



Mr. Cooke is a Canadian international consultant. He has spent the past 28 years working globally for a range of IFIs, UN Agencies and the private companies on a wide range of international environmental investment and technical assistance assignments. Prior experience covered progressive engineering, project and executive management positions with private sector oil and gas, and hazardous waste management companies. He holds degrees in mechanical engineering and metallurgy.

Relevant assignments undertaken include development and supervision of solid and hazardous waste management investment projects involving contaminated sites, POPs stockpile elimination, qualification of halogenated waste treatment/destruction technologies, and ODS production and consumption phase out. He was the international consultant supporting Colombia's successful MLF project qualifying national End of Life ODS refrigerant and blowing agent destruction capability.

Mr. Richard (Rick) Cooke

UNDP – International Consultant

WEBINAR SERIES

CLOSING THE LOOP: ENVIRONMENTALLY SOUND MANAGEMENT OF END-OF- LIFE ODS AND HFC

General Overview of Infrastructure Requirements for Environmentally Sound Management of EOL ODS/HFC

Rick Cooke
Man-West Environmental Group



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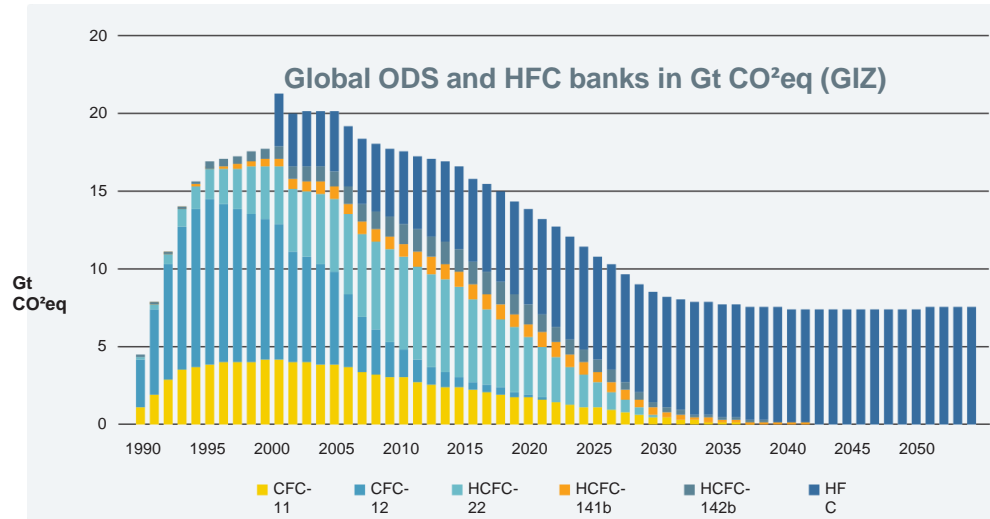
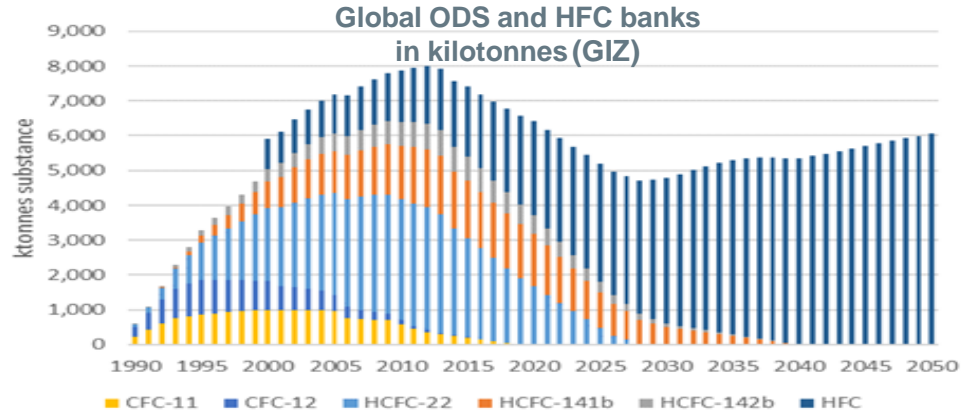
UNIDAD TECNICA OZONO
Colombia



This webinar is being organized within the
framework of a project funded by US EPA

Scope of EOL ODS/HFC Mgt. Issue

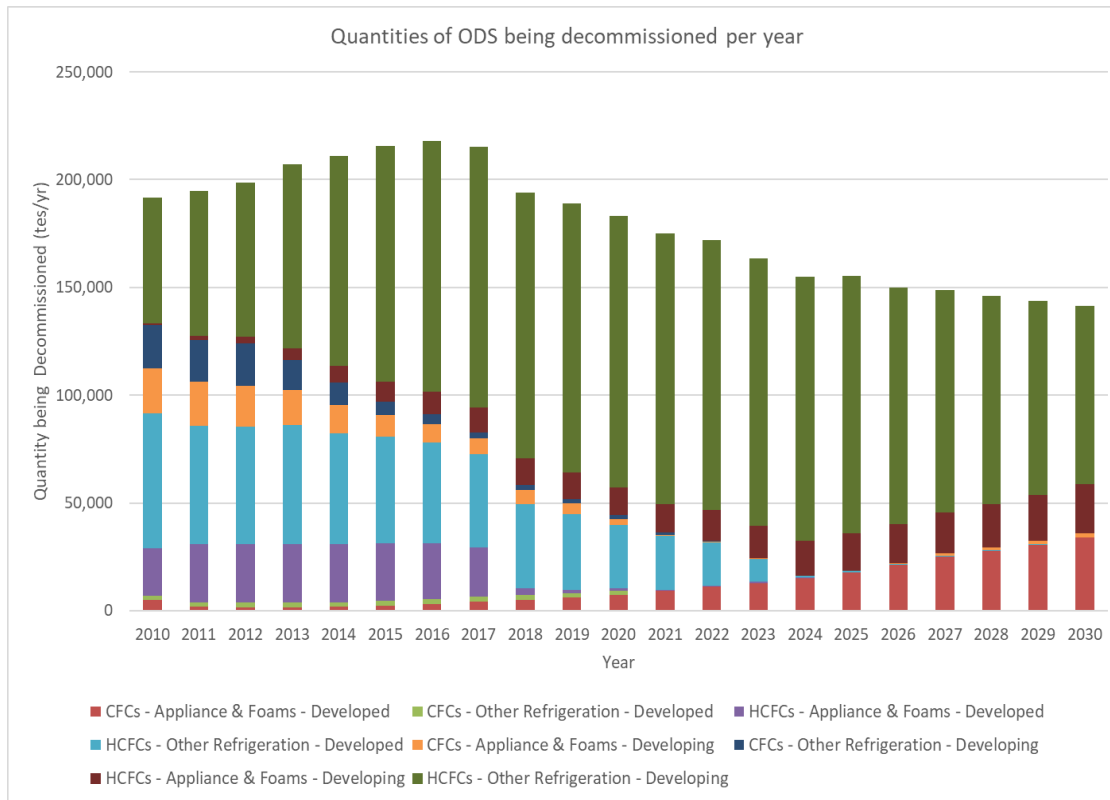
- Principle focus – Refrigerant, foam blowing agent
- Large “Active Bank” exists in-use products
- Assumption of release once produced and used
- No international mandatory requirements on prohibiting release or requiring ESM at end of life
- Impact on ozone depletion and climate change upon release at End of Life (EOL)
 - ❑ 6,000 Kt/year, 8-12 Gt CO₂ Eq/.year, 2020-2050.
- Bank transition – CFC to HCFC to HFCs overtime
- Impact priority moves from ozone to climate



Availability of EOL ODS/HFC for Mgt.

- EOL ODS/HFC practically reachable for ESM is what is important in waste mgt. terms.
- Inherent uncertainty in what this amount is
- TEAP modeled estimates of “decommissioned” – 200,000-435,000 t/year globally - 2020 to 2050
- Transition from mainly HCFCs to High GWP HFCs
- Should be an attractive waste market but would be a small niche in the overall chemical waste market.

**Estimated annual quantities of ODS entering the waste stream, 2010 to 2030 (tonnes)
(based on data from the Decision XX/7 TEAP Task Force)**



The “Appliance and Foams” category includes all refrigerants and blowing agents available from domestic refrigerators and other hermetic refrigeration appliances (e.g., freezers, stand-alone display cabinets etc.) and all other foams, such as building insulation foams. The “Other Refrigeration” category includes refrigerants from other refrigeration applications, including commercial, industrial, transport, mobile air conditioning and stationary air conditioning (e.g., CFC-11 centrifugal chillers).

Actual EOL ODS/HFC Mgt.

- **2019 MP reported EOL ODS/HFC destroyed**
 - ❑ **Total 18,000 t (75%+ CCL4)**
 - ❑ **4,600 t ODS (little HFC) refrigerant/blowing agent**
- **Mostly in 4 developed countries (incl. EU)**
- **Large gap between what practically can be eliminated and what actually is.**
- **Defines the scale of the task involved in achieving any form of effective impact mitigation of EOL ODS/HFC in terms of ozone depletion and climate change**

General Nature of the EOL ODS/HFC Waste Mgt. -1

- Addressing the issue in the hands of individual countries at this point
- Potentially driven as being a public policy priority and associated public awareness associated with growing climate change concern
- Regulatory and financial framework required to create the required market and investment.
- Implementation by private sector stakeholders including - Refrigeration servicing, waste mgt service providers, end product/chemicals supply chain.

General Nature of EOL ODS/HFC Waste Mgt. -2

- **Generally EOL ODS/HFC of minimal value**
- **EOL ODS/HFC default management options**
 - ❑ **Concentrated (refrigerant) – direct atmospheric release**
 - ❑ **Dilute (foam) – open burning, land disposal**
 - ❑ **Cost of Mgt. zero or minimal**
 - ❑ **Zero or low impact locally, high global impact**
- **ESM of EOL ODS/HFC concentrated and dilute waste different from a waste mgt. perspective both operationally and economically .**

Nature of Concentrated EOL ODS/HFC Waste

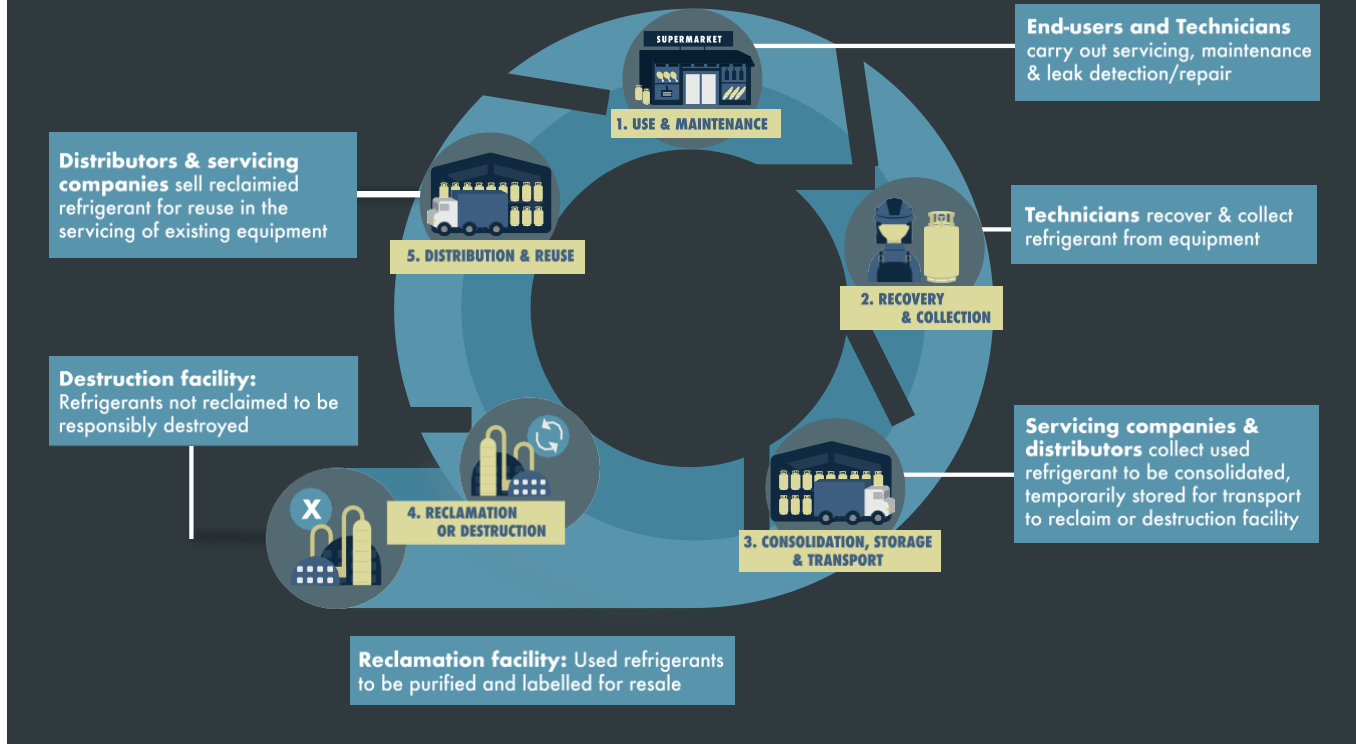
- Focus on refrigerants at EOL
- Refrigerant waste characteristics
 - ❑ Readily recoverable - identifiable/homogeneous
 - ❑ Managed as chemical waste with low losses
 - ❑ Sustained generation (market) into future
 - ❑ Re-Use/circular economy principals apply
 - ❑ Readily linked to extended producer responsibility
 - ❑ High reachable quantities give measurable GEB
 - ❑ Good potential to monetize global benefits

Overall Concentrated EOL ODS/HFC Waste Mgt. Process

- EOL refrigerant waste management from the point at it is available for recovery thru to its destruction or re-use.
- This presentation – From source of recovery to point of transfer to destruction facility
- Following presentation - Destruction options and commercial logistics.

REFRIGERANT LIFECYCLE

BEST PRACTICES



Environmental Investigation Agency (2019)

<https://content.eia-global.org/posts/documents/000/000/979/original/RefrigerantBanks.pdf?1573061483>

Concentrated EOL ODS/HFC Waste Mgt. at Source

- Primary infrastructure capacity constraint for EOL ODS/HFCs waste Mgt ability to recover, consolidate, accumulate and securely store sufficient material to justify destruction.
- Source point may be:
 - ❑ Site of the particular application
 - ❑ Centralized end product collection points
- Operational stakeholders - End-Users/waste generators, refrigeration servicing sector, and, potentially end product and refrigeration chemicals suppliers.

Concentrated EOL ODS/HFC Source Waste Mgt. Infrastructure Requirements

➤ Recovery Capability

- ❑ Incremental expansion of existing refrigeration servicing recovery capacity
- ❑ Same primary equipment - expanded as required
- ❑ Expanded technician work scope with appropriate training/certification, and awareness.
- ❑ Business/financial incentive to recover for EOL Mgt supported by regulations on release.
- ❑ A place to take recovered EOL ODS/HFCs

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LIFE ODS AND HFC



Concentrated EOL ODS/HFC Source Waste Mgt. Infrastructure Requirements

- Consolidation, Accumulation, Temporary Secure Storage Capability
 - ❑ Move widely distributed points to one or a chain of consolidation, accumulation and storage facilities.
 - ❑ First point may be refrigeration servicing operating base.
 - ❑ Further on it may commercial hazardous waste transfer station, or facilities in end-product or chemicals distribution system
 - ❑ Capacity for inventory/tracking records and analysis
 - ❑ Transportation capacity - HW/dangerous cargo

Concentrated EOL ODS/HFC Source Waste Mgt. Infrastructure Requirements

- Differences between developed and developing countries
- In developed countries market driven private sector capacity should be able rapidly provide the required capacity if policy/regulatory commitment along with sustainable financing mechanisms exists to present viable market.
- The same applies in larger industrializing countries albeit with greater effort
- Smaller developing countries will require international assistance and potentially act collectively.

Summary

- Potentially EOL ODS/HFC a viable commercial waste Mgt. opportunity.
- Expansion of source based capacity in developed and developing countries required as a first priority to demonstrate ability to capture EOL at source and present it for destruction.
- Done by market driven, private sector investment in developed/large industrialized developing countries with appropriate regulation and sustainable financial mechanisms. - Largest impact
- Smaller, less developed countries should act collectively with international support
- Active participation/cooperative actions of major industry stakeholders
- Need for general awareness of issue and global benefits gained

Overall Concluding Message

- **ODS/HFC Banks with continuing release for decades- sustained ozone depletion/global warming.**
- **Significant amounts of EOL ODS/HFC can captured and destroyed**
- **Reality is not much is and with a few national exceptions not improving globally**
- **Past technical focus has been on destruction**
- **Recognize that this is starting at wrong end of the problem and first need to focus on capture and ESM Mgt at source.**



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Thanks for your attention

Name of speaker. Rick Cooke
Position. UNDP International Consultant
E-mail. rickcooke1@compuserve.com
Company Man-West Environmental Group Ltd.