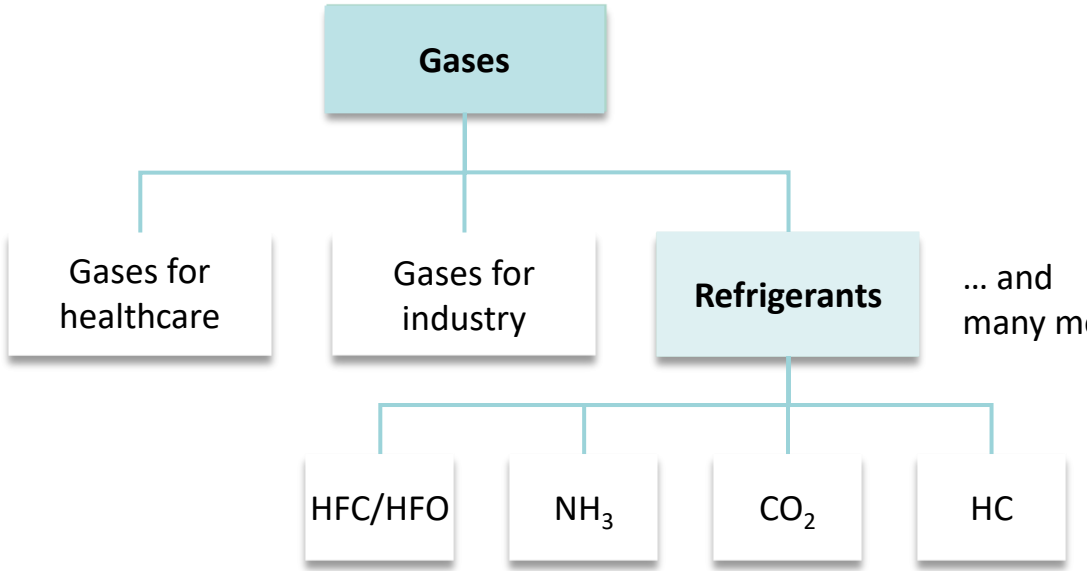
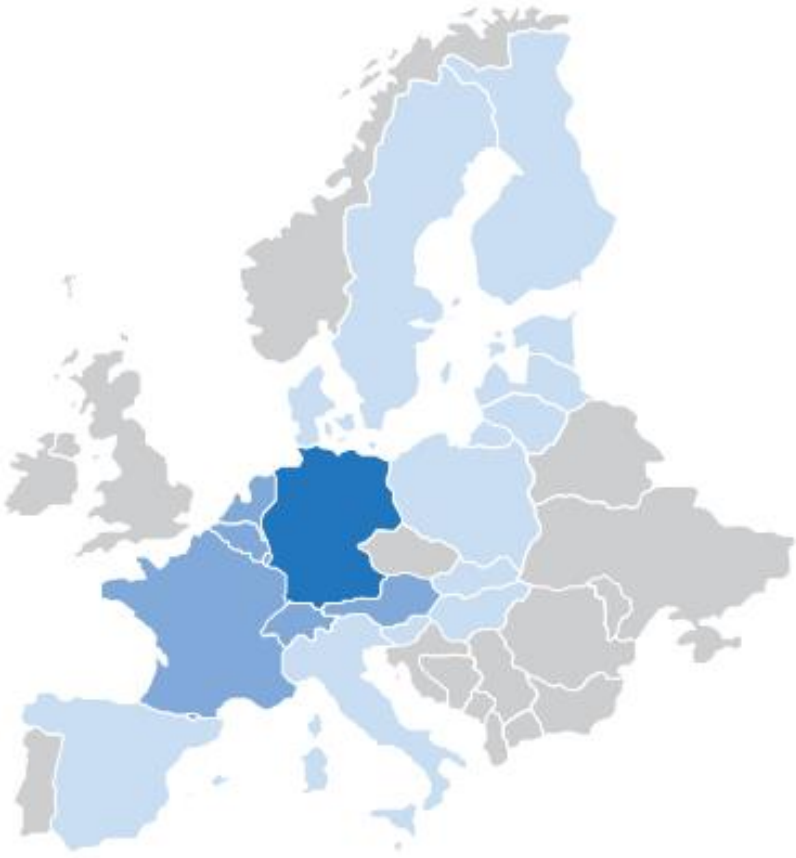
Challenges from the perspective of a refrigerant distributor

Marius Appenzeller I Westfalen Group I May 26th 2021

Our business units and our strength: availability and flexibility



- Experts in refrigerants since the 80s.
- Continuous growth of the business unit.
- Investment in new technologies, i.e. modern filling plants.
- Advanced logistic systems.
- Technical expertise in reclamation.



In Central Europe:

- 14 Westfalen logistic hubs
- More than 230 trucks for bottles under contract
- 480 distribution depots

Westfalen AG
Subsidiaries
Direct OEM supply

The natural refrigerants

NH_3
Ammonia

C_3H_8
Hydrocarbons

CO_2
carbon dioxid

Distribution of ammonia

- Storage only in specially equipped locations (plants).
- Filling content 500 kg (drum), 67 kg, 40 kg.
- Reference statement is mandatory.
- No F-gas certification is required.
- If a „Frigorist“ works on an Ammonia system, there is an increased risk potential!

Storage

Ammonia accident

Ammonia accident 2019-03-27

- 14 injured persons after ammonia leak at ice stadium.
- A pipe was damaged during construction work on the ice rink.
- The City of Straubing set up a citizen telephone.
- Specialized company has been requested.
- Reporting in the daily press.

Further educational measures by the industry are urgently required!

Transportation and storage of flammable refrigerants

- Shipment is not a major issue for suppliers.
- There is no difference between transport of propane for fuel applications or flammable refrigerants.
- Storage depends on quantity.
  - More than 2.9 tons of flammable substances (propane, acetylene, forming gases, refrigerant A2L/A3) are subject to the 4th regulation implementing the Federal Immission Protection Act in Germany.
- Construction approval required, time consuming and expensive.
- Bottling in ex-protected factories.

Used flammable refrigerants

Green Cooling Summit 2021

Maximum filling weights

Volume in liters	T12	T27	T52	T400	T900
R-290	3,5 kg	8 kg	15 kg	120 kg	270 kg
R-600a					
R-1270					
R-600					
R-32	6,5 kg	13 kg	24 kg	210 kg	490 kg
R-1234yf					
R-152a					
R-452B					
R-454A					
R-454B					
R-454C					
R-455A					

Attention! Do not overfill cylinders/drums. Danger of bursting

Cylinders for waste disposal
Only applicable for refrigerants according to label

This is criminal

Westfalen

Prüfbericht
"Flaschen/Fässer für Abfall zur Verwertung" **Nr.: 3324/19**

Gebinde: 27600503719083 (307249): R-Ware gefüllt T12 MFI R-410A
Kunde:

Prüfung und Analyse am 22.05.2019

Netto-Inhalt: 2,2 kg

Kältemittelanalyse: ☐ Wiederaufarbeitung möglich ☒ Wiederaufarbeitung nicht möglich
☐ Anlagegebinde

Bemerkungen:
Achtung !!!! Die Flasche enthält R 290 (Propan)

Widerrechtliche Befüllung! Keine Zulassung des Behälters für das eingefüllte Gas.

Durchgeführte Arbeiten:
☐ Spülen der Flasche/des Fasses
Abgepumpt in Fass-Nr.: am

Analyseergebnis:

• R 290	88,65 %	• R 32	7,27 %
• R 600a	3,79 %	• R 134a	0,29 %
• R 22	0 %	• R 125	0 %
• R 143A	0 %	• R 1234ze	0 %
• R 1234yf	0 %		

Quality of R-744

AHRI 700 Standard

- Carbon dioxide 3.0 (99,9%)
- Moisture 10 ppm by weight

Westfalen Quality: Pronat R-744

- Carbon dioxide 4.5 (99,995%)
- Moisture 5 ppm by volume = 2 ppm by weight

Table 1C Carbon Dioxide Refrigerant Characteristics and Allowable Levels of Contaminants

	Reporting Units	R-744
CHARACTERISTICS:		
Sublimation Point[1]	°C at 101 kPa	-78.4
Sublimation Point Range[1]	K	± 0.3
VAPOR PHASE[2]:		
Air and other non-condensables, Maximum	% by Volume at 10°C below the critical temperature and measure non-condensable directly	1.5
LIQUID PHASE[3]:		
Water, Maximum	ppm by weight	10
Hoigh Boiling Residue, Maximum	% by weight	0.0005
Particulates/Solids	Pass or Fail	Visually Clean
Minimum Purity	% by weight	99.9

Notes:
1. Sublimation Point, sublimation point range, although not required, are provided for informational purposes. Refrigerant data compiled from Refprop 9.1.
2. Sample taken from vapor phase.
3. Sample vaporized from liquid phase.

R-744, unter Druck verflüssigt

unter Druck verflüssigt DIN 8960				
Reinheit	99,995 Vol.-%			
Bezeichnung	R-744			
Nebenbestandteile				
Stickstoff + Sauerstoff	45 Vol.-ppm			
Feuchte	5 Vol.-ppm			
Kohlenwasserstoffe	50 Vol.-ppm			
Kohlenmonoxid	5 Vol.-ppm			
Lieferformen	In Stahlflaschen und Bündeln mit 12 Flaschen			
Flaschen-/Behältervolumen	13,4 l	33,0 l	50 l	12 x 50 l
Inhalt (kg)	10	25	37,5	450
Dampfdruck (bar)	57,3	57,3	57,3	57,3

Quality is crucial for system stability

low viscosity = high purification effect

leads to high pressure drops due to contamination

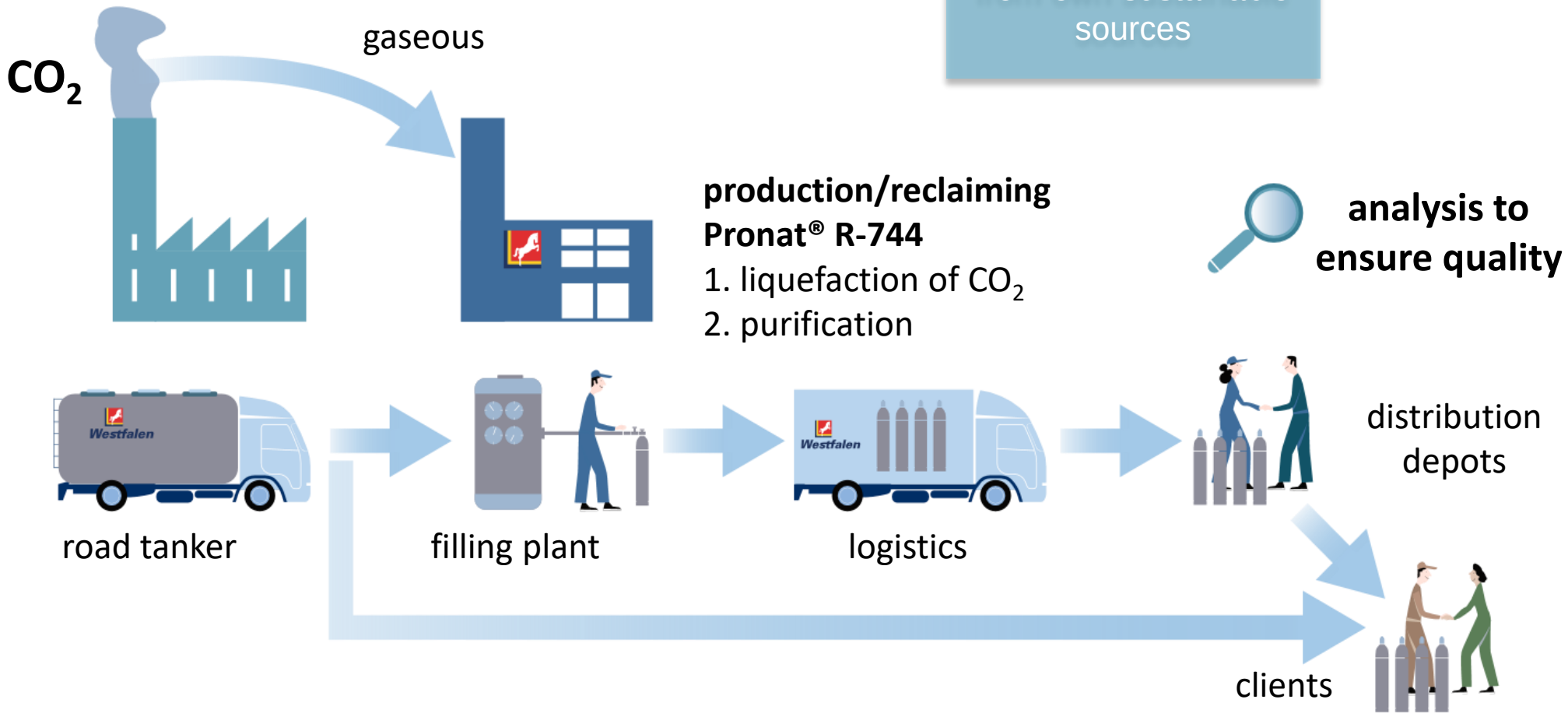
moisture in systems

may cause corrosion, formation of acid and ice (hydrates) on valves

Images: TEKO Gesellschaft für Kältetechnik, TEKO INFO Saubere Anlagentechnik durch Vermeidung von Verschmutzungen in CO_2 Anlagen

Production of R-744

over 50%
from own sustainable sources



A major change for the entire refrigeration industry

The EU climate goals can only be achieved through extensive changes in the substances used in refrigeration/air conditioning supply.

Natural refrigerants will cover a large part of the applications in the future.

There are still major challenges in terms of training and building up know-how in the industry.

Clear and pragmatic rules for the use of flammable refrigerants need to be established and communicated.

"The Shift to climate-friendly refrigerants can only succeed with a practical approach that includes knowledge transfer within the entire supply chain."

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