

A lifecycle approach to refrigerants

Stambul, February 6, 2026

**System of refrigerant collection, recycling,
and reclamation in Poland (RRR), organised
and run by PROZON, the Foundation for
Climate Protection.**

As-salamu alaikum

السلام عليكم

Krzysztof (KRIS) Grzegorzcyk
President of the Management Board



PROZON Foundation

The main objective was to meet the commitment of the Montreal Protocol to have a 3R network (1996)

- Recovery, Recycling, and Reclamation network was created **(3R)**
- The Reclamation Center was created with a specialized laboratory
- More than 1000 contracts with R&AC services were signed
- The main financing for the equipment was by Global Environmental Fund (World Bank), EkoFundusz, Founders: **Air Products, Linde, Schiessl Polska**
- 2500 RAC personnel were trained and received the „Green Card” – 1998/1999

PROZON in numbers.



20.000 special cylinders on the market



6000 partners



2.500 tons of refrigerants collected



5000 personnel trained for certification

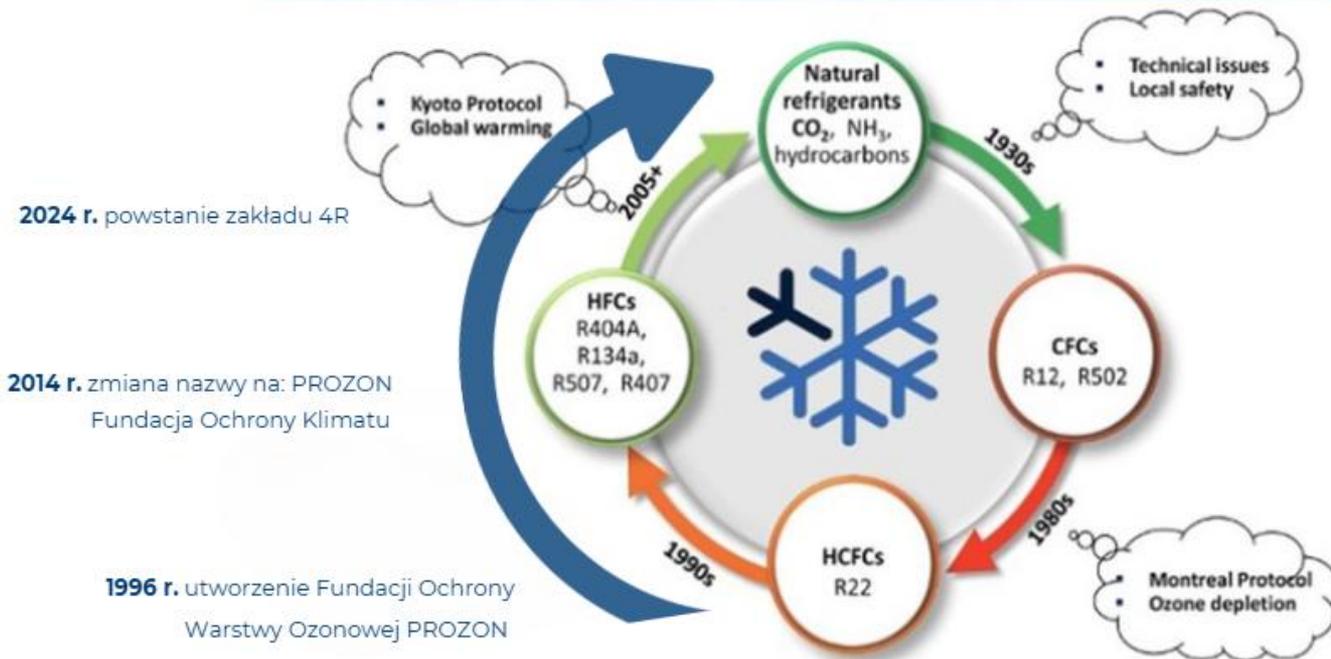


2000 people accredited for F-gas certificates



300 people accredited for SF6F-gas certificates SF₆ certificates

The Closed CycleDriving Natural & Alternative Refrigerant Solutions



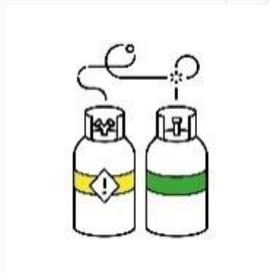
Definitions



Recovery

„Means the collection and storage of fluorinated greenhouse gases from products, including containers, and equipment during maintenance or servicing or prior to the disposal of the products or equipment.”

Evacuation of refrigerant from the AC, HP, or refrigeration unit



Reclamation

„Means the reprocessing of a recovered fluorinated greenhouse gas in order to match the equivalent performance of a virgin substance, taking into account its intended use;”

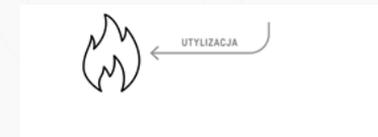
removing impurities above AHRI 700 standards



Recycling

„Recycling means the reuse of a recovered fluorinated greenhouse gas following a basic cleaning process.”

Basic cleaning process (not tested result)

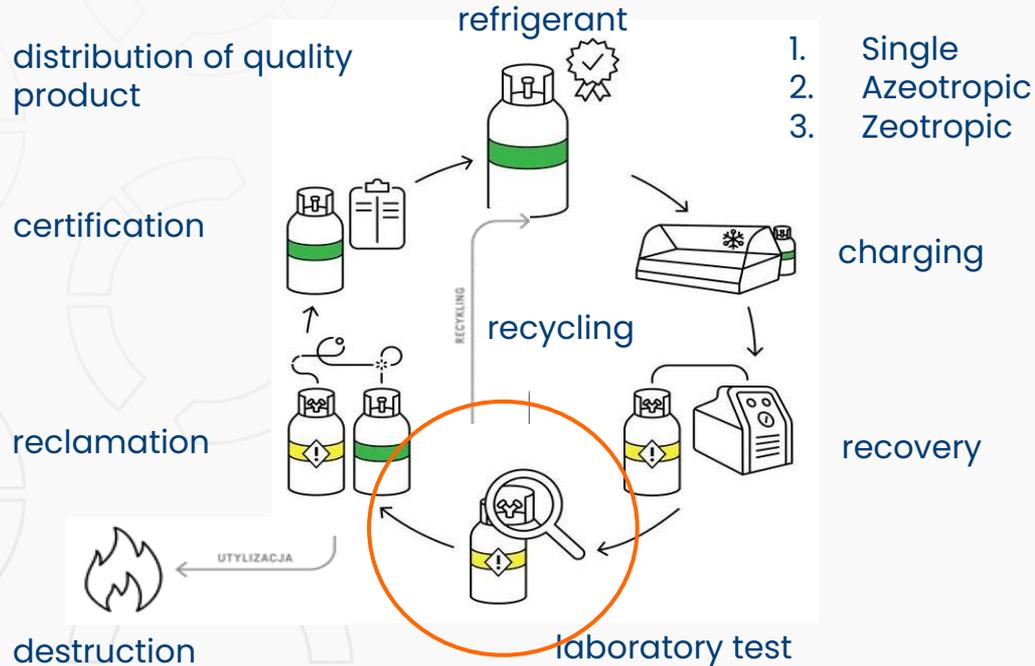


Destruction

„means the process of permanently transforming or decomposing all or most of a fluorinated greenhouse gas into one or more stable substances that are not fluorinated greenhouse gases;”

incineration

The lifecycle of refrigerants



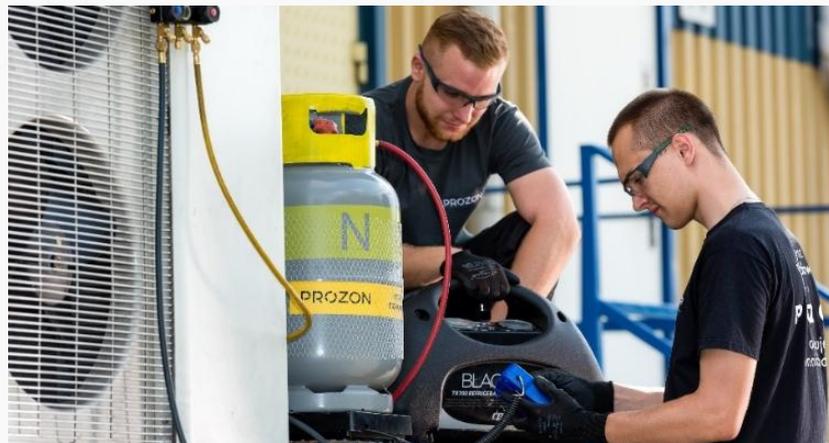
Refrigerants packaging



Recovered refrigerants sources



Recovery



Laboratory testing



Cylinders preparation



Challenges facing the industry soon

- Limited availability of high-GWP refrigerants
- Servicing is possible only with reclaimed (regenerated) refrigerants
- In many cases, the need to change the refrigerant – retrofit
- High GWP = high refrigerant price
- High GWP = limited availability
- Risk of purchasing from illegal sources
- Risk of purchasing substandard refrigerants
- Need to update and expand knowledge – safety considerations



Why the recovered refrigerants require reclamation?

Acids – destroying the installation

Wrong composition – energy consumption increases

Non-condensable gases – destroying compressors

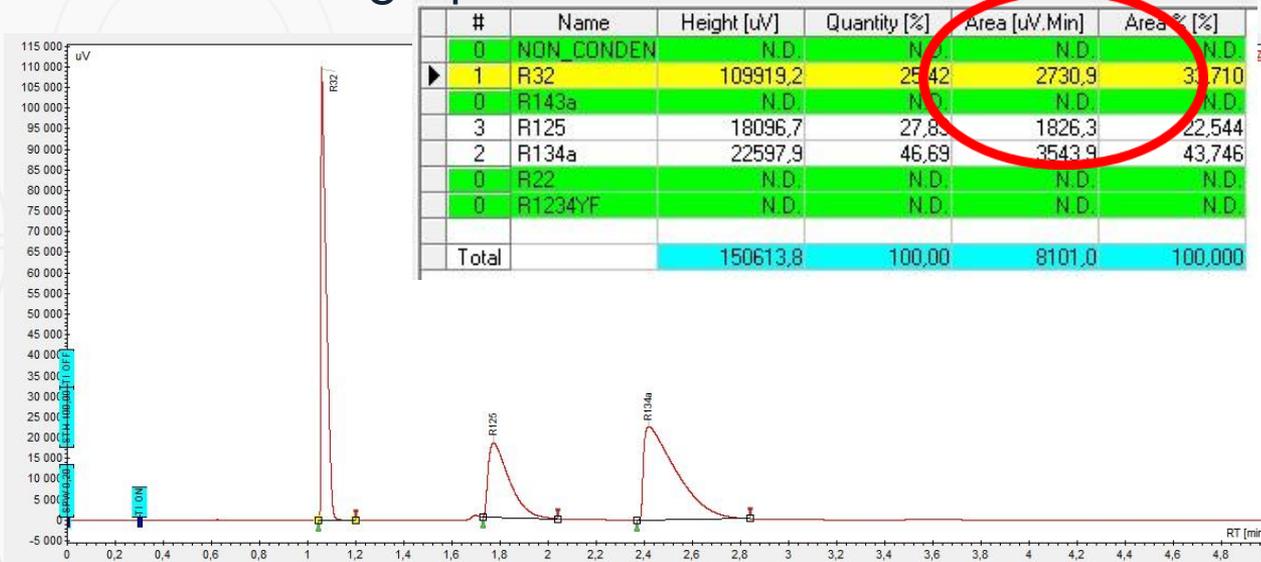
Moisture – blocks valves and capillary

Solid particles – destroying compressors



Testing refrigerants

Gas chromatograph



Karl Fisher - coulometer



23%, 25%, 52%

Reclamation

- distillation, cleaning, condensing
- removing non-condensable gases
- adding missing components
- homogenizing

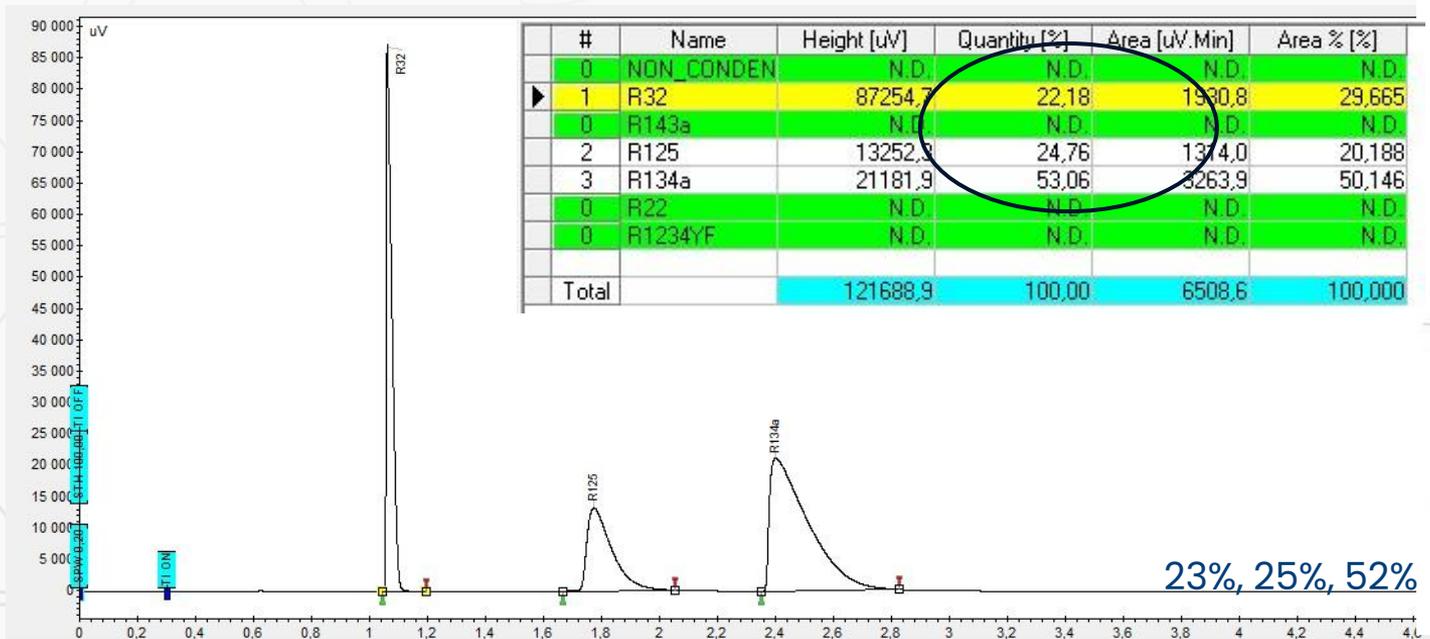


Laboratory test

- Nominal Composition
- Water content
- Acidity
- High boiling residues
- Chloride
- Non-condensable gases
- Solid particles



Quality of the products after reclamation (407C)



Aquamax KF v2.7d
 Nr seryjny 711978
 18 November 2017

Prg: 1 17:21:03 F
 Licz. netto 47.92ug
 Dryft: 0
 Format wyniku ppm
 Tryb obliczen W/w
 M. calkow. 610.6800 g
 Masa tary 602.4700 g
 Masa probki 8.2100 g
 Wynik 5.84 ppm

Aquamax KF v2.7d
 Nr seryjny 711978
 18 November 2017

Prg: 1 17:29:04 F
 Licz. netto 46.28ug
 Dryft: 1
 Format wyniku ppm
 Tryb obliczen W/w
 M. calkow. 602.5000 g
 Masa tary 594.2000 g
 Masa probki 8.3000 g
 Wynik 5.58 ppm

High moistures – stages of the reclamation

Laboratorium PROZON Fundacja Ochrony Klimatu	
PROTOKÓŁ BADAŃ LABORATORYJNYCH REGENERACJA	
NUMER PROTOKOŁU: <u>REL 12017 / 34</u>	
Proces: <u>ODWODNIECIE GAZEM</u>	Proces: <u>FILTRACJA</u>
Zbiornik: <u>44081</u>	Zbiornik: <u>423623</u>
Czynnik: <u>R404C</u>	Czynnik: <u>R404C</u>
Data badania: <u>18.11.2017</u>	Data badania: <u>18.11.2017</u>
WILGOTNOŚĆ	WILGOTNOŚĆ
<p>Pog: 1 19:23:19 F Licz. netto 3174.21ug Dyfzt: 5 Formał wyniku ppm Tryb obliczeń W/u M. całkow. 862.3488 g Masa tazy 853.2499 g Masa próbki 9.8988 g Wynik: 349.28 ppm</p> <p>Pog: 2 19:48:12 F Licz. netto 3312.85ug Dyfzt: 7 Formał wyniku ppm Tryb obliczeń W/u M. całkow. 853.2499 g Masa tazy 844.6888 g Masa próbki 0.6588 g Wynik: 382.89 ppm</p>	<p>Analiza nr 711978 Nr serzynowy 711978 19 November 2017 Pro: 1 12:43:05 F Licz. netto 730.10ug Dyfzt: 1 Formał wyniku ppm Tryb obliczeń W/u M. całkow. 591.5333 g Masa tazy 582.9833 g Masa próbki 202.58 ppm Wynik: 202.58 ppm</p> <p>Analiza nr 711978 Nr serzynowy 711978 17 November 2017 Pro: 1 12:48:11 F Licz. netto 1588.87ug Dyfzt: 1 Formał wyniku ppm Tryb obliczeń W/u M. całkow. 807.8000 g Masa tazy 806.7933 g Masa próbki 7.0067 g Wynik: 203.12 ppm</p>
ŚREDNIA WILGOTNOŚĆ [ppm]: <u>366.67</u>	ŚREDNIA WILGOTNOŚĆ [ppm]: <u>202.85</u>
POZOSTAŁOŚCI STAŁE: <u>nieznane</u>	POZOSTAŁOŚCI STAŁE: <u>brak</u>
POZOSTAŁOŚCI WYSOKOWRZĄCE [‰ob.]: <u>30</u>	POZOSTAŁOŚCI WYSOKOWRZĄCE [‰ob.]: <u>40</u>
KWASOWOŚĆ [ppm HCl]: <u>60</u>	KWASOWOŚĆ [ppm HCl]: <u>40</u>
Przeznaczenie: <u>FILTRACJA</u>	Przeznaczenie: <u>REGENERACJA</u>

Proces: <u>REGENERACJA</u>	Proces: <u>REGENERACJA</u>
Zbiornik: <u>422535</u>	Zbiornik: <u>44081</u>
Czynnik: <u>R404C</u>	Czynnik: <u>R404C</u>
Data badania: <u>10.11.2017</u>	Data badania: <u>10.11.2017</u>
WILGOTNOŚĆ	WILGOTNOŚĆ
<p>Pog: 2 18:14:17 F Licz. netto 225.88ug Dyfzt: 8 Formał wyniku ppm Tryb obliczeń W/u M. całkow. 862.3899 g Masa tazy 851.4388 g Masa próbki 18.9688 g Wynik: 28.53 ppm</p> <p>Pog: 2 17:58:12 F Licz. netto 98.49ug Dyfzt: 1 Formał wyniku ppm Tryb obliczeń W/u M. całkow. 882.5688 g Masa tazy 878.8488 g Masa próbki 4.5288 g Wynik: 21.79 ppm</p>	<p>Pog: 2 18:32:48 F Licz. netto 45.27ug Dyfzt: 1 Formał wyniku ppm Tryb obliczeń W/u M. całkow. 868.3788 g Masa tazy 848.8488 g Masa próbki 5.5388 g Wynik: 6.19 ppm</p> <p>Pog: 3 18:41:39 F Licz. netto 45.19ug Dyfzt: 8 Formał wyniku ppm Tryb obliczeń W/u M. całkow. 848.8288 g Masa tazy 835.8888 g Masa próbki 5.8288 g Wynik: 7.77 ppm</p>
ŚREDNIA WILGOTNOŚĆ [ppm]: <u>24,16 ppm</u>	ŚREDNIA WILGOTNOŚĆ [ppm]: <u>7,98</u>
POZOSTAŁOŚCI STAŁE: <u>brak</u>	POZOSTAŁOŚCI STAŁE: <u>brak</u>
POZOSTAŁOŚCI WYSOKOWRZĄCE [‰ob.]: <u>1</u>	POZOSTAŁOŚCI WYSOKOWRZĄCE [‰ob.]: <u>brak</u>
KWASOWOŚĆ [ppm HCl]: <u>brak</u>	KWASOWOŚĆ [ppm HCl]: <u>brak</u>
Przeznaczenie: <u>REGENERACJA</u>	Przeznaczenie: <u>DOPEŁNIENIE</u>

SKŁAD	
Komponent	Udział procentowy [‰mas.]
R32	26,85
R125	27,99
R134a	45,16
Domieszki	Udział procentowy [‰mas.]
-	-
-	-
-	-
Czystość: <u>100%</u>	
GAZY NIESKRAPIAJĄCE [‰mas.]: <u>BRAK</u>	
<p>Uwagi: <u>Sierazano do dopełnienia</u></p>	
Podpis: <u>Mankiewicz</u>	

Quality assurance

CERTIFICATE OF CONFORMITY

RELEASE DATE: _____

CERTIFICATE NUMBER: _____

NAME AND ADDRESS OF THE CUSTOMER

SUBSTANCE

Refrigerant R404A

(pentafluoroethane – R125; 1,1,1,2-tetrafluoroethane – R134a
1,1,1-trifluoroethane – R143a)

WEIGHT OF REFRIGERANT

BATCH NUMBER

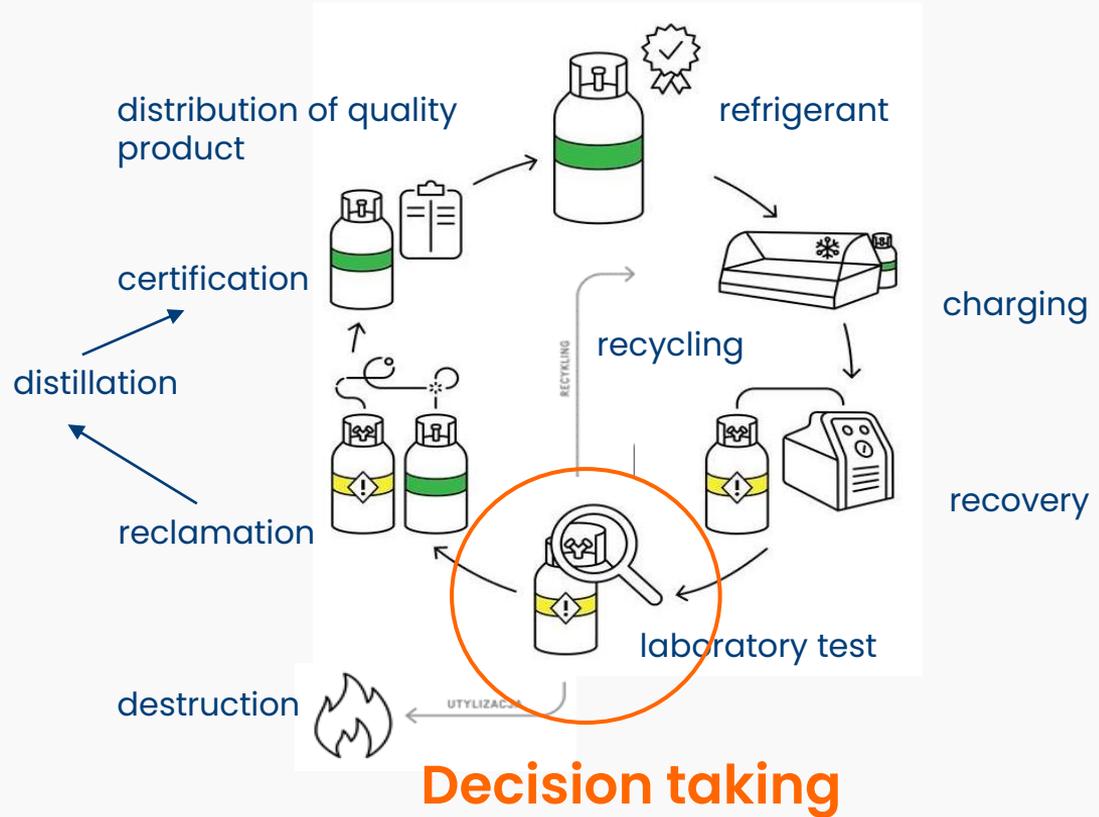
DATE

Quality specification:

- Composition: 42-46% by weight HFC-125 (R125)
2-6% by weight HFC-134a (R134a)
51-53% by weight HFC-143a (R143a)
- Impurities: ≤ 0,5% by weight
- Water content: ≤ 10 ppm by weight
- Chloride ions: 0
- Acidity: ≤ 1 ppm by weight
- High boiling residue ≤ 0,01% by volume
- Air in vapour phase ≤ 1,5% by volume
- Particulates/Solids 0

Authorization:

A lifecycle of refrigerants



Removing undesirable components or separating mixtures



Rotary kiln incineration

This method is widely used for destroying industrial waste, especially resulting from oil and gas extraction.

Decomposition efficiencies of the ODS in this method shall reach 99.99%, and none of the volatile organochlorine compounds must be formed.

The produced hydrochloric acid (HCl) and hafnium (Hf) with the decomposition of ODS and HFCs must be entirely removed by the existing treatment system, and concentrations of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofuranes (PCDDs/PCDFs) in flue gas shall be low enough with a concentration in the atmosphere below 1%

Source: COPA



Logistics



Why should I recover refrigerants?



Legislation

- You have to recover!
- Need to have a certificate



Social responsibility

- To help protect our ozone layer
- To be a responsible professional



Equipment available

- Recovery unit
- Two way valve cylinders
- Reclamation & incineration sites



Customers expectations

- Green card advantages
- Public contract requirements
- Industry standards



Incentives

- Avoid penalties
- Earn money - \$/kg
- Have a valuable product

Key success factors for RRR network

1. Supporting legislation
2. Reclamation Center
3. Dedicated Laboratory
4. Incineration facility
5. Pool of equipment for recovery
6. Collection points network
7. Good logistics
8. Technical training for personnel
9. Public awareness
10. Making money on RRR



Thank you and good luck!

