



**Natural Refrigerants:
the only solution?
ATMOSphere 2010**

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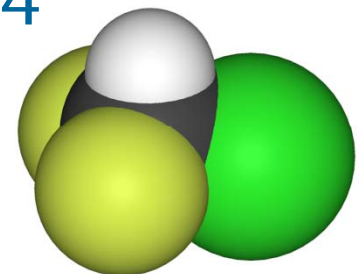
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- NVKL is the Dutch Association for companies active in Refrigeration and Airconditioning
- Contractors and suppliers
- 500 members
- Quality demands for contractors
- Major themes: Technology, Marketing and Education



- Montreal Protocol (1989): ban on CFC's en HCFC's
- CFK's: R11, R12 and R502 allready phased out
- HCFC's: R22 en 401, 402, 403, 408 en 409 (still on the market)
- R22 to be phased out at end of 2014





Aim NVKL: ensuring highest level of reliability, energy efficiency and cost-effectiveness

Key element in designing RAC system: “right” refrigerant; criteria:

- Characteristics of system
- Use
- Location
- Safety
- Cost
- Energy efficiency
- Environmental performance



- NR's play important role in future
- In terms of energy perf suitable in certain systems
- HC's perform well in smal applications
- CO₂ and NH₃ most adapted in large systems

However:

- NR's need much higher level of knowledge
- < 10% of contractors (NL) are equipped
- Education is highest priority
- First 10 years insufficient capacity



NVKL realised NR education in 3 modules:

NR1:

- Explaining differences between natural and synthetic refrigerants
- Specific information
 - rules, laws and developments in next future
 - durability
 - comparison of designs
 - propane, isobutene, carbon dioxide (CO₂), ammonia NH₃ (R717), ammonia with demethyl ether (R723)
- Introduction half day only

Goal: grow of interest and more widely knowledge



NR2:

- Designing and engineering systems with natural refrigerants
- Technical documentation and work instructions
- Energy consumption and possibilities for governmental grants
- 10 evenings 16.00 till 20.00
- **Goal:** Theoretical knowledge on system design and safety



NR3:

- Practical exercises on CO₂, NH₃ and propane systems in operation
- Learning and training of skills necessary if working with natural refrigerants and the use of personal safety provisions
- Focus on a number of cases as in normal practice:
 - Gas sensors with set values
 - How to handle in emergency circumstances
 - Start up and shut down procedures
 - Oil draining
 - Changing dryer cores
 - Replacing of some components



- Training and learning on environmental safety, based on:
- EN 378: requirements of the competent persons
- EN 13313: Competence of personnel
- Dutch rules for Ammonia plants PGS13
- 5 days including examination and certification



Training unit consists of:

- NH_3/CO_2 cascade system, capacity 50 kW
- NH_3 pump system with cold room
- Flooded NH_3/CO_2 cascade condenser
- CO_2 pump system with a cabinet for CO_2 as coolant
- CO_2 compressor system at $-35^\circ/-8^\circ\text{C}$
freezing room at -30°C
- Emergency cooling system with propane

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Trainings unit at site

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File Edit View Layers Clusters Options Modes

NVKL Groep 1

Blindschema :

Instellingen :

Zuigdrukregelwaarde : Bar
 Persdrukregelwaarde : Bar
 Maximale temp. kopkoeling : °C

Meetwaarden :

Compressor status : Rust
 Compressor storing : Geen storing

Zuigdrukmeetwaarde : -18,3 Bar
 Persdrukmeetwaarde : -4,2 Bar

Rapporten :

Alarmen Grafieken
 Schakelacties Details

Legenda

- Kijkglas
- Persgas
- Zuiggas
- Vloeistof

Compressor K11

- Thermische
- Lage druk
- Hogedruk
- Oliedruk
- Persgastemp. H
- Persgastemp. L

Templates

Van Kempen Koudetechniek 13:29:38

Groep

1 2 3
 4 5 6
 7 8 9
 10

Reset storing

Plattegrond
 Instellingen
 Informatie
 Inlozen
 History

File View Operations Settings Report

Start Time	End Time	Ack Time	Severity	Comments	Text
29-09-2009-08:27:48	29-09-2009-10:49:55		50	Primair:[Tiko 1] Laag nivo koudemiddel lekkage NH3	
29-09-2009-10:49:20	29-09-2009-11:20:40		30	PMP31 [Tiko 1]: Thermische storing pomp Kopkoeling	
29-09-2009-11:20:50	29-09-2009-11:20:55		30	PMP31 [Tiko 1]: Thermische storing pomp Kopkoeling	
29-09-2009-08:27:48	29-09-2009-10:51:25		10	Primair:[Tiko 1] Storing detectie module NH3	
29-09-2009-10:49:20			30	PMP33.1 vloerverwarming : Thermische storing	
29-09-2009-08:27:49			30	Nivo:[Tiko 1] Laag nivo melding	

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start ControlMaestro User ... Unacked : 21 - Event... Setpoint Loader NL 13:29

Simulation example



However:

- No refrigerant offers ideal solution in all cases
- Each system to be looked at in its own merits
- HFC's remain most energy efficient in wide range of small / medium applications
- Let expert contractors make professional choice



And:

- HFC's are harmless when kept in
- When we can prevent NH₃ leaks: we can also keep HFC's in
- HFC's remain most energy efficient in wide range of small / medium applications
- Let expert contractors make professional choice



Therefor:

- Development of NR's is a positive evolution
- As is the development of more environmental friendly synthetic refrigerants
- Energy efficiency records of HFC's must not be ignored.



Thank you!