



Benefits of Retrofitting Commercial Refrigeration Equipment

Mack McFarland, Ph.D.

DuPont Fluoroproducts

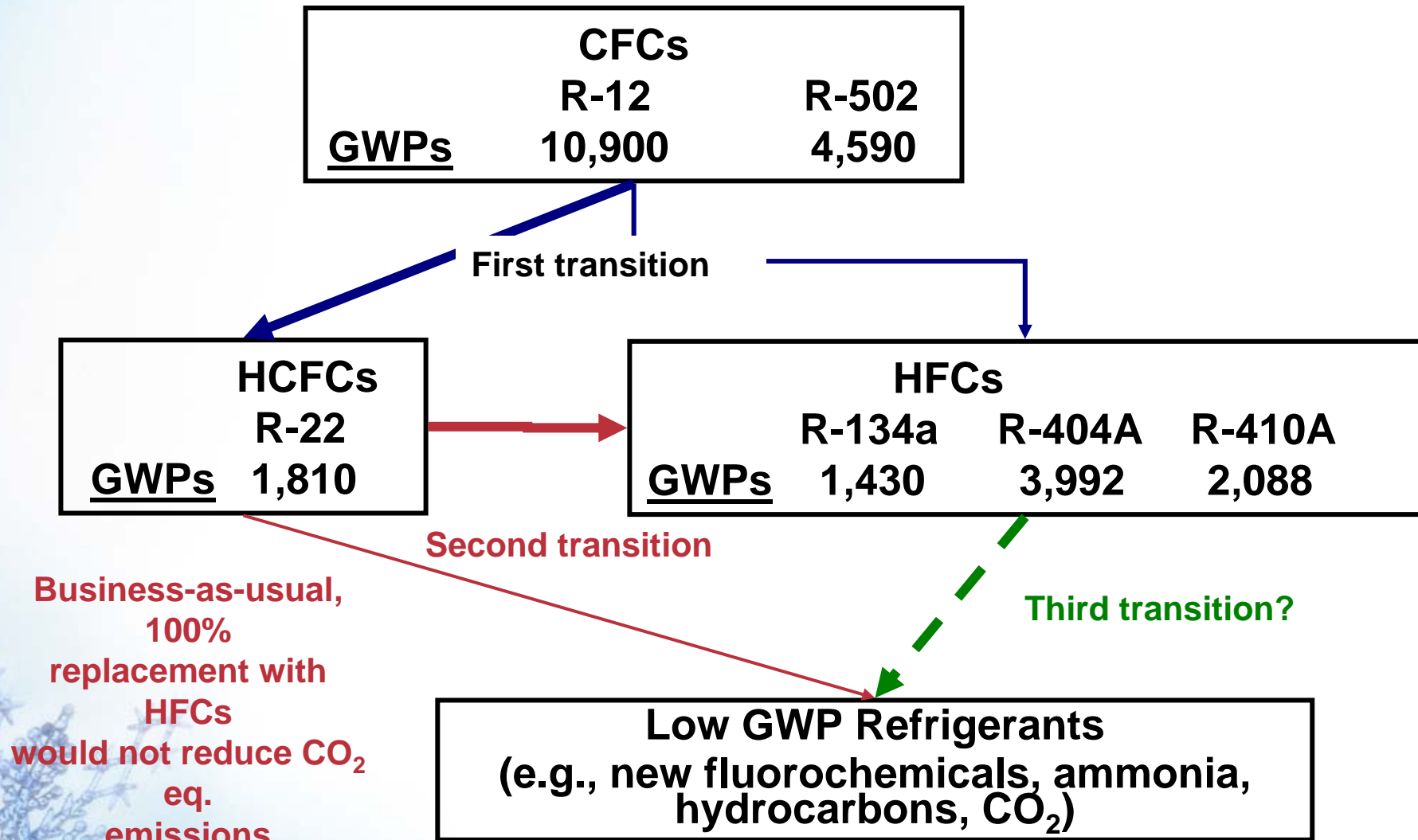


The miracles of science™

Agenda

- **Observations on the transitions away from ODSs**
- **Retrofit options for existing equipment**
- **HFC alternatives in new commercial refrigeration equipment**
- **Summary**

Transition with CFC/HCFC Phaseout



Observations in Implementing the HCFC Phaseout

- **Agreement on acceleration is encouraging signal that all countries can work together for environmental benefit**
- **Planning and early signals from regulatory bodies is critical to minimize cost of transition**
 - Ensures adequate planning horizon for introduction of new equipment
 - Minimizes potential for premature obsolescence of equipment
- **Alternatives to HCFCs are available – already being implemented in Article 2 countries**
- **All countries must go beyond business-as-usual to achieve both ozone and climate benefits**
 - Choose the best alternative that meets all criteria
 - Implement improved refrigerant management practices
 - Ensure continuous improvement in energy efficiency of equipment

Considerations in Continued Success

- **Safety must not be compromised – a primary advantage of fluorochemical gases**
- **Energy efficiency of equipment is critical for climate protection**
- **Life-cycle costs of products are important for cost effective transition**
 - **First cost**
 - **Operating cost**
- **Better refrigerant management practices are necessary**
- **Potential environmental issues other than climate change and ozone depletion should be evaluated**
- **Premature obsolescence of equipment should be avoided**

Avoiding Premature Obsolescence of Equipment

- **Introduce new non-ODS equipment sufficiently early to avoid shortages of service refrigerants**
- **If the adoption of new non-ODS equipment is not feasible, evaluate and implement retrofit options**
 - A reality in Article 5 countries for equipment using CFCs
 - A reality in Article 2 countries for equipment using HCFCs and, to a lesser extent, CFCs
 - Without proper planning, retrofitting could be a reality in Article 5 countries for equipment using HCFCs

In some cases, retrofit options are required to avoid premature obsolescence of equipment

A range of such options are available

DuPont™ ISCEON® 9 Series Refrigerants

ISCEON® # (ASHRAE #)	Composition	Replaces	Application	Safety Classification	GWP
MO59 (R-417A)	46.6% R-125, 50% R-134a, 3.4% HC	R-22	Medium Temperature Refrigeration (& Stationary A/C)	A1	2350
MO79 (R-422A)	85.1% R-125, 11.5% R-134a, 3.4% HC	R-22, R-502	Medium/Low Temperature Refrigeration	A1	3130
MO29 (R-422D)	65.1% R-125, 31.5% R-134a, 3.4% HC	R-22	Refrigeration (& Stationary A/C)	A1	2730
MO49 plus (R-437A*)	19.5% R-125, 78.5% R-134a, 2% HC	R-12	Medium Temperature Refrigeration (& Mobile A/C)	A1	1800

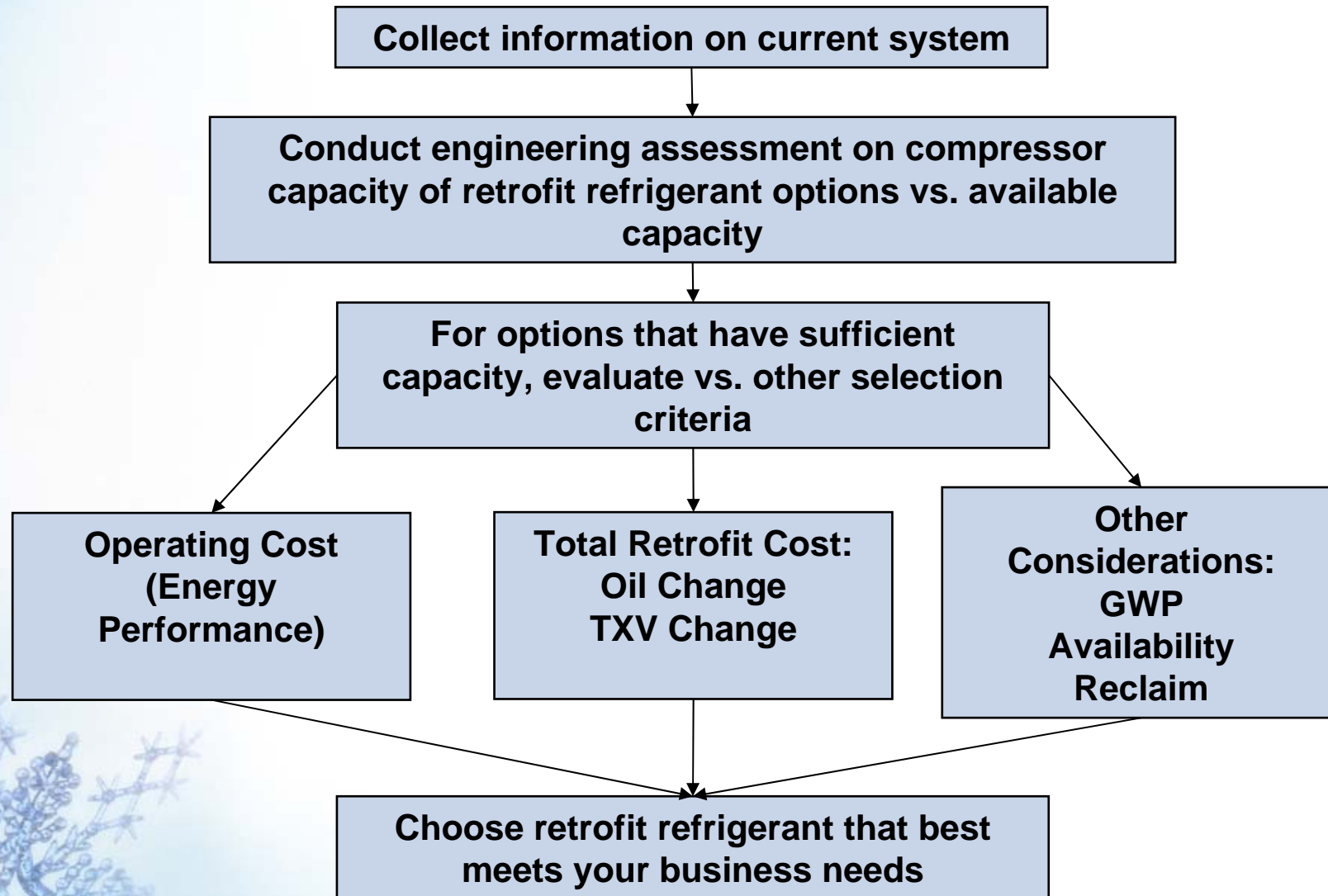
* Pending ASHRAE approval

Hydrocarbon reduces viscosity of mineral oil or alkyl benzene lubricant, permitting oil transport through system and return to compressor; no-oil-change-retrofit of CFC & HCFC equipment in most cases

Important Considerations for Retrofitting Commercial Refrigeration

- **Identify the equipment components that may need to be changed (gaskets, TXV's, etc.)**
- **System downtime for the retrofit**
- **Performance before and after retrofitting (energy efficiency, cooling capacity, etc.)**
- **After retrofitting, equipment must be properly serviced and maintained to minimize emissions and maintain efficiency**

Refrigerant Selection Process



Items to Check When Retrofitting

- **System set points (superheat, subcool, cut in/cut out temperatures, etc.)**
- **Verify oil is returning to compressors**
- **Check seals/flanges for refrigerant leaks**

Benefits of Retrofitting to HFCs vs. Continuing to Rely on CFCs and HCFCs

Refrigerant	Compared to	Energy Efficiency %	Capacity %
R-437A* (refrigeration)	R-12 or R-134a	0 to -4	2 to 8
R-437A* (mobile A/C)	R-12 or R-134a	2 to 5	0
R-422A (low temp.)	R-502	-4	-1
R-422A (low temp.)	R-22	12	29
R-422D (low temp.)	R-22	8	12
R-422D (medium temp.)	R-22	0	-5

*Pending ASHRAE approval

- **Zero ozone-depletion potential**
- **Comparable energy efficiency and cooling capacity**
- **Allows current equipment to be used for rest of useful life and new equipment investment is deferred**

New HFC Equipment Designed for Performance \geq to CFC / HCFC

CFC/HCFC	ODP	GWP	Replacement HFC	ODP	GWP
R-12	1	10,900	R-134a	0	1430
			R-437A*	0	1800
R-502	0.3275	4,590	R-404A	0	3920
			R-507	0	4000
			R-422D	0	3130
R-22	0.055	1,810	R-407C	0	1770
			R-410A	0	2090
			R-422D	0	2730

*Pending ASHRAE approval