THE F-GAS REGULATION AND ITS IMPLICATIONS IN FIRE SUPPRESSION APPLICATIONS

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ABSTRACT

In August 2003 the European Union (EU) proposed a new regulation on fluorinated gases, entitled *Proposal for a Regulation of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases*, also known as the "F-Gas Regulation." The F-Gas Regulation will put into place a legislative framework to reduce emissions of HFCs (hydrofluorocarbons), PFCs (perfluorocarbons), and sulfur hexafluoride. The proposal passed the EU Parliament First Reading in 2004, and had its Second Reading in the European Parliament late in 2005, where a total of 26 amendments relative to the regulation were adopted. The text of the F-Gas Regulation then received final approval in early 2006.

The development and current status of the F-Gas Regulation will be detailed, with an emphasis on the implications of the regulation on the use of HFCs in fire suppression applications. Implications related to system design, inspection, and labeling will be discussed. The current status and implications of other international regulations affecting fire suppression systems (e.g., the Kyoto Protocol) will also be summarized.

INTRODUCTION

Hydrofluorocarbons (HFCs) are the most widely employed replacements for Halon 1301 in total flooding applications, and are also employed as replacements for Halon 1211 in streaming applications. These clean, non ozone depleting extinguishing agents were developed in direct response to the issue of stratospheric ozone depletion, and currently protect billions of dollars worth of assets worldwide.

Table 1 indicates the composition of the HFC clean extinguishing agents in current use, and Table 2 summarizes the environmental properties of these agents, including the ozone depletion (ODP), global warming potential (GWP), and atmospheric lifetime for the agents. HFCs employed in clean agent systems include HFC-23 (CF_3H), HFC-125 (CF_3CF_2H), HFC-227ea (CF_3CHFCF_3), and HFC-236fa ($CF_3CH_2CF_3$).

Table 1. HFC Clean Fire Extinguishing Agents

HFC Designation	Chemical Formula	Tradename	Manufacturer
HFC-23	CF_3H	FE-13	DuPont
HFC-125	CF_3CF_2H	FE-25	DuPont
HFC-227ea	CF_3CHFCF_3	FE-227 FM-200	DuPont Chemtura
HFC-236fa	$CF_3CH_2CF_3$	FE-36	DuPont

Table 2. Environmental Properties of the HFC Clean Agents

HFC	Chemical Formula	ODP	GWP (100 year)	Atmospheric Lifetime (years)
HFC-23	CF_3H	0	12,000	264
HFC-125	CF_3CF_2H	0	3,400	32.6
HFC-227ea	CF_3CHFCF_3	0	3,500	36.5
HFC-236fa	$CF_3CH_2CF_3$	0	9,400	209

INTERNATIONAL REGULATION OF HFCs

The HFC clean fire extinguishing agents are characterized by zero ODPs, and as a result are not subject to any of the provisions of the Montreal Protocol.

On an international basis, HFCs are subject to the provisions of the United Nations Framework Convention on Climate Change (UNFCCC). As a result of concerns over the effects of climate change, most countries joined the UNFCCC more than a decade ago. The UNFCCC is an international treaty which establishes an overall framework for intergovernmental efforts to address the challenges posed by climate change. Under the UNFCCC, governments collect and exchange information on greenhouse gas (GHG) emissions, and establish strategies for addressing these emissions.

In 1997 an amendment to the UNFCCC treaty, known as the Kyoto Protocol to the United Nations Framework Convention on Climate Change (the "Kyoto Protocol") was adopted by consensus at the third meeting of the Conference of Parties (COP3) to the UNFCCC.

The primary goal of the Kyoto Protocol is to reduce GHG emissions. Key aspects of the Kyoto Protocol include emissions targets, timetables for industrialized nations to reduce emissions, and the development of policies and procedures for meeting those emissions targets. The Kyoto Protocol covers a "basket" of six GHGs: carbon dioxide, nitrous oxide, methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride.

The Kyoto Protocol does not call for the phase-out or banning of any HFCs, or of any GHGs. The goal of the Kyoto Protocol is the overall reduction of GHG emissions.

THE F-GAS REGULATION: DEVELOPMENT

The European Commission (EC) began working on its European Climate Change Program (ECCP) in June of 2000. On August 11, 2003 the EC published its proposed regulation on fluorinated gases, entitled "Proposal for a Regulation of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases," [1], also known as the "F-Gas Regulation." The F-Gas Regulation would put into place a legislative framework to reduce emissions of HFCs, PFCs, and sulfur hexafluoride, and includes provisions for the containment, reporting, marketing and use of fluorinated greenhouse gases.

The original proposal was comprised of fourteen Articles, as detailed in Table 3. It should be noted that the originally proposed F-Gas Regulation did not call for any restrictions or bans of the use of HFCs in fire suppression applications. With regard to fire suppression applications, the only agents proposed to be prohibited in these applications under Article 8 are the perfluoro-carbon (PFC) agents. As can be seen from Table 4, Article 7 proposes to prohibit the use of HFCs in several very specific applications, but proposes no restrictions on their use in fire suppression applications.

In late 2003, Rapporteur Robert Goodwill of the Environment Committee of the European Parliament published his draft report on the F-Gas proposal [2]. This draft report suggested 30 amendments to the original proposal, six of which related to fire suppression applications.
Amendment 16 proposed that the inspection requirements of ISO 14520 [3] be regarded as fulfilling the inspection requirements of the F-Gas Regulation. Amendment 17 proposed that less frequent inspections be required for systems containing fluorinated gases where a leakage detection system was installed. Amendment 18 proposed that systems containing more than 300 kg of fluorinated gases be required to install leakage detection systems. Amendment 19 proposed that owners of systems containing 3 kg or more of fluorinated gas maintain records on any quantities added and the quantity recovered during maintenance and servicing. Amendment 20 proposed that Member States establish training and certification programs for personnel handling fluorinated gases. Amendment 21 proposed that for fire protection systems, actual emission figures equating to data on refills be recorded by trained and certified personnel.

In January of 2004, an additional 244 amendments were suggested for consideration by the Environment Committee [4]. A number of these amendments related to leakage detection, leakage inspection and record keeping for fluorinated gas systems, including fire suppression systems. Amendments specifically related to the use of HFCs in fire suppression applications

Table 3: Original F-Gas Regulation Proposal: 11 August 2003

Article	Title	Description
1	Scope	Regulation applies to the containment, use, placement on market and reporting of information on HFCs, PFCs and SF_6
2	Definitions	Definitions
3	Containment	Measures must be taken to minimize emissions of fluorinated gases; leakage inspections required
4	Recovery	Requires recovery of fluorinated gases for recycling, reclamation or destruction
5	Training/Certification Programs	Member States required to establish training & certification programs for personnel carrying out activities of Articles 3 and 4
6	Reporting	Reporting requirements for producers, importers, exporters of > 1 ton per annum of fluorinated gas
7	Control of Use	SF_6 use prohibited in Mg die-casting unless quantity of SF_6 is below 500 kg/year; SF_6 prohibited for filling of tires Use of fluorinated gases with GWP > 150 to fill AC systems for first time in new vehicles prohibited
8	Placing on the Market	Prohibits placing on market of fluorinated gases in certain applications (listed in Annex II)
9	AC Systems in New Vehicles	If refrigerant employed has GWP > 150, leakage rate must be less than 50 gram/year
10	Quotas for MAC	Yearly quotas established for fluorinated gases with GWP > 150 employed in new vehicles (e.g., in 2013, 10% of vehicles can use refrigerant with GWP > 150
11	Review	Commission submits report on experience with the Regulation within 5 years of entry into force
12	Committee	Commission assisted by committee instituted by Article 18 of Regulation (EC) No. 2037/2000
13	Sanctions	Member States determine rules on sanctions
14	Entry into Force	20th day following publication in Off. J. Eur. Union

Table 4: ANNEX II of the Original F-Gas Regulation Proposal: Prohibited Applications

Fluorinated Gas	Prohibited Application
GWP > 150	Mobile air conditioning (MAC)
SF_6, HFCs, PFCs	Non-refillable containers, except lab and analytical use and MDI
HFCs, PFCs	Refrigerant in non-confined direct-evaporation systems
PFCs	Fire protection systems, fire extinguishers
SF_6, HFCs, PFCs	Windows
SF_6	Footwear
HFCs	One component foams, except to meet national safety standards
HFCs	Novelty aerosols
HFCs and PFCs	Footwear

included Amendments 181 and 189, which proposed a gradual phase out of HFCs in fire suppression applications, Amendment 270 which proposed to prohibit HFCs with a GWP larger than 3000 in fire suppression applications, and Amendment 184 which proposed to prohibit HFCs in fire suppression applications except for critical uses. It should be noted that none of these amendments were approved by the Environmental Committee. Amendments 265 and 266 proposed to allow PFCs in fire suppression applications.

On March 16, 2004 the Environmental Committee adopted its opinion on the proposed EC regulation on certain fluorinated gases [5]. The Environmental Committee passed 84 amendments, and these 84 amendments, along with 28 late tabled amendments (total of 112 amendments), went forward to the First Reading (Plenary) in the European Parliament on March 31, 2004. Several of the passed amendments related to leakage detection and inspection intervals (Amendments 25-33). Amendment 36 proposed that entities that install, distribute or maintain fire protection systems register with the relevant competent authority. Amendment 63 proposed that for fire protection systems, actual emission figures equating to data on refills be recorded by trained and certified personnel.

On March 31, 2004 the European Parliament had it first reading (Plenary), and the Plenary adopted 80 of the 112 amendments passed on from the Environment Committee [6,7]. The Commission totally rejected all amendments proposing to restrict the use of HFCs in fire suppression applications, and also totally rejected the amendment proposing that entities that install, distribute or maintain fire protection systems register with the relevant competent authority.

On April 28, 2004 the first Council Working Group took place and it was agreed that the measures in the Regulation relating to mobile air conditioning (MAC) should form a separate Directive. Hence the original proposal was divided into two separate pieces of legislation: the F-Gas Regulation and the MAC Directive.

Political Agreement (Common Position) on the F-Gas Regulation (and the MAC Directive) was reached at the Environment Council meeting on October 14, 2005, and the Common Position was formally adopted by the Council on June 21, 2005 and published in the Official Journal of the European Union on July 26, 2005 [8].

In fall of 2005, the Environment Committee submitted 38 amendments for consideration during Parliament's Second Reading [9-11].

The F-Gas Regulation had its Second Reading in the European Parliament on October 26, 2005, where a total of 26 amendments were passed. On January 31, 2006, agreement was reached at the conciliation meeting between Parliament and Council and the text of the F-Gas Regulation was approved. This in effect concludes the negotiation stage of the F-Gas Regulation.

THE F-GAS REGULATION: FINAL FORM

As indicated above, on January 31, 2006 the Conciliation Committee approved the text for the F-Gas Regulation, which in effect concludes negotiation on the F-Gas Regulation. The final text will now go to the EP and the Council for formal adoption. Once formal adoption has been completed, the agreed upon texts have to be translated into the different languages of the 25 Member States of the EU, and once translated, the F-Gas Regulation will be published in the Official Journal of the European Union. The F-Gas Regulation will enter into force 20 days after its publication in the Official Journal (i.e., mid- to late-2006) and shall apply from 12 months after the date of entry into force (i.e., mid-2007).

Table 5 summarizes the final form of the F-Gas Regulation, which is comprised of thirteen Articles.

THE F-GAS REGULATION AND FIRE SUPPRESSION SYSTEMS

Containment. Article 3 of the F-Gas Regulation is concerned with containment, and operators of fire suppression systems are required to prevent leakage of the fluorinated greenhouse gases. Final Amendment 43 requires that applications containing 300 kg or more of an HFC install leak detection systems. For fire protection systems installed prior to the entry into force of the regulation, Final Amendment 43 indicates, “In the case of fire protection systems installed before the date of entry into force of this Regulation, leak detection systems must be fitted within three years of entry into force of the Regulation, provided safety and insurance are not compromised. When a leakage detection system is installed, the leakage detection system would have to be inspected at least once every 12 months to ensure its proper functioning.”

Final Amendments 16, 17, and 18 are related to the leakage inspection of fire suppression systems. Table 6 shows the frequency for performing leak inspections under the F-Gas Regulation.

Table 5: F-Gas Regulation, Approved Text

Article	Title	Description
1	Scope	"The objective of this Regulation is to prevent and reduce emissions of the fluorinated greenhouse gases covered in the Kyoto Protocol."
2	Definitions	Definitions
3	Containment	Requires operators to prevent leakage of fluorinated greenhouse gases and to repair any detected leaks; establishes inspection schedule
4	Recovery	Requires recovery of fluorinated gases for recycling, reclamation or destruction
5	Training/Certification Programs	Will introduce minimum requirements and mutual recognition for training programs & certification for relevant personnel involved in carrying out activities of Articles 3 and 4
6	Reporting	Reporting requirements for producers, importers, exporters of > 1 ton per annum of fluorinated gas
7	Labeling	Label must indicate product or equipment contains a fluorinated greenhouse gas, must include chemical name, and include GWP value
8	Control of Use	SF_6 use prohibited in Mg die-casting unless quantity of SF_6 is below 850 kg/year; SF_6 prohibited for filling of tires
9	Placing on the Market	Prohibits placing on market of fluorinated gases in certain applications (listed in Annex II)
10	Review	Establishes schedule for Commission to review the Regulation and publish reports
11	Committee	F-Gas Regulation Commission, set up under Regulation (EC) No 2037/2000 on substances that deplete the ozone layer assists the Commission
12	Penalties	Member States define their own sanctions for infringements of provisions
13	Entry into Force	12 months following publication in Off. J. Eur. Union

Table 6. Fire Suppression Systems:

Frequency of Leakage Inspection

System Size	Leak Detection System Installed?	Frequency of Leakage Inspection
> 3 kg	No	12 months
	Yes	12 months
>30 kg	No	6 months
	Yes	12 months
>300 kg	No	3 months
	Yes	6 months

Recovery. Article 4 of the F-Gas Regulation requires that operators of fire suppression systems put in place arrangements for the proper recovery, by certified personnel, of fluorinated greenhouse gases to ensure their recycling, reclamation or destruction.

Training & Certification. Article 5 of the F-Gas Regulation is concerned with training and certification. Under the F-Gas Regulation, the Commission is required to establish minimum requirements for the training and certification of personnel involving in the handling of fluorinated greenhouse gases. These requirements will be based on information received from Member States and in consultation with members of the fire protection sector.

Reporting. Article 6 of the F-Gas Regulation defines reporting requirements. By March 31 of each year, each producer of more than 1 ton per annum of fluorinated greenhouse gases must report to the commission its total production of each gas, identifying its applications, the quantities of gas placed on the market, and any quantities of gas recycled, reclaimed or destroyed. Importers of more than 1 ton per annum of fluorinated greenhouse gases must report the quantities of each gas imported, identifying its applications, and the quantities of gas imported for recycling, reclamation or destruction. Each exporter of more than 1 ton per annum of fluorinated greenhouse gases must report quantities exported, and any quantities of gas exported for recycling, reclamation or destruction. The Commission will take appropriate steps to protect the confidentiality of the information submitted.

Labeling. Article 7 of the F-Gas regulation defines labeling requirements for products of equipment containing fluorinated greenhouse gases. Equipment or products containing fluorinated greenhouse gases must have the chemical name of the gas clearly displayed on the label. The label must indicate the fact that the product or equipment contains fluorinated greenhouse gases, and must also indicate the GWP value of the gas.

Placing on Market. Article 9 of the F-Gas Regulation prohibits the use of HFCs in certain applications. Table 7 lists those applications of HFCs prohibited under the F-Gas Regulation. It should be noted that there are no restrictions on the use of HFCs in fire suppression applications.

Table 7: ANNEX II of the F-Gas Regulation:

Prohibited Applications

Fluorinated Gas	Prohibited Application
Fluorinated GHGs	Non-refillable containers
HFCs, PFCs	Refrigerant in non-confined direct-evaporation systems
PFCs	Fire protection systems, fire extinguishers
Fluorinated GHGs	Windows
Fluorinated GHGs	Footwear
Fluorinated GHGs	One component foams, except to meet national safety standards
Fluorinated GHGs	Tires
HFCs	Novelty aerosols

The primary objective of the F-Gas Regulation is to prevent and reduce emissions of the fluorinated gases covered by the Kyoto Protocol. The proposed regulation recognizes that fire suppression applications are essentially non-emissive, and does not impose any restrictions on the use of HFCs in fire suppression applications.

U.S. REGULATION OF HFCs

On March 18, 1994, the U.S. EPA published its Final Rulemaking for its Significant New Alternatives Policy (SNAP) rule. This Rulemaking listed acceptable substitutes for CFCs in the major end use sectors, including the fire suppression sector. The U.S. EPA currently has no policy for the regulation of HFCs in fire suppression applications.

CONCLUSION

On an international basis, HFCs are subject to the provisions of the Kyoto Protocol, and within the EU they are subject to the provisions of the F-Gas Regulation. The Kyoto Protocol and the F-Gas Regulation support the maintenance and inspection of systems, but neither the Kyoto Protocol nor the F-Gas Regulation impose limits on the use of HFCs in fire suppression applications, nor do they propose any bans of HFCs in fire suppression applications.

REFERENCES

1. *Proposal for a Regulation of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases,* COM(2003), 492 final, 2003/0189 (C)D), August 11, 2003.

2. Goodwill, R., *Draft Report on the Proposal for a Regulation of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases,* COM(2003), 492 - C5-0397/03 - 2003/0189(COD), December 18, 2003.

3. ISO 14520, Gaseous fire-extinguishing systems - Physical properties and system design - Part 1: General requirements, August 2000.

4. Goodwill, R., *Amendments 28-272, Draft Report, Proposal for a Regulation of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases, Proposal for a Regulation* (COM(2003), 492 - C5-0397/03 - 2003/0189(COD)), PE 337.064/28-272, January 29, 2004.

5. Goodwill, R., Report on the *Proposal for a Regulation of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases* (COM(2003), 492 - C5-0397/03 - 2003/0189(COD)), Final A5-0172/2004, March 18, 2004.

6. *Position of the European Parliament adopted at the First Reading on 31 March 2004 with a View to the Adoption of Regulation (EC) No .../2004 of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases* (EP-PE_TC1-COD(2003)0189), March 31, 2004.

7. *Outcome of the European Parliament's First Reading*, Council of the European Union Interinstitutional File: 2003/0189 (COD), 7939/04, CODEC 471, ENV 471, April 14, 2004.

8. *Common Position (EC) No 25/2005 adopted by the Council on 21 June 2005 with a view to adopting Regulation (EC) No .../2005 of the European Parliament and of the Council of...on certain fluorinated greenhouse gases*, Official J. Eur. Union, C183E, Volume 48, 26 July 2005; p 1-16.

9. Doyle, A., *Draft Recommendation for Second Reading on the Council Common Position for adopting a regulation of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases* (1606/5/2004 - C6-0221/2005 - 2003/0189A(COD)), Provisional 2003/0189A (COD), July 7, 2005.

10. Doyle, A., *Draft Recommendation for Second Reading on the Council Common Position for adopting a regulation of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases Council Common Position* (1606/5/2004 - C6-0221/2005 - 2003/0189A(COD)), PE 360.264v01-00), September 20, 2005.

11. Doyle, A., *Draft Recommendation for Second Reading on the Council Common Position for adopting a regulation of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases* (1606/5/2004 - C6-0221/2005 - 2003/0189A(COD)), FINAL A6-0301/2005, October 13, 2005.

12. *European Parliament Legislative Resolution on the Council Common Position for Adopting a Regulation of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases* ((1606/5/2004 - C6-0221/2005 - 2003/0189A(COD), Texts Adopted by Parliament, October 26, 2005.