Possible Bans for Aerosols and Foams

A review of the technical and economic impact of potential bans on the use HFCs for in the aerosol and foam market sectors

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Version 1, February 19th 2013

1. Introduction

This document provides a discussion of the potential for banning the use of HFCs in certain types of aerosol and foam blowing.

It is estimated that in 2010 the aerosol and foam blowing markets accounted for EU HFC consumption of around 22.5 MT CO_2 equivalent, which is around 10% of the total for all F-Gases. The breakdown of this HFC consumption is summarised in Table 1.

Table1: HFC Use for aerosol and foam blowing

Market	Sub-Sector	HFC Consumption 2010, kT CO_2	HFCs Used
Aerosols	Non-Medical	5,000	134a
	MDI	7,000	134a, 227ea
Foams	XPS	5,000	134a, 152a
	Spray PU	3,500	245fa, 365mfc, 227ea
	Other PU	2,000	245fa, 365mfc, 227ea
Total		22,500	

The MDI aerosol market cannot easily move away from HFC propellants – the process of developing and testing alternative MDI propellants would be extremely costly and take at least 10 years. However, there are promising technical developments in the non-medical aerosol and foam blowing markets which are discussed in the sections below.

2. Non-Medical Aerosols

The majority of the aerosol market used CFC propellants prior to 1990. In the transition away from CFCs under the Ozone Regulation, the majority of the market moved away from fluorocarbons, mainly to HCs (hydrocarbons) and DME (dimethyl ether). This move was made on cost grounds – HCs and DME are significantly cheaper than HFCs. Both of these alternative propellants are highly flammable, so cannot be used in all applications.

Novelty aerosols used HFCs until July 2009, when HFC use was banned under the current F-Gas Regulation. They used HFCs as a non-flammable propellant was required. Since the HFC ban the novelty aerosol market has made a successful transition to HFO 1234ze.

The MDI sector made the transition from CFC 12 to HFC 134a or HFC 227ea. As stated above, there is no reasonable possibility of an HFC ban in this sector.

The remaining HFC consumption of around 5 MT CO_2 is for “technical” aerosols where a non-flammable propellant is required. Examples include air dusters and lubricant aerosols that are often used in enclosed locations with sources of ignition present.

Is there a technical solution available for non-medical aerosols?

Yes, HFO 1234ze is suited to almost all non-medical aerosol applications. The experience with novelty aerosols showed it was reasonably easy for manufacturers to reformulate their products to use this new propellant. Some technical aerosols have already made a voluntary transition to this propellant to give the product “green credentials”.

What is the cost impact?

HFO 1234ze is more costly than HFC 134a – the cost differential is around €8 per kg. The CO_2 savings are 1.4 tonnes CO_2 per kg, hence the on-going cost impact is under €6 per tonne CO_2 saved. There is additional one-off cost for reformulation and conversion – we have no data available, but this will be small if the costs are amortised across the period to 2030. This is a market that can bear a small cost premium, because there is no alternative unless the user can move to a “not-in-kind” (NIK) product. The market already bears the cost premium of HFCs (compared to HCs).

Is the new propellant commercially available in sufficient quantity?

Yes, HFO 1234ze is being developed for several other markets (including foams and refrigeration). A new plant is being opened in 2014 to ensure sufficient product is available.

Is a ban possible and what dates are suitable?

Yes, this is a sector that is well suited to a fairly early ban. A 2 to 3 year period may be required to allow manufacturers to reformulate their products. Assuming a new Regulation is agreed by early 2014, a ban in 2016 or 2017 is possible and will stimulate an early move away from HFCs.

Would the sector make the transition without a ban?

The sector will probably move if HFC prices rise via the phase down mechanism and the price differential with HFO 1234ze falls. However, the transition will be uncertain and almost certainly take several years longer to be completed compared to a ban.

Are any exemptions required?

We are not aware of any situations where a non-medical aerosol could not make the transition to an HFO propellant, although some form of exemption mechanism for special cases via appeal to a Commission management committee may be worth considering.

3. Foams

The foams market is more complex than the aerosol sector. A key consideration is thermal performance and TEWI (total equivalent warming impact) which is the sum of direct HFC emissions and indirect energy related emissions. The main types of product are:

a) **XPS** – extruded polystyrene, used in large boards for floor, wall and roof insulation. Two very large manufacturers dominate the market, although there are at least a further 10 smaller players. Historically CFCs and HCFCs were used. Recently CO_2 has been used widely in place of HFCs, but thermal performance is relatively poor. Hence HFC 134a and 134a/152a blends are still quite widely used when thermal performance is critical.

b) **PU spray foam** – polyurethane, sprayed in situ e.g. to insulate an existing roof. It is difficult to use HCs in this market as high flammability is impossible to deal with safely when spraying in situ. Hence this market uses HFC 245fa or HFC 365mfc. As 365mfc is mildly flammable, it is sometimes blended with HFC 227ea. The spray foam market has recently grown to support Member State energy efficiency Regulations (e.g. in Netherlands).

c) **PU appliances**. Domestic refrigerators and other appliances are insulated with PU. The bulk of this market uses HCs. Imported US refrigerators use HFC 245fa.

d) **PU boards, continuous production**. PU is used to make laminated insulation boards and steel faced insulated panels. In large factories it is made in a continuous process. The bulk of this market has moved to HCs – the flammability issues can be safely addressed in large factories. HCs are much cheaper than HFCs, hence the move to HCs was driven by cost. HFCs 245fa or 365mfc are still used where fire performance is a crucial issue.

e) **PU boards, discontinuous production**. Small volume production is done with a discontinuous process. The extra investment required to move to HCs is harder to justify in small factories, so many still use HFCs 245fa or 365mfc.

f) **PU block foam and pipe-in-pipe insulation.** Block foam is used to make products such as pipe section or vessel insulation. Pipe-in-pipe insulation has PU sandwiched between an inner and outer pipe. Currently HFCs 245fa or 365mfc is used for most of these products.

Foam insulation products require a number of important properties including:

- Low thermal conductivity
- Good compression strength
- Good fire performance.

The relative importance of each property depends on the application. For example, if space is constrained, thermal conductivity is crucial – whereas, if space is not an issue a thicker layer of insulation will give the same performance. Good compression strength is important if the insulation is in the floor, but less important in other locations. CO_2 in XPS gives poor thermal conductivity and has poor compression strength. HCs in PU foam has poor fire performance. HFO alternatives (discussed below) have been shown to have good performance in all three of these key areas.

Is there a technical solution available for foam?

XPS Yes, HFO 1234ze can be used as a blowing agent, sometimes in combination with a co-blowing agent such as DME. Almost all producers have already trialled this product and a small number voluntarily produce XPS using HFO blowing agent as a "high end" product with green credentials.

PU Yes, but commercialisation still needed in most PU markets. At least two HFOs (1233zd and 1336mzz) have been announced as liquid blowing agents for PU foams. They should be applicable to spray foam, appliances, board stock and block foam. Whirlpool, the US refrigerator manufacturer has just announced a move from HFC 245fa to HFO 1233zd to begin at the end of 2013, following a successful trial. The driver for their move is an improved thermal conductivity which helps them meet very tough US energy efficiency targets. Pilot trials have been done on a small scale in the EU but no manufacturer has yet announced any commercial products.

What is the cost impact?

XPS The new HFOs will be more expensive than HFC 134a – the cost differential is expected to be around €8 per kg. The CO_2 savings are 1.4 tonnes CO_2 per kg. Hence the on-going cost impact is €6 per tonne CO_2 saved. There is additional one-off cost for reformulation and conversion – we have no data available, but this will be small if the costs are amortised across the period to 2030.

PU The new HFOs will be more expensive than HFC 245fa or 365mfc – the cost differential is expected to be around €8 per kg. The CO_2 savings are 1.0 tonnes CO_2 per kg for HFC 245fa and 0.8 tonnes CO_2 per kg for HFC 365mfc. Hence the on-going cost impact is between €8 and €10 per tonne CO_2 saved. There is additional one-off cost for reformulation and conversion – we have no data available, but this will be small if the costs are amortised across the period to 2030.

Some parts of the foam market will struggle with any cost premiums as they are in competition with NIK alternatives such as mineral fibre in some applications.

Are the new propellants commercially available in sufficient quantity?

XPS Yes, HFO 1234ze is being developed for several other markets (including aerosols and refrigeration). A new plant is being opened in 2014 to ensure sufficient product is available.

PU Not certain. Some time may be required to ensure there is sufficient blowing agent available

Is a ban possible and what dates are suitable?

XPS Yes, this is a sector that is well suited to a fairly early ban. A 2 to 3 year period may be required to allow manufacturers to carry out changes to their production process. Assuming a new Regulation is agreed by early 2014, a ban in 2016 or 2017 is possible for XPS and will stimulate an early move away from HFCs.

PU Yes, but more time is needed to develop new foam blowing processes and to ensure sufficient blowing agent is available. A ban from 2019 or 2020 might be possible.

Would the sector make the transition without a ban?

The sector will probably move if HFC prices rise via the phase down mechanism and the price differential with HFOs fall. However, the transition will be uncertain and almost certainly take several years longer to be completed compared to a ban.

Are any exemptions required?

We are not aware of any situations where foams could not make the transition to an HFO propellant, although HFOs have not yet been trialled for all PU products. There could be unusual circumstances that we are unaware of that are unsuited to HFOs and the cost impact could be much worse than average for some specialised products. Some form of exemption mechanism for special cases via appeal to a Commission management committee may be worth considering.