Chillventa CONGRESS 2016
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CONNECTING
EXPERTS.

New training needs in the EU

ChillVenta, 10th October 2016

Marco Buoni

VicePresident, AREA

Air Conditioning & Refrigeration European contractors' Association (www.area-eur.be)

Secretary General Italian Association of Refrigeration Technician, ATF

(www.associazioneATF.org)

Director Centro Studi Galileo (www.centrogalileo.it)

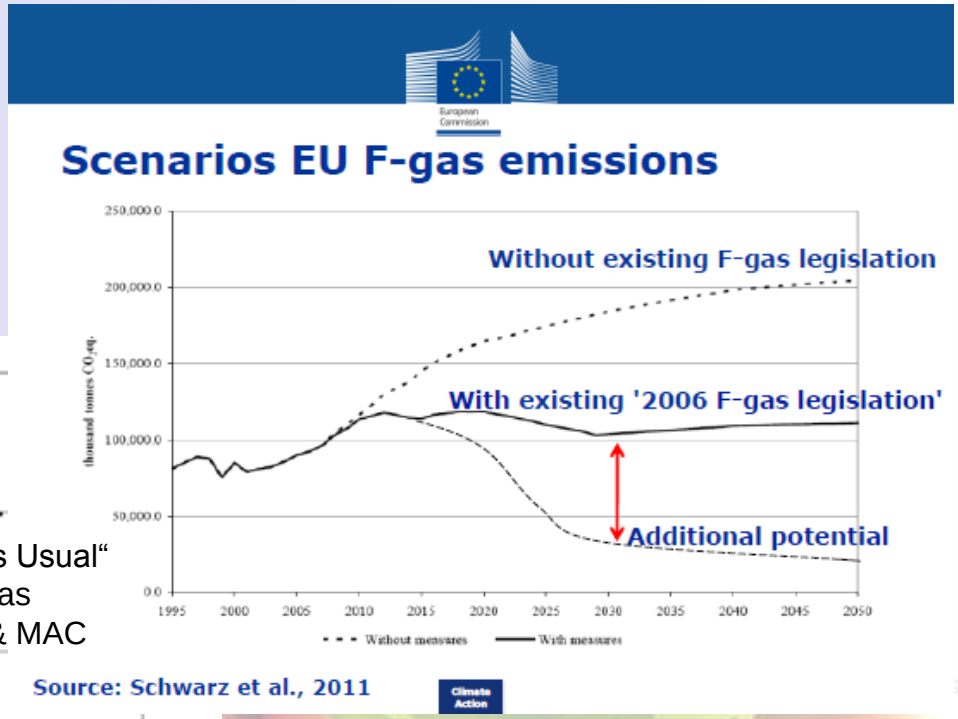
AREA

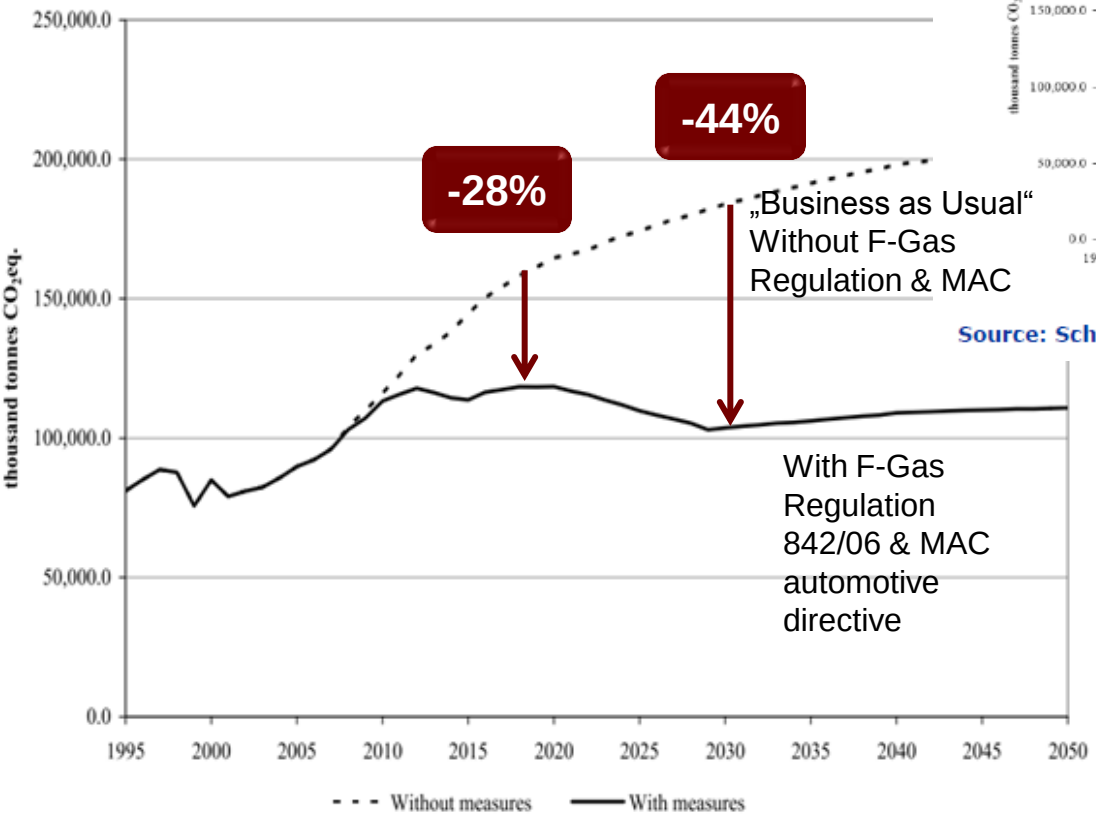
The indisputable voice of European RACHP contractors

- Funded in 1988 in Brussels, Belgium
- Represents RACHP contractors
- AREA in figures:
  - 22 national member associations
  - 19 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

Emissions of refrigerants present and future in EU





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

The use of HFCs is legislatively decreased and consequently the use of natural refrigerants is pushed, there will be a gap between training offer and training needs resulting in a shortage of trained contractors

! Fgas Certified Technicians in EU: nearly 500.000 !

The revision of the F-Gas Regulation include measures in favour of a decreased use of HFCs in RACHP equipment. Such measures would, in turn, result in an increased use of alternatives, namely low GWP (global warming potential) refrigerants, and in particular the so-called "natural refrigerants" (CO2, hydrocarbons and ammonia). Mindful of the key role played by contractors in the safe, efficient and reliable functioning of equipment working with natural refrigerants, AREA sought an overview of the availability and level of training in the EU.

Solution could be starting from the F-Gas certification of personnel adding modules for natural refrigerants

Fgas Certification the numbers *(data June 2016)*

UK
- 40,021 individuals hold certificates
- 7123 UK companies are registered

Germany
- 45.000 Personnel certified in Germany
- 3.500 Companies certified in Germany

Italy
- 56300 Personnel certified in Italy
- 23500 Companies certified in Italy

- Average cost for preparation to the certification and the assessment is 600 Euro

- Craftsmen are happy to be certified as they have a recognition of their important job. Certification can be spent by craftsmen as a proper professional qualification, which is mutual recognized in all 28 European Countries

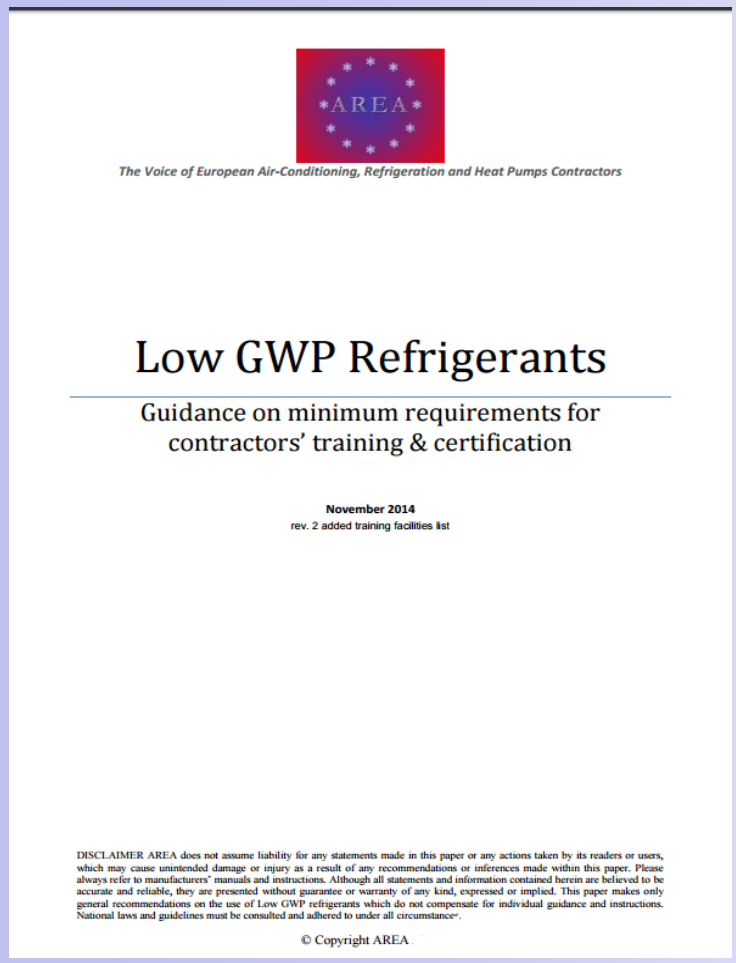
Recommendations of AREA: Minimum Requirements for the specific refrigerant HC – NH_3– CO_2– HFO

COMPETENCE OF SERVICE TECHNICIANS Assessment: P Practical T Thoretical	HC	NH_3	CO_2	HFO A2L
BASIC THERMODYNAMICS AND PHYSICS	***T***	***T***	***T***	***T***
• Properties : temperature, pressure, density, thermal capacity.. • Differences between Low GWP refrigerants and HFCs • ……				
GOOD PRACTICE	***P***	***P***	***P***	***P***
• Identify typical application • State and identify the commonly used refrigerants designation • ……				
HEALTH AND SAFETY REQUIREMENTS	***P***	***P***	***P***	***P***
• Safe system shutdown and isolation • Extinguish a fire, First aid care treatment • ……				
REGULATIONS AND STANDARDS	***T***	***T***	***T***	***T***
• Knowledge of International and National Regulations standards • Storage of the refrigerant • …….				




Details in AREA Guidance
www.area-eur.be

Training offer in low GWP refrigerants in EU



The Voice of European Air-Conditioning, Refrigeration and Heat Pumps Contractors

Low GWP Refrigerants

Guidance on minimum requirements for contractors' training & certification

November 2014
rev. 2 added training facilities list

DISCLAIMER AREA does not assume liability for any statements made in this paper or any actions taken by its readers or users, which may cause unintended damage or injury as a result of any recommendations or inferences made within this paper. Please always refer to manufacturers' manuals and instructions. Although all statements and information contained herein are believed to be accurate and reliable, they are presented without guarantee or warranty of any kind, expressed or implied. This paper makes only general recommendations on the use of Low GWP refrigerants which do not compensate for individual guidance and instructions. National laws and guidelines must be consulted and adhered to under all circumstance".

List of training providers for Alternative Refrigerants in EU:

- More than 40 training centres in total
  - 27 Ammonia
  - 22 Hydrocarbons
  - 29 CO2
  - Only few on HFOs

Training in low GWP refrigerants Training facilities:

- Few in Eastern Europe (with some exceptions, e.g. ammonia in PL)
- More in Western Europe but many are insufficiently equipped, thus focusing on theoretical training (N.B.: facilities in DK and NL are relatively well equipped)
- Usually run by the private sector: guilds, training centres, sometimes manufacturers or distributors
- Creating a training centre is costly – e.g. €300,000 for centre on NH3 in NL

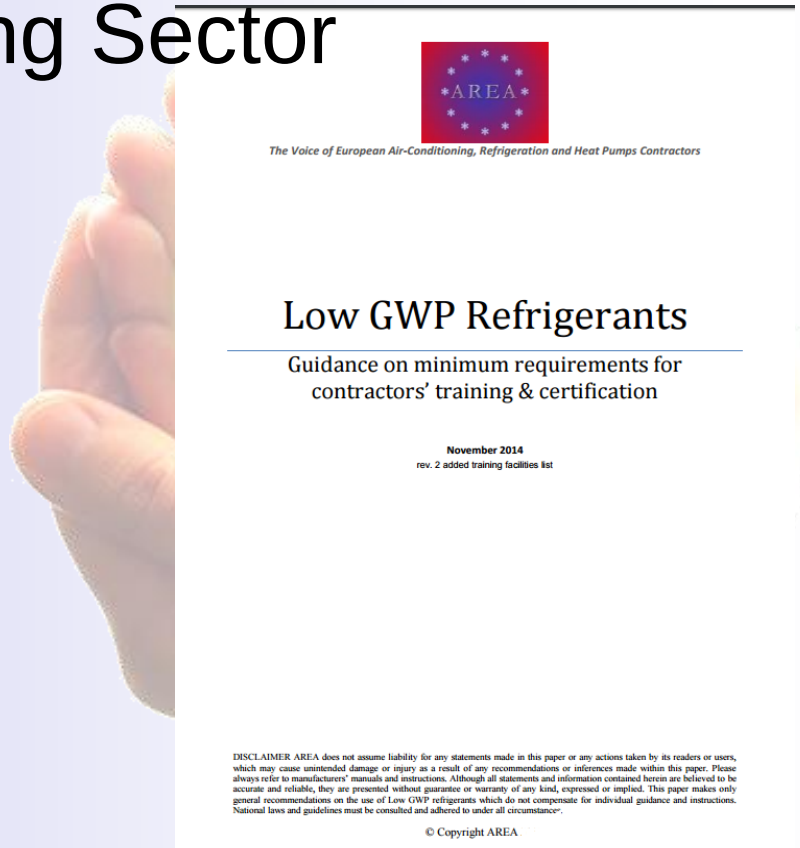
AREA guidelines

- Low GWP Refrigerants

Guidance on minimum requirements for contractors in Servicing Sector

Training & Certification

Used by several EU member states for implementing national legislations and recommendations



Example: training for Hydrocarbons

Course details

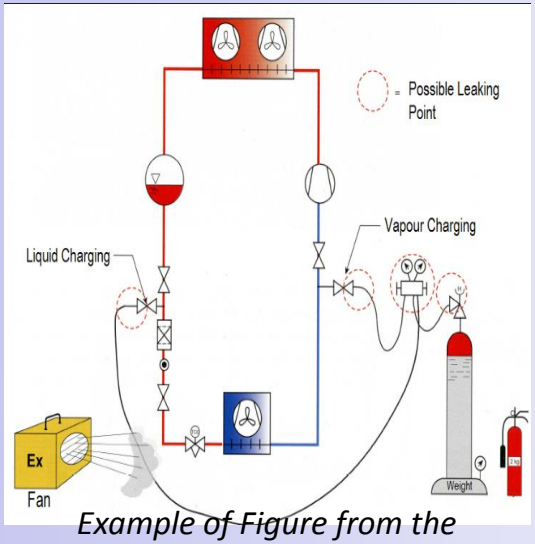
- Thermodynamic characteristic of Hydrocarbons as refrigerant - p/h diagram
- Specific components for Hydrocarbons
- Electronic components suitable for flammable refrigerants
- Refrigeration and Air conditioning applications with HC
- Recovery or Venting Hydrocarbons
- Vacuum-Charging procedures
- Leak testing
- Mechanical/compression joint connections – avoid brazing
- Flammability and safety issues, first aid
- Conversion HCFC – HFC systems into HC
- National and European regulations and standards
- Transport and storage requirements
- Logbook

Necessary equipment and components (minimum)

- Test Rig equipped with Pressure Gauges, sight glasses in key points, service valves for connections, temperature well - thermowell (Domestic/Commercial refrigerator or small packaged portable air conditioning unit)
- Mechanical/compression joint tool and connectors
- Nitrogen Regulator - Cylinder of High Purity Nitrogen
- Electronic Weighing Platform
- Hydrocarbon Cylinder
- Electronic or analogue Vacuum gauge
- Manifold set - Hoses with ball valves
- Vacuum Pumps and Hose
- Electronic Leak Detector (suit HC)
- Proprietary Leak Spray
- Temperature meter
- Ammeter
- Tools, Pipe Cutters, Pipe Deburring Tool, Pipework Expanders, Hacksaws, Brazing Rods
- Flaring Tool
- Personal protective equipment

AREA guidelines

- Equipment for refrigerants with lower (A2L) and higher (A3) flammability



Example of Figure from the guideline: Possible sources for leakage and safety equipment used when filling flammable refrigerant

The Voice of European Air-Conditioning, Refrigeration and Heat Pumps Contractors

EQUIPMENT FOR REFRIGERANTS
WITH LOWER (A2L) AND
HIGHER (A3) FLAMMABILITY

Version 1.0 – April 2016

AREA (www.area-eur.be) is the European organisation of air-conditioning, refrigeration and heat pumps contractors. Established in 1988, AREA voices the interests of 21 national members from 19 European countries, representing more than 9,000 companies across Europe (mainly small to medium sized enterprises), employing some 125,000 people and with an annual turnover approaching € 20 billion.

! Translated already in 6 EU languages !

Global Training and certification
In cooperation with UNEP

Refrigerant Driving License (RDL)	• Initiated by UNEP and AHRI • Participation of ASHRAE, JRAIA, AREA, EPEE, ABRAVA, UNIDO and GRME • Currently at Stage-I Assessment, Pilot phase starts end of 2016
Streamlining Training for RSS	• Joint approach for assessing global training programs for RSS • Includes participation of IAs and RAC associations • First Stakeholders workshop in April 2016 • Target is to have global Roadmap for RSS training
Specialized Training Program for Future Alternatives	• Cooperation with AREA • Benefiting of REAL program • Specialized training packages on future alternative refrigerants • Programs offered to training institutes in A5 countries

! MOP 28 in Kigali – Rwanda:
decision for a global HFC phase down !

UNEP

National Certification Schemes for Refrigeration and Air Conditioning Service Technicians

Examples of Strategies and Requirements for their Establishment and Operation

United Nations Environment Programme

Certification
is the best practical method to verify the competence of personnel handling refrigerants and to ensure the correct installation, maintenance, repair and dismantling of a refrigeration, airconditioning and heat pump systems.

Training and certification worldwide

- Together with the UN implementing agencies UNEP, UNIDO, UNDP over the past few years AREA has been deeply involved in helping developing countries through **training RSS technicians** to install, repair, maintain and design RAC systems and **numerous Certification Sessions in Africa and Asia.**
- **Pics from top: Rwanda, Former Soviet Union Rep, Benin, Gambia, and also Ghana, Tunisia, Eritrea, Montenegro, Saudi Arabia, Turkey… etc…).**

FREE Blended learning for alternative refrigerants in new equipment

safety, efficiency, reliability and containment

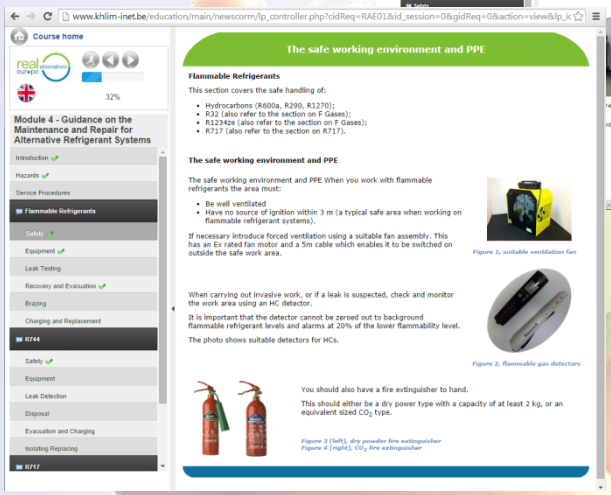
e-library

e-learning

REAL Alternatives

www.realalternatives.eu

classroom practice

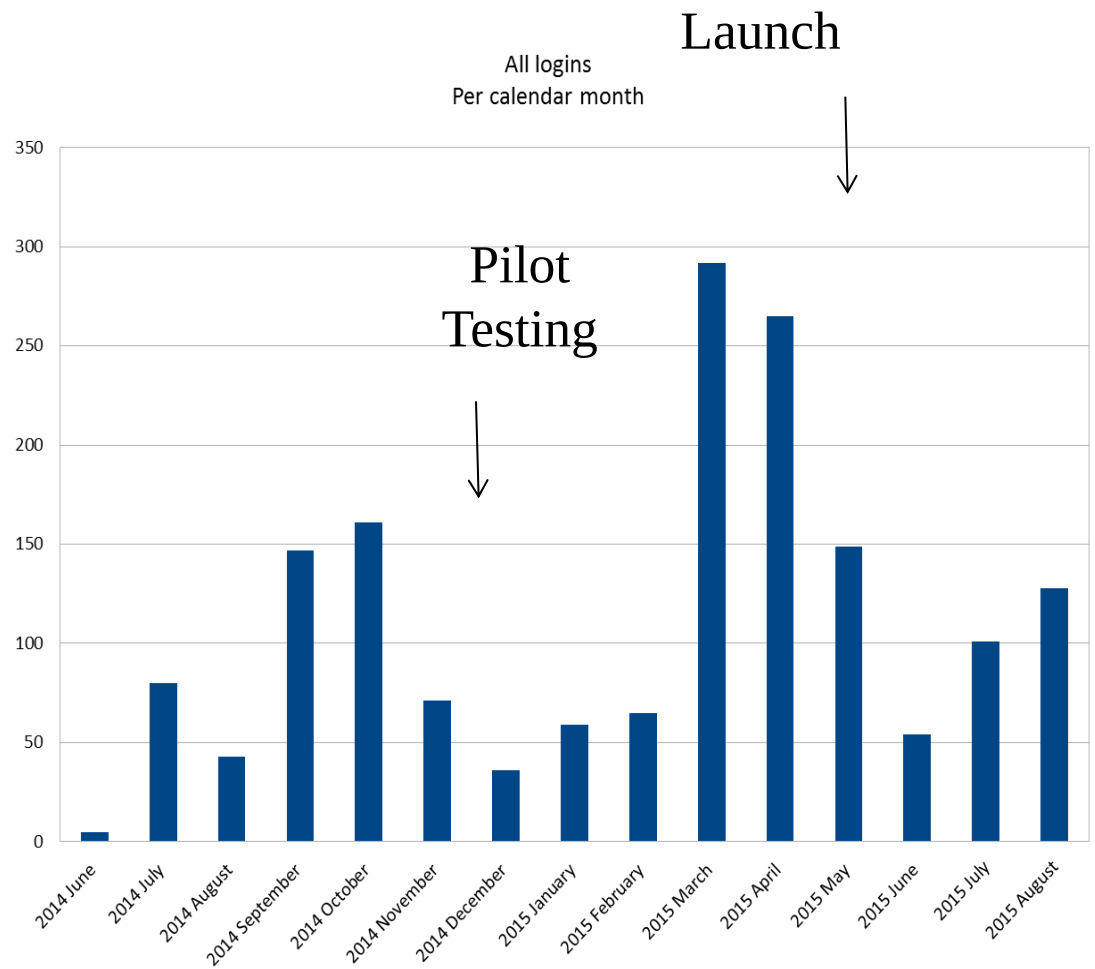


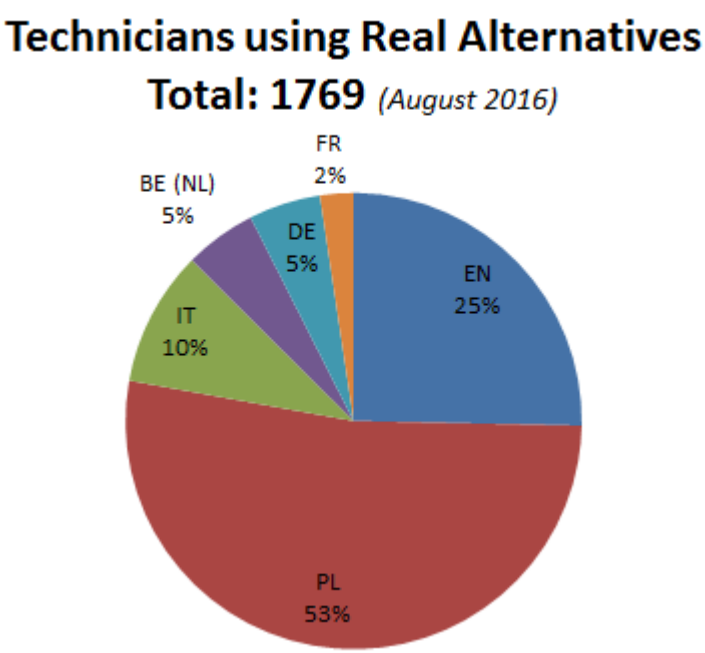
Co-financed by Lifelong Learning Programme

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

real alternatives europe

Numbers – Elearning Login





1500 have registered login to the Real_Alt website

- download
- library/manuals
- booklets

Refrigerant Emissions and Leakage-blended learning for alternative refrigerants in new equipment

safety, efficiency, reliability and containment

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

The focus is on carbon dioxide, ammonia, hydrocarbon and HFO refrigerants. It will cover safety, efficiency, reliability and containment in service and maintenance. There will be a focus on refrigerant emissions and leakage.

Delivered through innovative blended learning - a mix of e-learning, face-to-face training materials and an e-library of learning resources from across Europe. Building on the success of REAL Skills Europe & REAL Zero containment programmes

Co-financed by Lifelong Learning Programme

Refrigerant Emissions and Leakage-blended learning for ALTERNATIVE REFRIGERANTS in new equipment

A European project co-funded by the EU Leonardo Life Long Learning programme to address skills needs in technicians in the refrigeration, air conditioning and heat pump sector in:

- Carbon dioxide CO_2 R744
- Ammonia NH_3 R717
- Hydrocarbon HC R600a-R290-R1270
- Low Flammables (HFOs/R32 etc)

Refrigerant Emissions and Leakage-blended learning for ALTERNATIVE REFRIGERANTS in new equipment

Addresses safety, efficiency, reliability and containment aspects of service and maintenance.

Critical safety factors associated with alternative refrigerants:

- Flammability
- Toxicity
- Higher system pressures

Sharing best practice across Europe for an INDEPENDENT training and education in Alternative Refrigerants

Institute of Refrigeration

London South Bank University

Associazione Tecnici del Freddo, Italy

Limburg Catholic University College

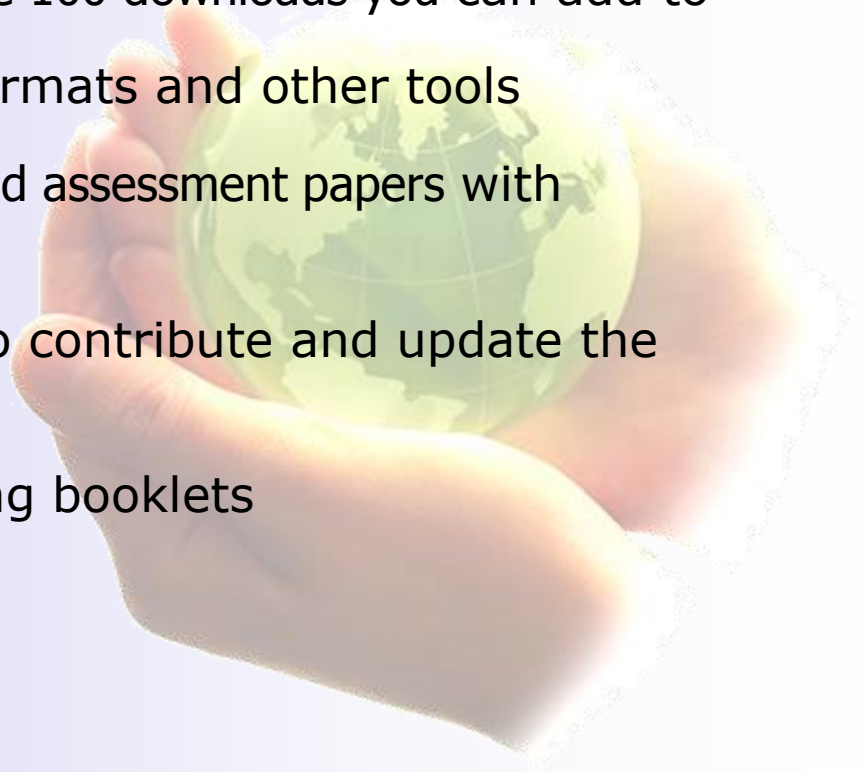
Foundation for the Protection of the Ozone Layer, Poland

Informationszentrum für Kälte- Klima- und Energietechnik gGmbH

Air Conditioning and Refrigeration European Association

REAL Alternatives blended learning resources:

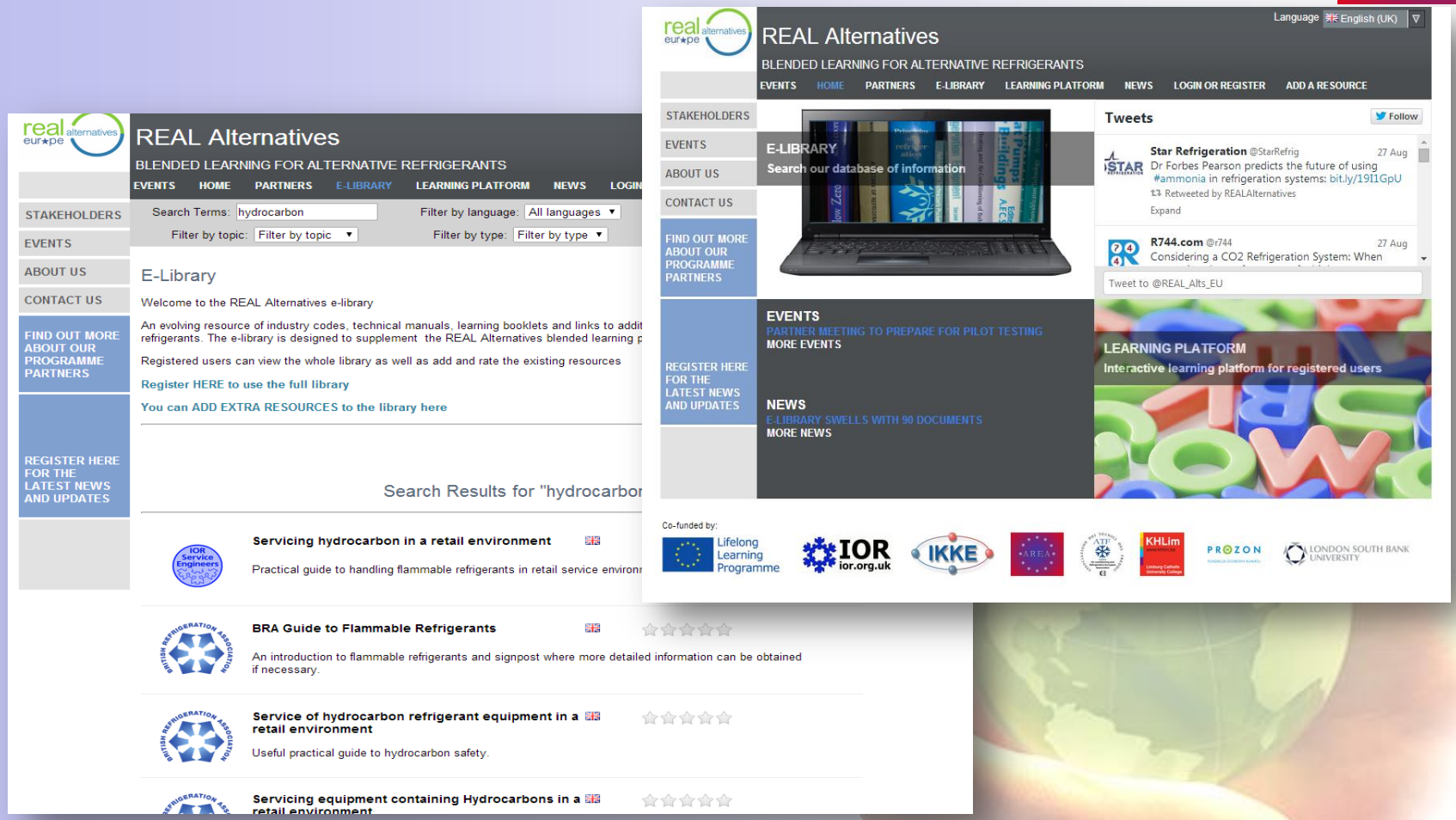
- flexible learning programmes for use by individuals, companies or training providers.
- multi-lingual website
- interactive e-learning in five languages (*more countries interested to translate it*)
- searchable e-library with over free 100 downloads you can add to
- tracking spreadsheets, report formats and other tools
- standard on-line tests and controlled assessment papers with optional certification
- opportunities for stakeholders to contribute and update the materials and resources
- downloadable guides and training booklets



Technical content of materials

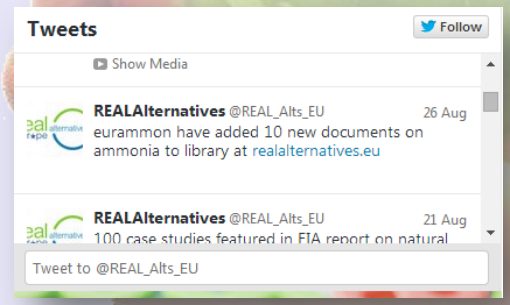
Real Alternatives Europe programme modules:
1. Introduction to Alternative Refrigerants - safety, efficiency, reliability and good practice
2. System design using alternative refrigerants
3. Containment and leak detection of alternative refrigerants
4. Maintenance and repair of alternative refrigerant systems
5. Retrofitting existing systems
6. Checklist of legal obligations when working with alt refrig
7. Measuring the financial and environmental impact of leakage
8. Tools and guidance for conducting site surveys

Website and e-library already available
E-LEARNING LAUNCH IN MARCH 2015



How you can get involved

- become a stakeholder
- add technical material to the e-library now
- **sign up technicians for the FREE e-learning courses when launched in MARCH 2015**
- register to deliver classroom training courses using these materials as an employer or training provider
- register for updates at the website, follow us on twitter
- translate in other languages
- spread the word…



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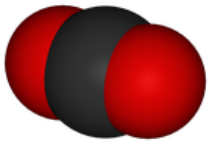
Module 1 - Introduction to Alternative Refrigerants

R744 (Carbon Dioxide, CO_2) WP = 1

Properties

R744 has high operating pressures, a low critical temperature (31°C) and a high triple point. Its volumetric cooling capacity is between 5 and 8 times that of HFCs, reducing the required compressor displacement and pipe size. Its properties have an effect on how the system is designed and operates, especially in high ambient temperatures. It has a high discharge temperature, necessitating two stage compression for low temperature systems. The document highlighted below has detailed information on how these properties effect the application of R744.



CO_2 molecule

Usage

R744 is used in the following system types:

- Pumped secondary – where R744 is the secondary fluid cooled by a primary system. R744 is a volatile secondary which, coupled with the high capacity and density, reduces the required pump power compared to other secondary fluids such as glycol.
- Cascade – where the heat rejected by the condensing R744 is absorbed by the evaporating refrigerant in a separate high stage system. In these systems the R744 operates below the critical point and the high side pressure is generally below 40 bar g. The high stage system can be R744 (see below), or it can be HFC, HC, HFO or R717.
- Transcritical systems – where the R744 heat is rejected to ambient air and at ambient temperatures above approximately 21°C the R744 will be above the critical point (31°C) – i.e. it will be transcritical. The R744 does not condense – it remains a super critical fluid until its pressure is reduced to below the critical pressure (72.8 bar g).The high side pressure is typically 90 bar g when transcritical.

Currently (2014) R744 has been used in several thousand retail systems and in industrial systems in Europe. It is starting to be used in heat pumps and in integral systems. Some examples of R744 are shown below:

The application of R744 has required additional skills for design engineers and service technicians, and availability of new components.

This video gives an introduction to carbon dioxide properties when used in refrigeration

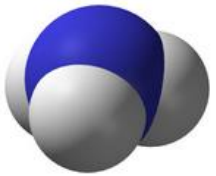
Module 1 - Introduction to Alternative Refrigerants

R717 (Ammonia, NH_3) GWP = 0

Properties

R717 has a relatively high saturation temperature at atmospheric pressure, is highly toxic, mildly flammable and has a pungent odour.

It can be smelt at concentrations of just 3mg/m^3 so it is evident at levels much lower than those which are hazardous (the ATEL / ODL is 350 mg/$m^{3)}$. It is the only commonly used refrigerant which is lighter than air which means that dispersion of any leaked refrigerant takes place quickly.



NH_3 molecule

R717 also operates with very high discharge temperatures. Single stage compression can therefore normally be used above -10°C evaporating temperature. Below this, two stage compression with interstage cooling is required.

The high toxicity limits the application of R717 to very low charge systems or industrial systems (i.e. systems in areas which are not accessible by the general public). This typically includes distribution cold stores and food processing plants, usually using secondary systems where R717 is the primary refrigerant.

Some examples of Ammonia packaged systems are shown below:

Ammonia corrodes copper so steel pipe work and open drive compressors are used. It is also immiscible with conventional mineral oils, making oil rectification an additional requirement of the refrigeration systems. The use of steel pipe, open drive compressors and oil rectification impact on the capital cost of an ammonia installation.

The video below shows an example of an adsorption ammonia system used in a building services application

Module 4 - Guidance on the Maintenance and Repair for Alternative Refrigerant Systems

The safe working environment and PPE

Flammable Refrigerants

This section covers the safe handling of:

- Hydrocarbons (R600a, R290, R1270);
- R32 (also refer to the section on F Gases);
- R1234ze (also refer to the section on F Gases);
- R717 (also refer to the section on R717).

The safe working environment and PPE

The safe working environment and PPE When you work with flammable refrigerants the area must:

- Be well ventilated
- Have no source of ignition within 3 m (a typical safe area when working on flammable refrigerant systems).

If necessary introduce forced ventilation using a suitable fan assembly. This has an Ex rated fan motor and a 5m cable which enables it to be switched on outside the safe work area.

Figure 1, suitable ventilation fan

When carrying out invasive work, or if a leak is suspected, check and monitor the work area using an HC detector.

It is important that the detector cannot be zeroed out to background flammable refrigerant levels and alarms at 20% of the lower flammability level.

The photo shows suitable detectors for HCs.

Figure 2, flammable gas detectors

You should also have a fire extinguisher to hand.

This should either be a dry power type with a capacity of at least 2 kg, or an equivalent sized CO_2 type.

Figure 3 (left), dry powder fire extinguisher
Figure 4 (right), CO_2 fire extinguisher

Real Alternatives to comply to 517/14 Article 10 Training and Certification

8. Member States shall ensure that all natural persons holding certificates under certification programmes provided for in paragraphs 1 and 7 have access to information regarding each of the following:

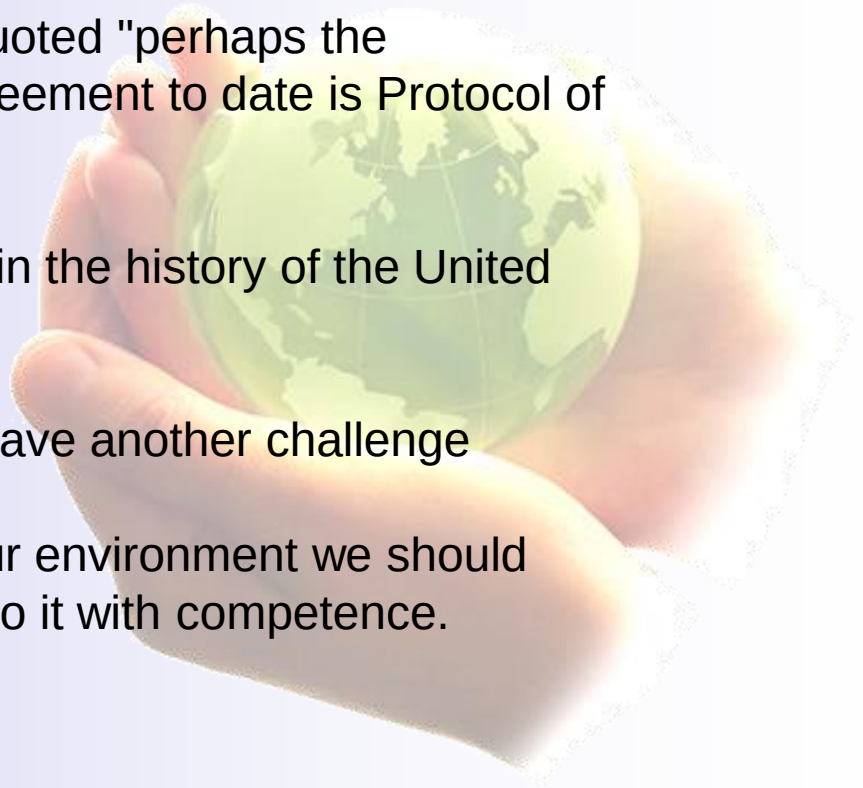
(a) technologies referred to point (e) of paragraph 3

9. Member States shall ensure the availability of training for natural persons who wish to update their knowledge in relation to the matters referred to in paragraph 3

New Challenges

DUBAI PATHWAY ON HFCS

- This week in Kigali–Rwanda is taking place MOP28 and will be decided the future of a HFCs phase down worldwide under the Protocol of Montreal
- Kofi Annan past Secretary General UN quoted "perhaps the single **most successful** international agreement to date is Protocol of Montreal"
- Signed by 197 countries – the first treaty in the history of the United Nations to achieve universal ratification
- Today, in the hottest year on record, we have another challenge
- To preserve our water, our climate and our environment we should move to new refrigerants but we should do it with competence.



Join the European refrigeration, air conditioning and heat pump contractors for their

COCKTAIL RECEPTION

WEDNESDAY, 12 OCTOBER 2016

17:30

HALL 9/ 9-320

AREA

BIV

CHILLVENTA

New AREA membership category: International Observers

Due to the significant worldwide interest in European legislative evolutions, and the increase in competence of the personnel who handle the new refrigerants, we wish to introduce to you the brand new "International Observer" membership category in AREA. This will give a fantastic opportunity for RACHP installers' bodies, throughout the world, to benefit from the expertise and discussions within Europe through their access to AREA.

!Meet AREA
22 EU Associations of
RAC Technicians!

Email: buoni@centrogalileo.it

Marco Buoni

VicePresident, AREA

Air Conditioning & Refrigeration European contractors' Association

(www.area-eur.be)

Secretary General Italian Association of Refrigeration Technician, ATF

(www.associazioneATF.org)

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