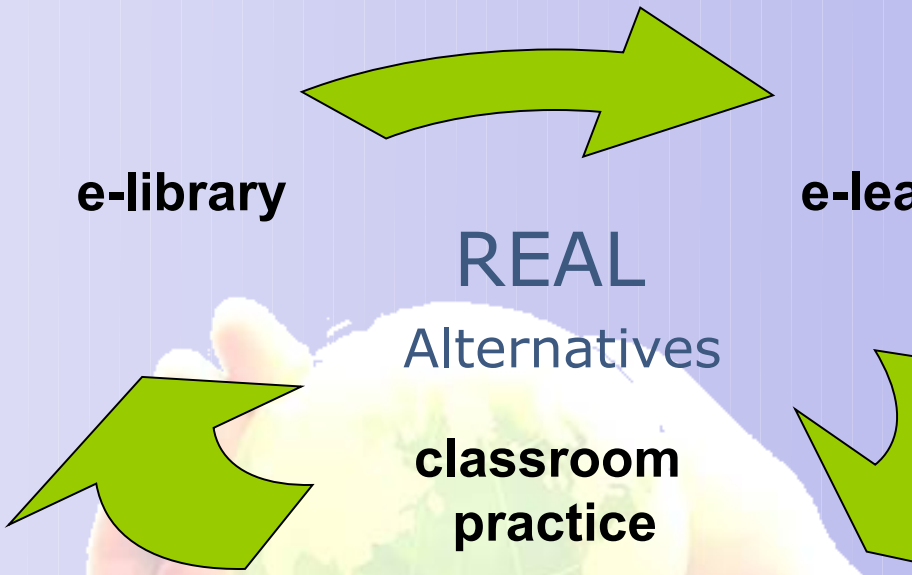


From AREA Guidance
www.area-eur.be

Blended learning for alternative refrigerants in new equipment

REAL alternatives is European project that will address skills shortages amongst technicians working in the refrigeration, air conditioning and heat pump sector

The focus will be on carbon dioxide, ammonia, hydrocarbon and HFO refrigerants. It will cover safety, efficiency, reliability and containment in service and maintenance.



Co-financed by
Lifelong Learning Programme

We are proud to have among our stakeholders **the European Commission DG Clima & UNEP Ozone Action**

Use the right Equipment (1)
(few available on the market)

- ***Characteristic: Flammable proof***
- Leak detector
- Recovery unit
- Charging station (automotive)

Use the right Equipment (2)
(few available on the market)

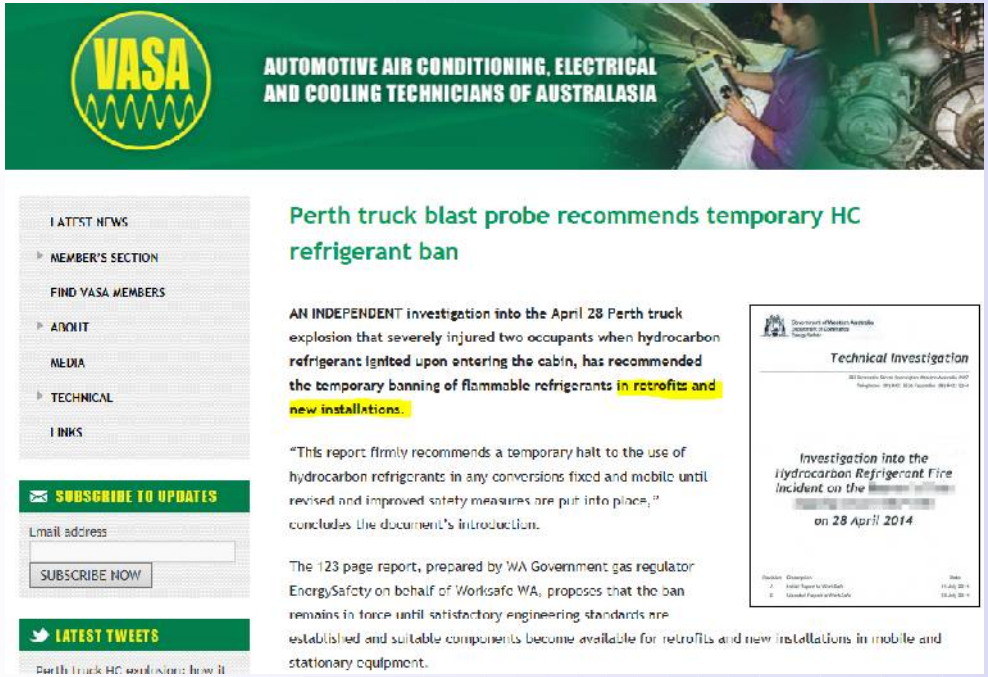
- A **flammable gas detector** should be used to monitor the air in the work area.
- If an **electronic leak detector** is used it must be safe and sensitive to the flammable refrigerant. Most HFC leak detectors do not need this requirement. Leak detection fluid can be used.
- HFC **recovery machines** have not been assessed for use with flammable refrigerants. Approval must be sought from the manufacturer before using a standard HFC recovery machine with any flammable refrigerant – they may be safe to use with flammable HFCs but not HCs. A recovery machine suitable for use with HCs is available and could be used with other flammable refrigerants.
- More accurate **scales** are necessary when charging small, critical charged systems with some flammable refrigerants such as HCs. An accuracy of ±5 g is often necessary – most scales used for service are not this accurate.
- A dry powder or CO_2 **fire extinguisher** must be available at the location.
- A suitable **ventilation fan** should be used when working inside if there is insufficient natural ventilation.

Source: BRA Guide to Flammable Refrigerants, July 2012

- You will need to determinate if your current R-134a detector can be used with a mildly flammable refrigerants

Source: Dupont Guidelines for Use and Handling of HFO-1234yf

Final Warning and conclusions



Higher costs of Refrigerants will bring to cowboys techinicians to test hydrocarbons in systems both
in developing and developed countries

Australia: VASA president Ian Stangroome said it has been campaigning for years against the irresponsible use of flammable hydrocarbon refrigerants in vehicle air conditioning systems.

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