REFRIGERANT
RECLAIM
AUSTRALIA

REFRIGERANT RECLAIM AUSTRALIA

ACRONYMS AND DESCRIPTIONS

CFC

Chlorofluorocarbon: a refrigerant that depletes ozone and also contributes to global warming

GWP

Global Warming Potential: the measurement of how much a particular refrigerant contributes to global warming

HCFC

Hydrochlorofluorocarbon: a refrigerant that depletes ozone and also contributes to global warming

HFC

Hydrofluorocarbon: a refrigerant that does not deplete the ozone layer but that may contribute to global warming

KIGALI AMENDMENT

The amendment to the Montreal Protocol that reduces the emissions of refrigerants that contribute to global warming

MONTREAL PROTOCOL

The international treaty to protect and restore the ozone layer, which is critical to life on Earth

ODS

Ozone Depleting Substance: a chemical that damages stratospheric ozone

ODP

Ozone Depleting Potential: the measurement of how much damage a particular refrigerant may do to the ozone layer

RRA

Refrigerant Reclaim Australia: the not-for-profit organisation established by the Australian RAC industry to collect and safely dispose of ODS and SGG refrigerants

SGG

Synthetic Greenhouse Gas: A manufactured chemical that contributes to global warming

REFRIGERATION AND AIR CONDITIONING

KEY ENABLING TECHNOLOGY OF CIVILISATION (AS WE KNOW IT ANYWAY)

WITHOUT AIR CONDITIONING THERE WOULD BE NO

_ High rises
_ Semi-conductor industry
_ Pharmaceutical industry
_ Data storage centres
_ Cool cars on a hot day

WITHOUT REFRIGERATION THERE WOULD BE NO

_ Food cold chain (supermarkets)
_ Blood transfusions
_ Vaccine transport and storage
_ Laser surgery
_ Slushies

HOW DOES IT WORK?

_ It's called the vapour compression cycle and was first developed in the late 1800's.

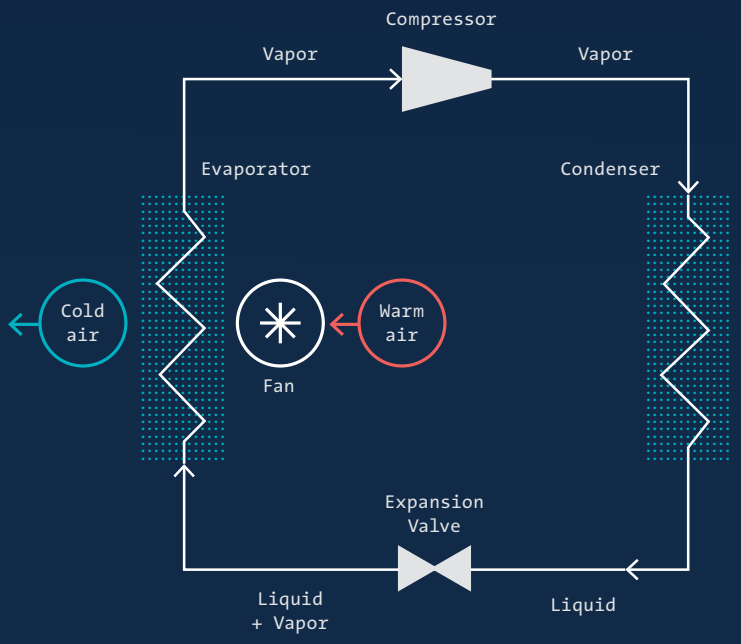
_ A material (refrigerant) is cycled through its liquid and gaseous phase to provide cooling

_ The refrigerant must have particular thermodynamic properties for the system to work

_ Different refrigerants have different properties to provide different cooling capacity from -80c to +25c, for example.

TYPICAL SINGLE-STAGE VAPOR COMPRESSION REFRIGERATION

Condenser may be water-cooled or air-cooled



REFRIGERANTS

_ Early refrigerants were toxic and flammable

_ In the 1930's new chemicals – fluorocarbons – were created and identified as ideal refrigerants

_ They had ideal thermodynamic properties and were neither toxic nor flammable

_ They were rapidly taken up by manufacturers and eventually chlorofluorocarbons (CFCs) dominated refrigeration, and hydrochlorofluorocarbons (HCFCs) dominated air conditioning

_ This seeming harmlessness was due to their molecular stability – they didn't break down easily and thus had a long life in the atmosphere when emitted

_ And that's where things began to go awry

STRATOSPHERIC OZONE DEPLETION

_ The stratosphere is the atmospheric band existing 12-50 kilometres around the planet

_ Ozone, a molecule with three oxygen atoms – O3 – exists in this space

_ Ozone is critical to life on Earth as it acts as filter for harmful ultra violet radiation – UVB

_ The long lived CFC molecules rise into the stratosphere where they are broken down and release chlorine - Cl

_ Cl then reacts with O3 and removes it from the stratosphere allowing UVB levels to increase

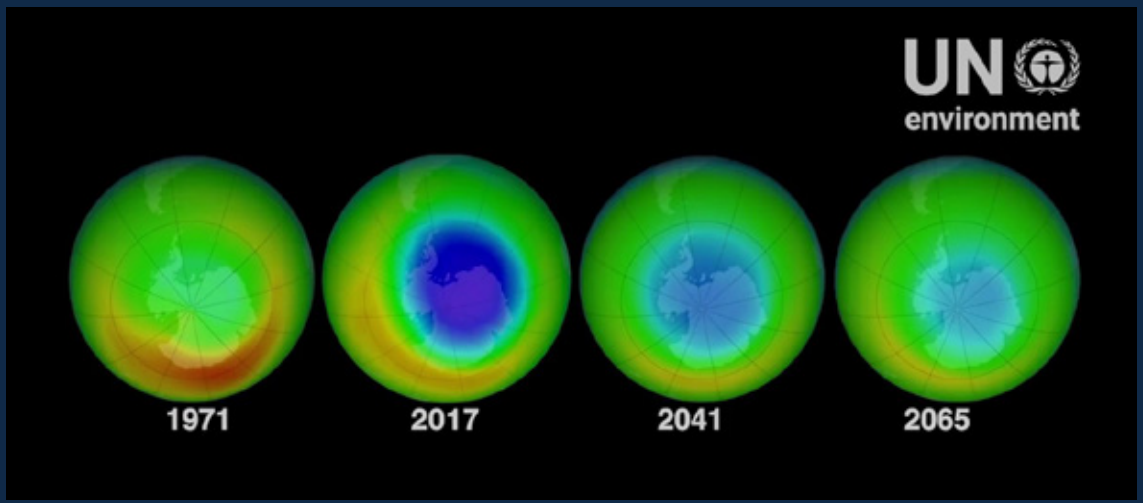
_ This can occur at a rate of 10,000 to 1, so that 1 kilogram of CFC12 can destroy up to 10 tonnes of stratospheric ozone

_ CFCs were banned under the Montreal Protocol in developed nations from 1995 and subsequently in developing nations

_ Our planet is a wonderful organism and since we stopped sending harmful chemicals into the stratosphere it has commenced repairing itself

_ The image below shows average ozone over Antarctica in October. As can be seen, man-made ozone chemicals seriously depleted ozone but since their use was banned improvement can be seen.

_ As a result of global cooperation between governments and industry on current trends the ozone hole will be fully repaired by 2075.



CLIMATE CHANGE AND GLOBAL WARMING

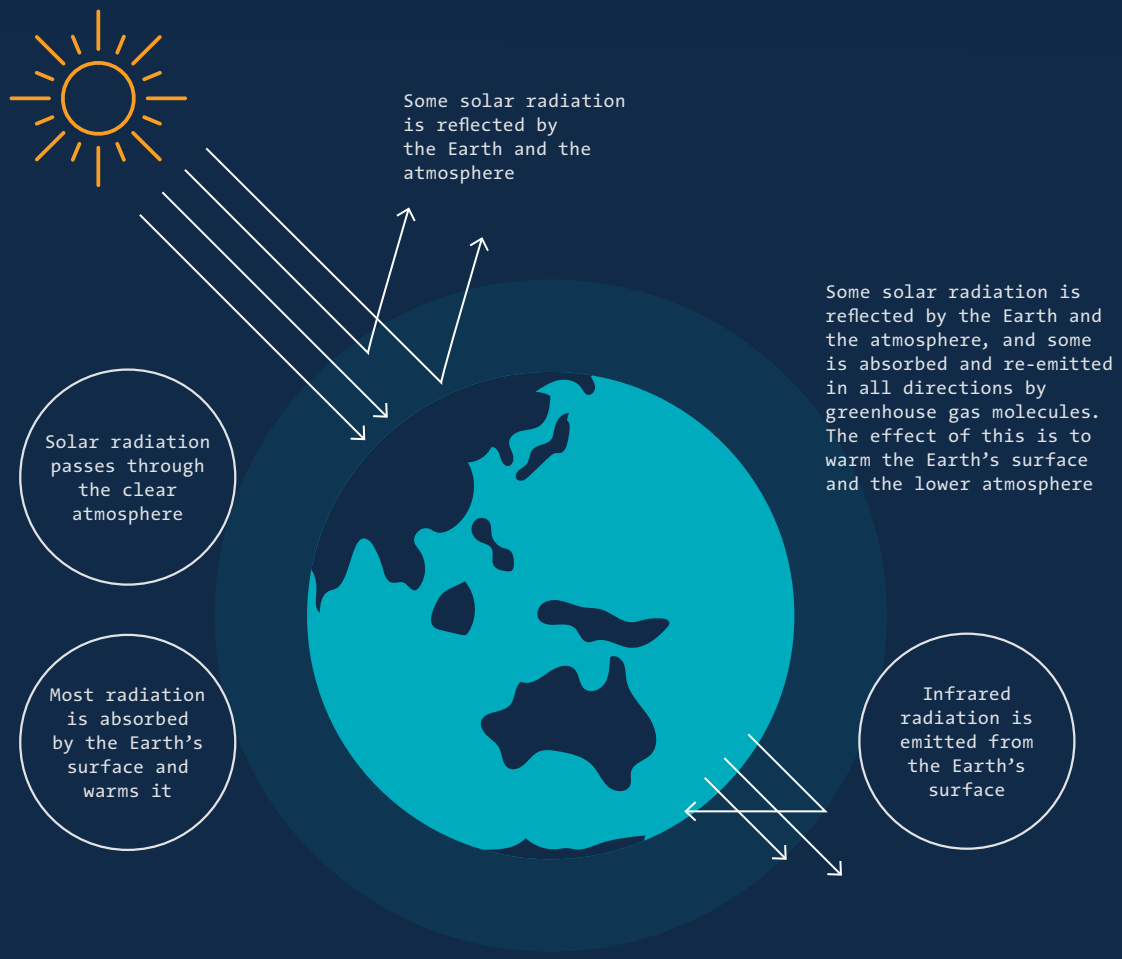
_ CFCs were also powerful global warming gases – some 10,000 times more powerful that carbon dioxide

_ Many of the refrigerants used to replace them, such as hydrofluorocarbons (HFCs), also have high GWPs (global warming potential) but average around 2,000

_ The Montreal Protocol has now been expanded to include the phase-down of these refrigerants

_ Developed countries commenced the HFC phase-down of high global warming potential HFCs in 2018 and developing countries will start in 2024

THE GREENHOUSE EFFECT



AUSTRALIA'S REGULATORY ENVIRONMENT

_ Controlled by the Ozone Protection and Synthetic Greenhouse Gas Management Act

_ Various licensing requirements for imports, sales, use, etc

_ Importantly, avoidable emissions are prohibited – this means ozone depleting and synthetic greenhouse gas refrigerants must be recovered, and must not be emitted to the atmosphere

_ But they are colourless odourless gases and policing emissions is difficult

_ Australia does not have strict recycling laws for consumer durables such as refrigerators, air conditioners, and motor vehicles – elsewhere and in Japan they do and this is why their refrigerant product stewardship scheme outperforms ours

_ Despite concerted long-term efforts we have been unable to strengthen the regulatory requirements for recycling consumer durables so need to find an alternate approach to increasing recovery

TIMELINE

1975 — Ozone depletion suspected to be occurring

1987 — Montreal Protocol for the Protection of the Ozone Layer

1989 — Commonwealth Ozone Act

1991 — State legislation

1993 — RRA created to take back ODS (voluntary)

1997 — Kyoto Protocol

2002 — RRA expands program to take back SGG (voluntary)

2004 — Commonwealth Ozone Protection Act incorporates SGG and makes product stewardship mandatory for importers of refrigerants either as bulk or in equipment

Avoidable emissions become illegal making recovery mandatory

2010 — Ban on the import of equipment containing HCFCs

2016 — Kigali Amendment to the Montreal Protocol instituting a phase-down of the manufacture and use of HFCs and PFCs

2018 — Australia commences phasing down the import of HFC refrigerants in bulk and cylinders

WHO IS RRA?

_ Not for profit Trust based company

_ Funded by an industry levy on sales of ozone depleting refrigerants and synthetic greenhouse gases

_ Take responsibility for installed refrigerant

_ Collect, store, reclaim, and destroy contaminated, surplus and unwanted ozone depleting and synthetic greenhouse gas refrigerants

RRA established by the industry to:

_ provide environmental stewardship for ozone depleting and synthetic greenhouse gas refrigerants

_ assist in meeting Australia's international obligations

_ share the costs to ensure fairness, and compliance with regulations

_ establish the necessary infrastructure to successfully fulfill industry's obligations

WHO IS INVOLVED WITH RRA?

_ RRA Board is a vertical slice of the industry with representatives from:

- Importers
- Wholesalers
- Contractors
- End users

_ Members of RRA include the major industry associations, and large contributors from both bulk and equipment sectors

_ All importers and wholesalers of ozone depleting and synthetic greenhouse gas refrigerants participate in the program

_ There are 30 importers of bulk refrigerant, and 580 importers of equipment containingt containing refrigerant contribute to the program

_ There are approximately 91,000 techncians and 22,000 businesses involved across the various refrigeration and air conditioning sectors

WHAT DOES RRA DO?

_ Refrigerant is recovered from systems during servicing and end-of-life operations.

_ If it is contaminated, unusable, or of a type unwanted by the technician or recycler it is filled into a special cylinder and eventually delivered to one of RRA's collection points – these collection points are generally the wholesalers of new refrigerant and equipment

_ The wholesalers decant the numerous small cylinders into larger ones provided by RRA, and advise when they are full

_ RRA arranges collection and transport to specialist contracted facilities for processing

_ Once received the contents are tested, then decanted into bulk storage to await destruction

_ In recent years, due to the high value of some refrigerants, wholesalers have been retaining substantial quantities of recovered refrigerant for reclamation, purification to new specification, and resale

_ Since commencing operations we have taken back and safely disposed of over 8,000 tonnes of ozone depleting and synthetic greenhouse gas refrigerants resulting in significant environmental benefits

_ More than 10 million tonnes of stratospheric ozone has been saved from destruction

_ More than 15 Million tonnes of carbon dioxide equivalent has been prevented from emission

_ Current per annum savings are the equivalent of taking 100,000 vehicles off the road, every year

CUMULATIVE PERFORMANCE

8400+
TONNES RECOVERED SINCE 1993

7800+
RETURNED FOR DESTRUCTION

500+
TONNES RECLAIMED

100+
TONNES USED AS FEEDSTOCK

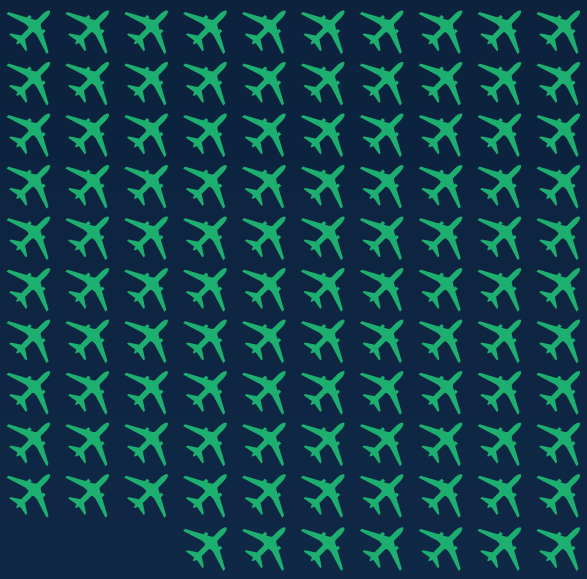
$70M
IN REBATES PAID TO INDUSTRY SINCE 2004

107M

CO2-EQUIVALENT ABATEMENT

has reached over 15 million tonnes, the average greenhouse gas emissions of 107 million economy class passengers taking return flights between Melbourne and Sydney[1].

[1]International Civil Aviation Organization Carbon Emissions Calculator

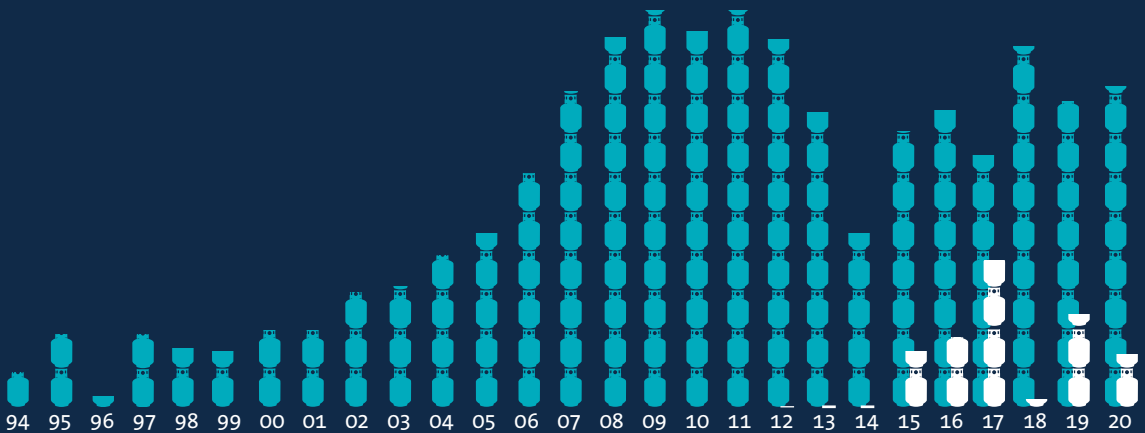


1 million passengers

500T

MORE THAN 500 TONNES RECLAIMED IN TOTAL

to as new specification and supplied back into the market to relieve shortages.



Returned
each equal to approx. 50,000kg

Reclaimed
each equal to approx. 50,00kg

HOW ARE RECOVERED REFRIGERANTS DESTROYED?

_ Most of our destruction is carried our using using an argon plasma-arc furnace

_ This is pyrolysis rather than incineration

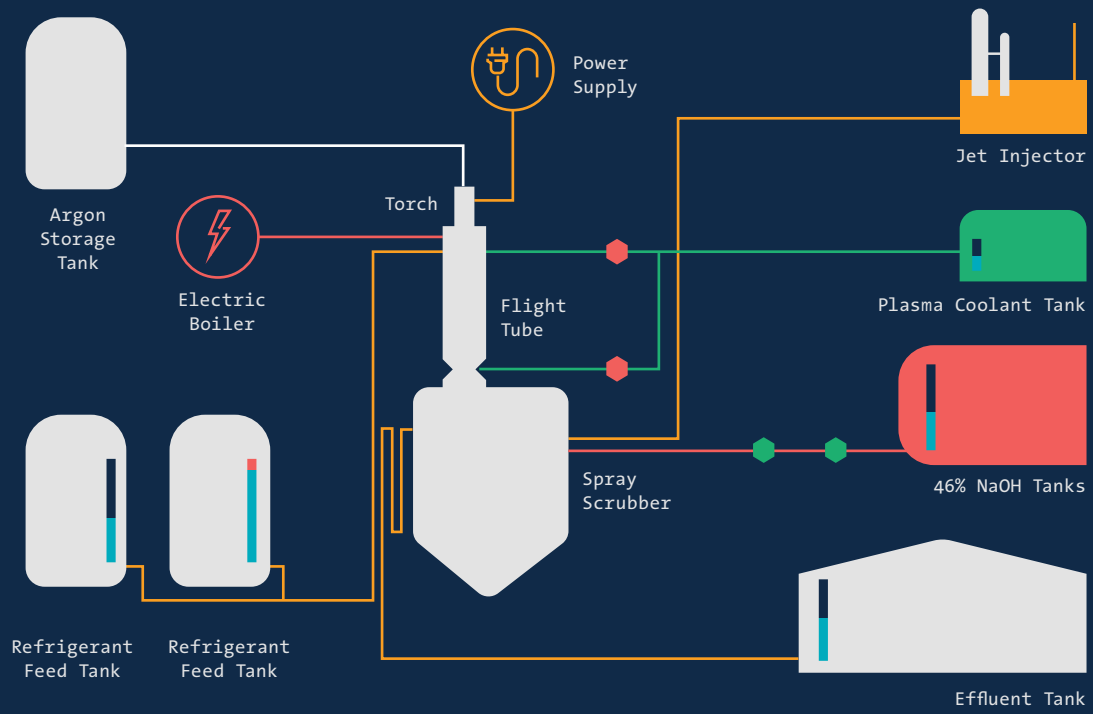
_ The fluorocarbon, typically hydrogen, fluorine, chlorine, and carbon, is injected into a chamber where argon plasma has been created at about 10,000°C

_ The molecular bond is broken and HF and HCl are formed

_ The hot acid gases are quenched and neutralised using a solution of water and NaOH – caustic soda

_ The result is NaCl – sodium chloride salt, NaF sodium fluoride salt, water and small quantity of CO_2

_ The salt solution is sent through the sewer system where it is diluted and ultimately used for irrigation at the Werribee vegetable farms



REFRIGERANT RECLAIM AUSTRALIA

For more information, please
contact Refrigerant Reclaim Australia

Phone (02) 6230 5244
Email info@refrigerantreclaim.com.au