Best Practices for End of Life Refrigerant Management

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Introduction to A-Gas

• The global leader in Lifecycle Refrigerant Management (LRM).

• World leading platform in recovery, reclamation and destruction in adherence with Montreal Protocol guidelines.

• Fully circular solution, focused on preventing the release of refrigerant gases to atmosphere.

• ~8.6m CO2-e MT abatement in 2022.

• Commitment to reduce carbon emissions by >50% by 2028 and to achieve net-zero by 2035.

Build a Sustainable Future
What is LRM? – A ‘Circular’ Solution

Recovery
• Recovery of refrigerants from existing systems in a safe and compliant manner to avoid the release to atmosphere.

Reclamation
• Oil and Moisture removal/Separation of mixed refrigerants and purification to AHRI-700 specification.

Destruction
• Destruction of ‘End of Life’ gases (where no re-use is possible, or by customer choice) using a TEAP approved destruction technology.

Supply
• Supply of reclaimed refrigerant to reduce the need for virgin product.
• Sale of all lower GWP alternatives.
The Pillars of LRM

**Enhanced Product Stewardship**
- Programs which provide the building blocks for economic and technical feasibility of LRM

**Refrigerant Recovery, Reclamation and Re-use**
- Incentives to make recovery economical

**Leak Reduction**
- Large climate benefit at low cost

**Reporting and Enforcement**
- A level playing field through stricter enforcement of legal obligations and reporting of improper LRM practices

**Workforce Development**
- Technical competency and capability to handle lower GWP gases and safe, environmental recovery / disposal

**Installation and Servicing**
- Improve practices for installation, commissioning, and servicing equipment.

**Destruction**
- End of Life disposal using TEAP approved technology
Global cooling demand expected to grow, especially in developing countries.

HFC Banks are increasing and will dominate global quantities by the early 2030s.

HFC Banks in developed countries are the largest overall - as equipment reaches end-of-life in the next decade there is a risk of increased emissions.

Recovery minimises direct refrigerant emissions to atmosphere - must form part of the HFC emission reduction strategy.

~1.5GT Global annual emissions from the ODS & HFC banks are estimated to equate to ~1.5GT CO2e per annum*.

~75% In A-Gas’ core markets, of the ~130kMT which comes to end of useful life each year ~75% are not recovered.

The Importance of Recovery

*Source: COPA ‘Global Emissions of ODS & HFC Banks’
Incentivising Recovery

Drivers:

- Increased education and awareness around the harmful environmental impacts of these gases and the environmental benefits recovery brings.
- Tailored recovery options based on the needs of each customer segment.
- Targeted incentives to drive better recovery practice.
- Increasing investment in reclamation and destruction technology.

Case Studies:

- Market leading air conditioning OEM – we provided bespoke onsite refrigerant recovery from numerous job sites; refrigerant was reclaimed and re-supplied negating the need for virgin product.
- Food processing plant retrofit – on site recovery of high GWP refrigerant and replaced with energy efficient lower GWP refrigerant.
Reclamation

- Used recovered refrigerant processed through mechanisms such as filtering, drying, Non-Condensable Gas removal, separation/distillation.

- Re-blending of recovered gas into reclaim refrigerant may require the use of virgin products.

- **Verification of purity and other quality parameters to AHRI 700 standards** to determine whether the reclamation process has been successful, and the refrigerant is fit for re-use.

- The **separation & reclamation** process for mixed refrigerants / cocktails requires **significant investment and expertise**.

- We have invested millions of dollars in market leading reclamation technology in multiple regions around our Group.
Why Reclaim Supports Transition

Benefits:

• Using a kg of reclaim refrigerant mitigates the requirement for a kg of virgin product thereby contributing to the circular economy.

• New equipment continues to be sold containing high GWP gases; use of reclaim enables servicing and maintenance until equipment can be retrofitted or replaced.

• Existing equipment can be maintained using reclaimed refrigerant meeting therefore negating the reliance on virgin.

• Reclaim supports the market transition through HFC phasedowns and quota environments while HFC demand remains strong - e.g., in Australia, HFC-404A grew from 2,800 tonnes of the refrigerant bank in 2006 to 22,400 tonnes in 2021.*

• Reclaim provides time for development of appropriate training and upskilling of technicians to safely handle flammable refrigerants.

  ➢ Important to assess the environmental, technical, safety and cost implications associated with each option (virgin, use of reclaim, or lower GWP alternatives) in decision-making.

*Cold Hard Facts 2022
“Where product is either ineligible for reclamation or there is no longer sufficient demand for re-use after all other options have been exhausted”.

- PyroPlas® employs argon plasma arc technology to destroy waste Ozone Depleting Substances and global warming refrigerant gases; it has a DRE of 99.9999%.
- PyroPlas® proprietary technology works by producing an intense high temperature plasma to pyrolyse end-of-life refrigerants to achieve clean, safe, controlled and transparent destruction.
- It has been used for the destruction of refrigerants and halons in Australia, Mexico, UK and the USA.
- As dictated by the Montreal Protocol, Argon Plasma-arc technology is a TEAP (Technology and Economic Assessment Panel) approved technology for destroying ODS and HFCs.
- The technology has been used commercially since 1996 with decades of operating credibility and performance.
Barriers in Article 5 Countries

Lack of:
- Information on the size of the installed banks and stockpiles.
- Access to LRM infrastructure.
- Qualified Technicians and training.
- Education and awareness.
- Financial incentives to fund upskilling of technicians to perform recoveries.
- Policies, regulations and enforcement around recovery and handling at end of life.
- Economies of scale
  - Reclamation / separation – investment difficult to justify at virgin product pricing.
  - Destruction – investment requires proven access to recovered gas at scale.

Requirements
- Integrated local logistics to support recovery, handling and transport activities.
- Removal of barriers to support ease of product import and export for reclamation and destruction.

- Inconsistent classification of recovered refrigerant at end of life between countries. ‘Hazardous wastes’ classification impacts transboundary movement – subjecting product to requirements of the Basel Convention on the Control of Transboundary Movements of Hazardous Waste. This restricts access to efficient reclaim and destruction technology, leading to reduced recovery.
In Conclusion

- LRM is a key enabler of the circular economy and transition to lower GWP refrigerants where they are suitable, safe and available.
- By maximizing recovery, recycling, reclamation and reuse we can limit the amounts of virgin HFCs required and reduce premature destruction for products still in-demand.
- LRM bridges the gap created by HFC phase-down targets and quotas, as reclaimed refrigerant sits outside this framework.

LRM Enablers

- Education – increasing volumes becoming available for recovery, requiring accelerated efforts through all industry stakeholders to avoid increasing emissions.
- Collaborative efforts to reduce barriers to transboundary movements and facilitate permitting.
- Carbon finance mechanisms to incentivise LRM activities.
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