

End User Experience with Ammonia and CO₂

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ATMO
sphere
faster to market
natural refrigerants

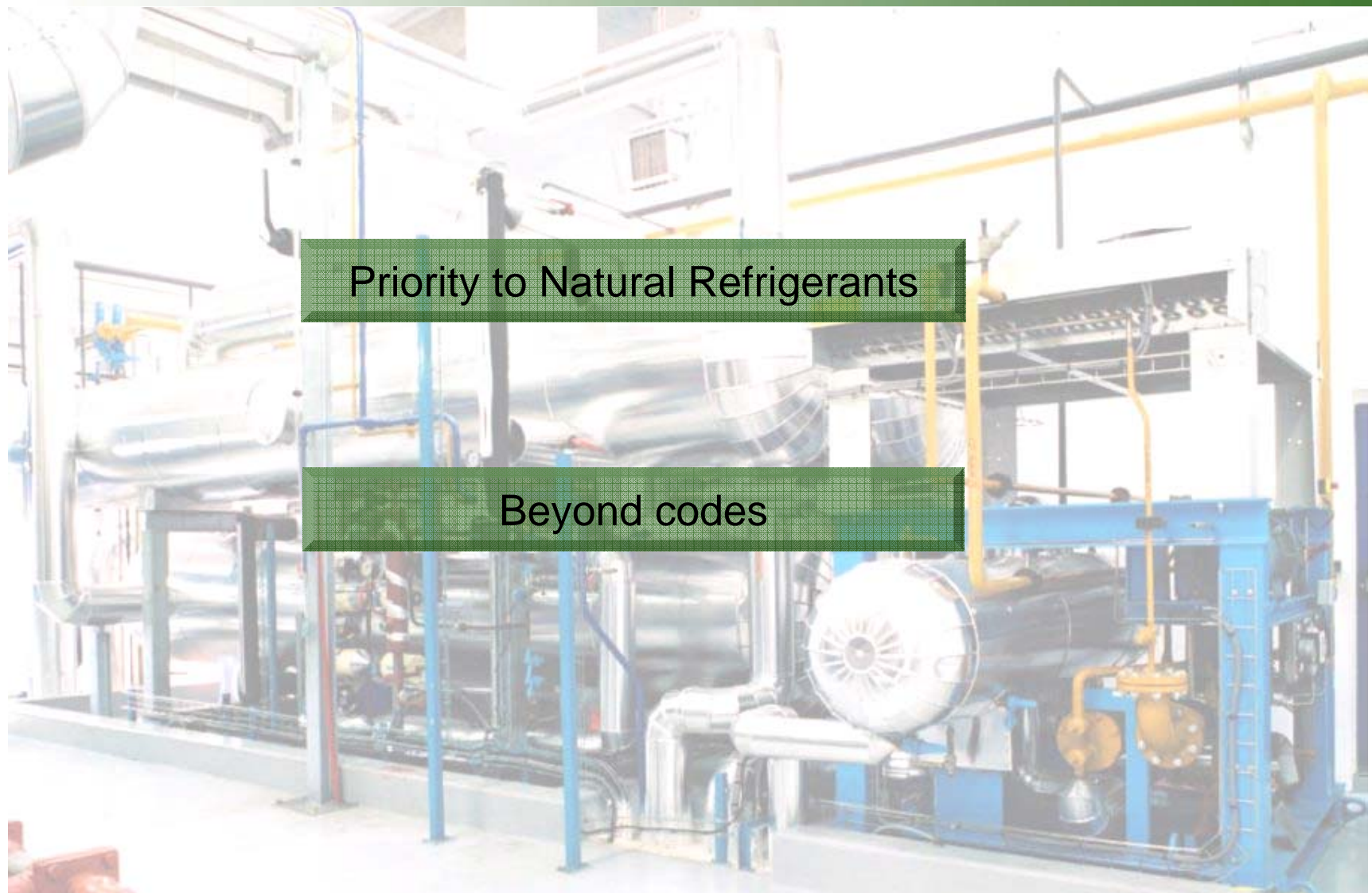
October 19-20, 2009

Brussels, Belgium



Presentation Steps

20'



Priority to Natural Refrigerants

Beyond codes

Priority to natural refrigerants



Industrial Refrigeration



Positive Temperatures

- NH₃ Chillers
- HC's , CO₂ ?

Negative Temperatures

- CO₂ / NH₃ cascade
- CO₂ as brine



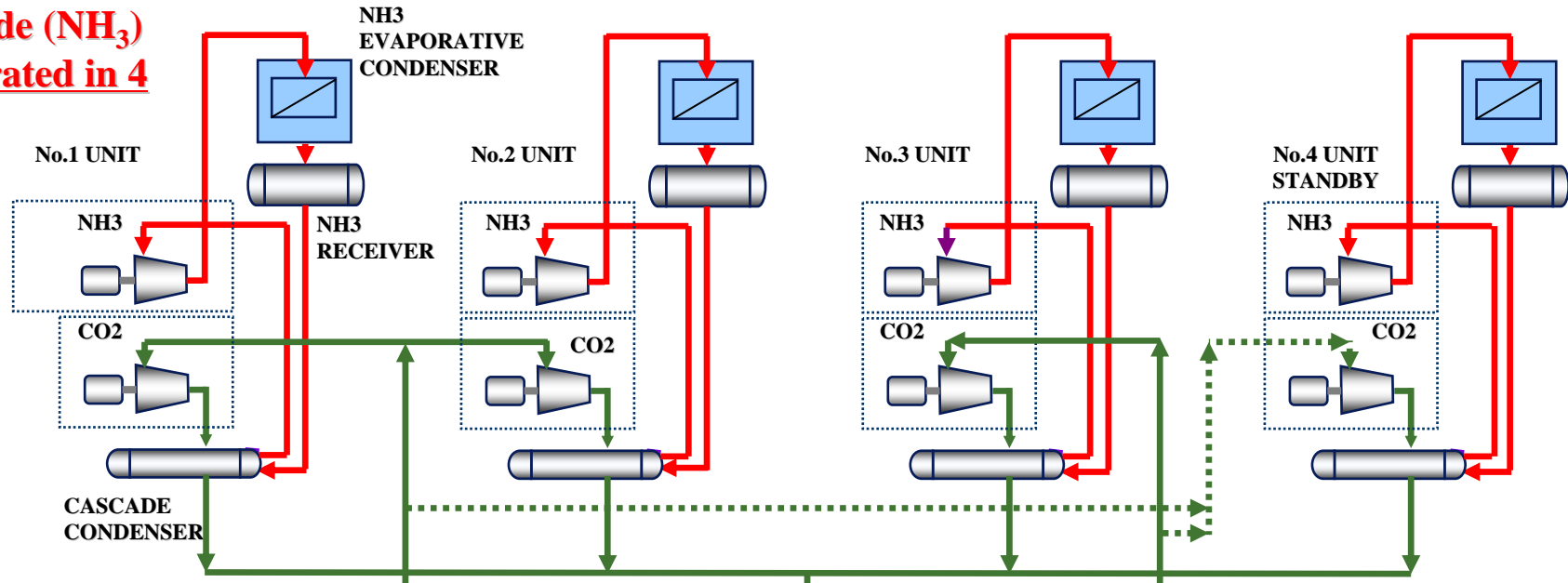
Deployment on going, cost and availability issue for small size units

$\text{CO}_2 / \text{NH}_3$ cascade (Japan - Coffee Freeze Drying)

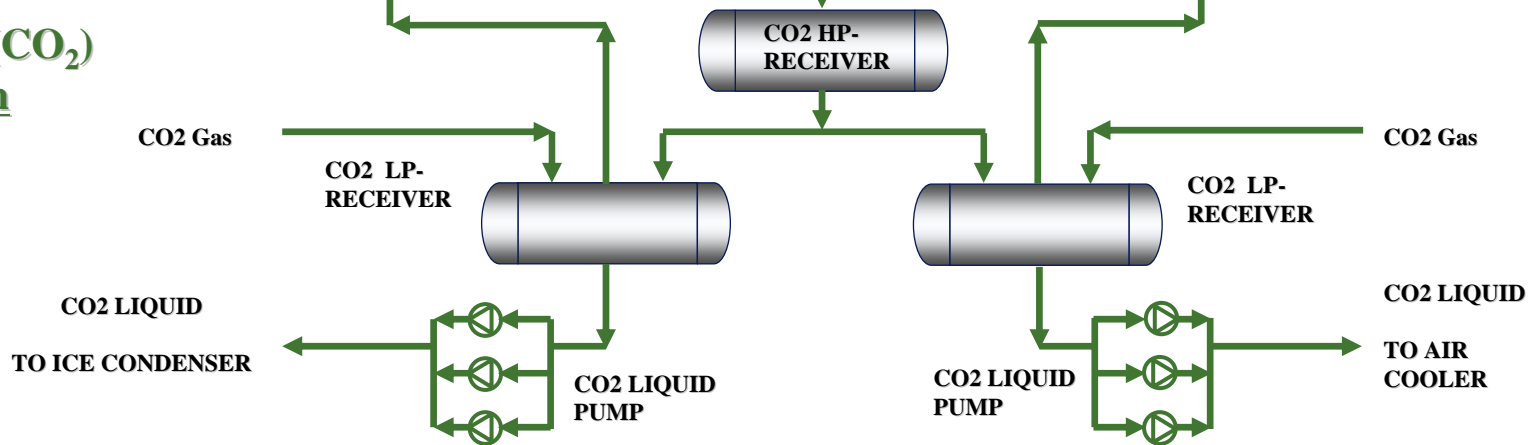


CO₂ / NH₃ cascade (Japan - Coffee Freeze Drying)

**High side (NH₃)
is separated in 4**



**Low side (CO₂)
is common**



World first CO₂ ice cream freezer



High stage

NH₃

Low stage

CO₂



- First skid mounted unit Thailand IC Factory
- Refrigeration capacity: @ -45°C/-7°C/+38°C: 380 kW

CO₂ / NH₃ cold store (Moscow)



CO₂ / NH₃ cascade (Czech Republic)

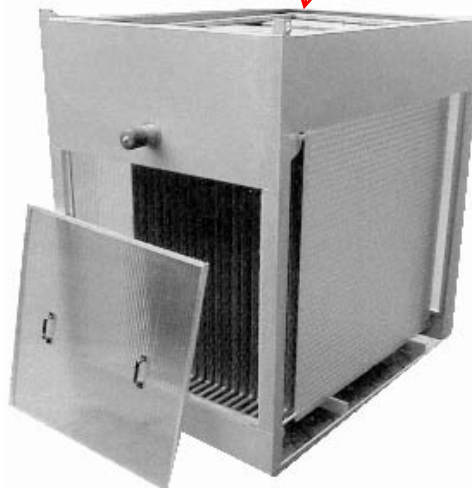


CO₂ piston
compressors

Ammonia Chiller - Nigeria



Ammonia chilled water plant Indonesia



- Cooling capacity 3'000 kW
- Water supply temperature +3°C
- 2 screw compressor package
- 2 Falling film evaporator

Ammonia Water Chiller Shanghai



- 2 screw compressors (duo)
- Cooling Capacity: 1'000 kW
- Ammonia charge: 110 kg
- Water temperature +12°C/+7°C
- Evaporator/Condenser: Plate Heat Exchangers

Ammonia Water Chiller Vietnam



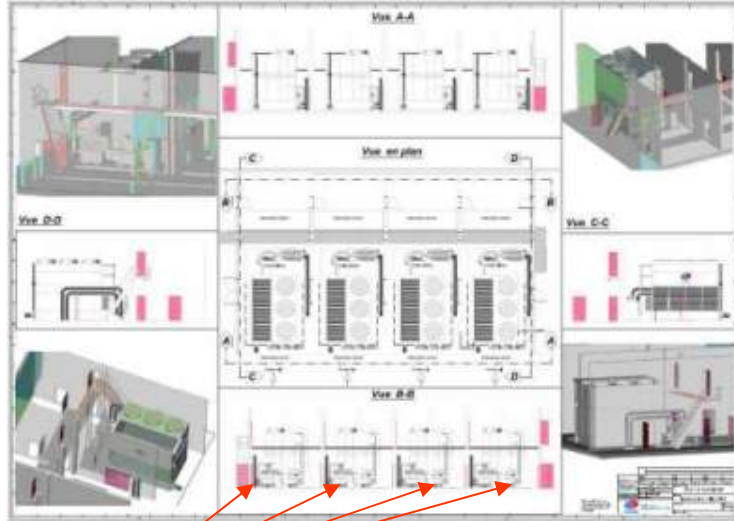
- 1 piston compressor
- Cooling Capacity: 700 kW
- Ammonia charge: 30 kg
- Water temperature: +13°C/+7°C
- Evaporator/Condenser: Plate Heat Exchangers





Low charge Ammonia water chillers for buildings

Computers Servers centre



NH₃ absorber



R&D Centre

~100 kW, 5 kg NH₃
installed above the walk-on ceiling



Wellnes centre - Vevey HO - Switzerland



NH₃ glycol Chiller



CO₂ DX
unit



Flammable HC water chillers



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Refrigerants

Natural refrigerants have replaced most ozone depleting substances

For nearly two decades, Nestlé has played a leadership role in developing and implementing sustainable, natural alternatives to ozone depleting substances for large scale industrial refrigeration, well ahead of the requirements imposed by the Montreal Protocol.

Since 1986 we have reduced emissions of ozone depleting substances per tonne of product by 99%. Currently we have 6 major investments in industrial refrigeration plants underway which will result in a further 80 tonnes of R22 being removed from our installations. Investment into these environmentally superior technologies currently stands at CHF 34.3 million.

Nestlé is now extending this experience to smaller, commercial refrigeration units and has started building and testing ice cream freezers with CO2 refrigeration systems. This natural substance fulfils most requirements expected from a modern refrigerant, and, unlike currently available solutions, it has a negligible impact on the environment and is inherently safe even under the most extreme conditions.

Natural Refrigerants Nestlé has played a leadership role in developing and implementing sustainable alternatives to ozone depleting substances for large scale industrial refrigeration, well ahead of the requirements imposed by the Montreal Protocol. The Company's program to replace CFCs and HCFCs by environmentally

Documents

[A reminder on Nestlé Policy on the use of Natural Refrigerants](#)
(pdf, 305 kb)

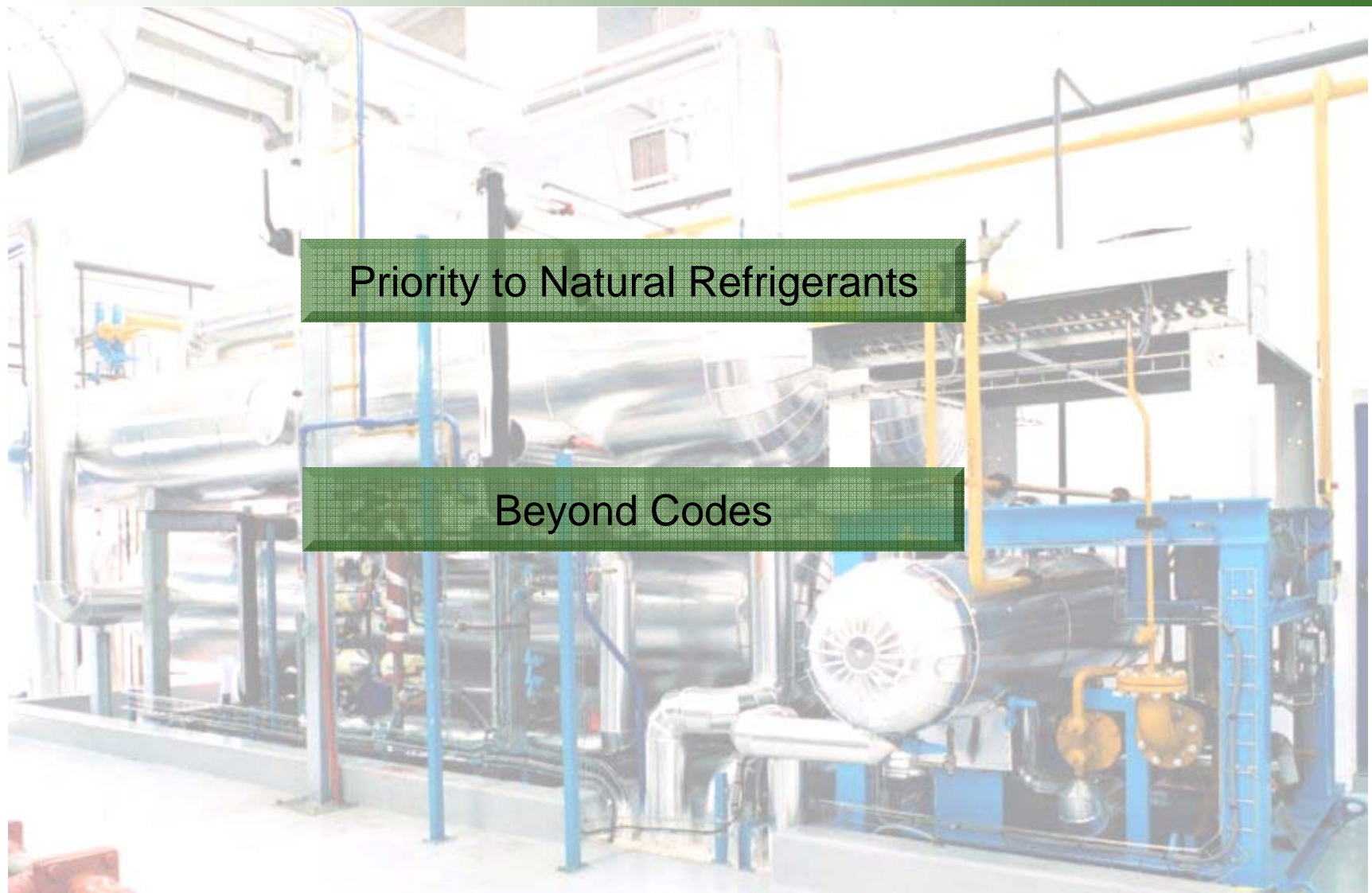
[Nestlé Position on Refrigeration](#)
(pdf, 78 kb)

[Sustainable Refrigeration - Commercial Application](#)
(pdf, 219 kb)

[Sustainable Refrigeration - Industrial Application](#)
(pdf, 601 kb)

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Presentation Steps



Priority to Natural Refrigerants

Beyond Codes

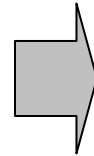
Beyond codes

- **Compliance to codes is not enough.** Not all aspects are covered: The way the equipment is arranged, installed, operated and maintained. A safe component that is not properly installed or maintained can lead to unsafe situations.
- With the number of ammonia systems increasing, **new safeguards** are needed to avoid incidents that will be detrimental to ammonia and that can often be avoided.
- Safety of refrigeration plants is impacted by all 4 major activities:

1. Design and Manufacturing	Manufacturer/Contractor
2. Installation	Contractor
3. Operation	End user / Contractor
4. Maintenance	End user / Contractor

Safe Accesses

Good access is essential to allow to maintenance personnel to work in safe conditions and to easily access all parts of the ammonia circuits, while carrying a tool box.



Defective insulation

Condensations

Frost

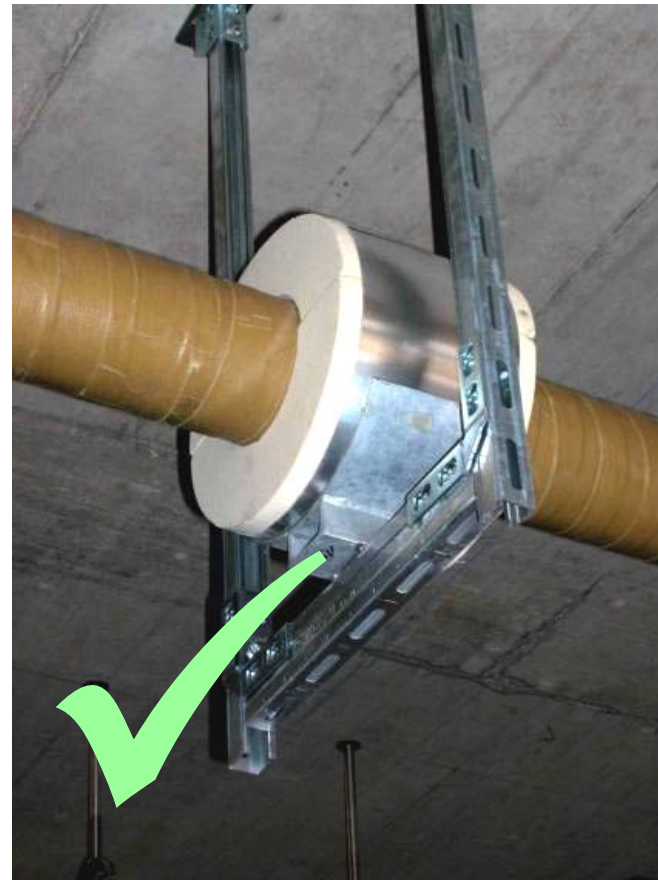


Heavy corrosion under insulation

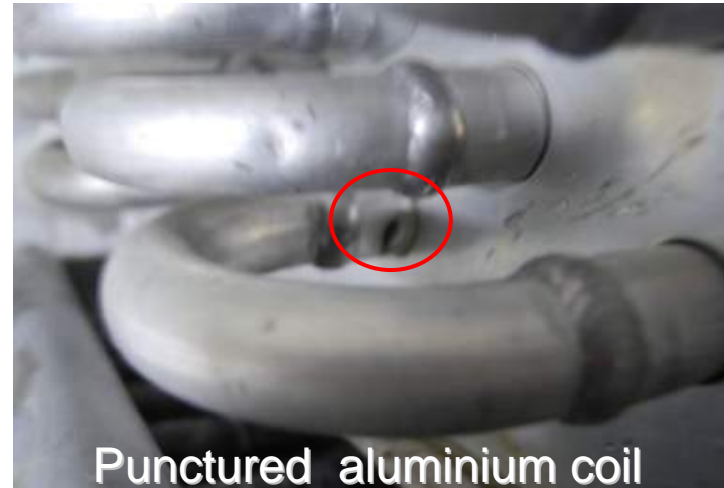
One of the most common diseases of refrigeration plants



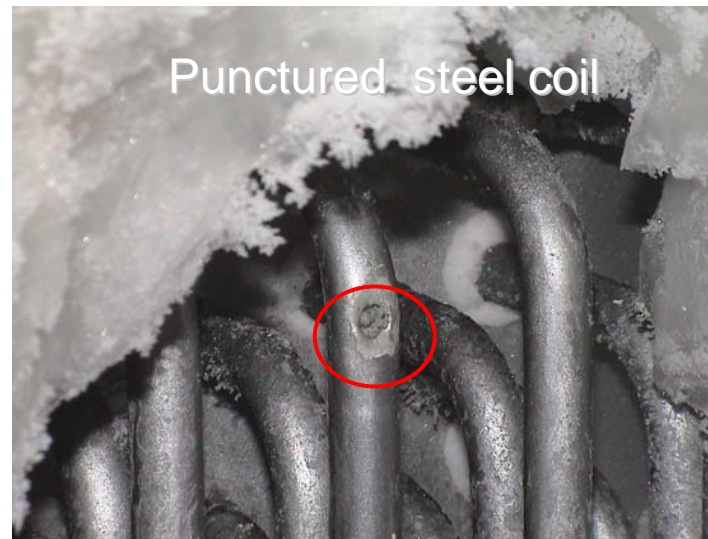
Good, long lasting protection against corrosion: Grease tape



Defrosting with a screw driver and a hammer...



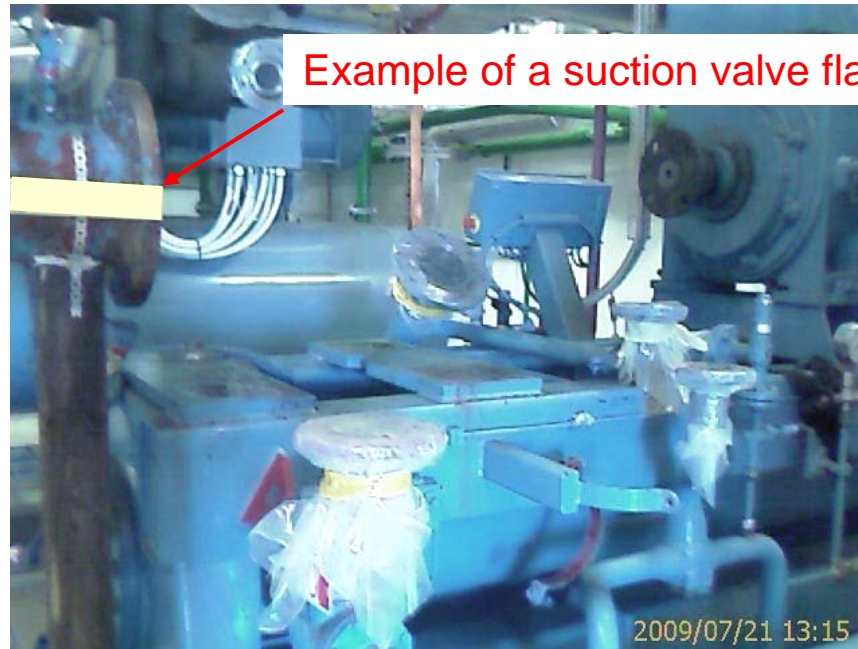
Punctured aluminium coil



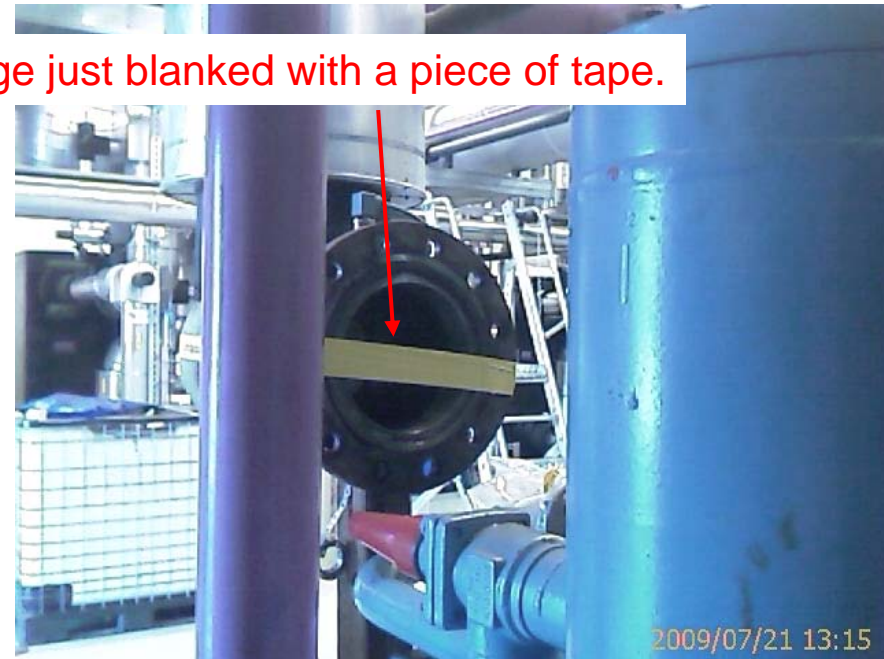
Punctured steel coil

Conclusion

Poor example of outsourcing: Any live opened pipe must be **blinded with plain counter flanges**, not relying on shut off valves alone.



Example of a suction valve flange just blanked with a piece of tape.



A **code of good practice** and **know how development** are needed.

Ammonia is an excellent refrigerant, much safer when used in combination with CO₂



Thank you for the opportunity