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replacing or reducing the use of fluorinated greenhouse gases

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REPORT FROM THE COMMISSION

on availability of training for service personnel regarding the safe handling of climate-friendly technologies replacing or reducing the use of fluorinated greenhouse gases

1. Introduction

Regulation (EU) No 517/2014¹ requires a reduction in the quantities of hydrofluorocarbons (HFCs) that companies may place on the market in the EU, i. e. through import or production. By reducing the sale of these often highly warming greenhouse gases, their emissions will be reduced significantly over time.

The phase-down started in 2015 and will reduce the permitted supply of HFCs: by 2030 the supply of HFCs will be reduced by 79% compared to 2009-2012. In 2030 alone, the phase-down will have resulted in emissions avoided corresponding to 70 million tonnes of CO₂ equivalents². This is a two-thirds reduction compared to business as usual. Thus it will make a significant contribution to meeting the Union's climate targets.³

When the supply of HFCs is reduced, manufacturers of equipment and products using HFCs today must shift to climate-friendly alternative refrigerants. As technological progress has made large strides in recent years, shifting to suitable and energy-efficient alternative refrigerants with a low global warming potential (GWP) has become feasible in many types of equipment and products.⁴

However, many of the alternative refrigerants have properties that may be less familiar to equipment service personnel and the end-user e.g. flammability or high pressure. To enable the safe installation and operation of equipment using alternative refrigerants, appropriate training must become available and taken up by the service personnel on a large scale across the whole of the EU as the phase-down progresses. If this is not the case, it may be putting the transition to alternative refrigerants at risk and result in higher costs than necessary.

In this context, this report responds to Article 21(6) of Regulation (EU) No 517/2014 requiring the Commission to, *"no later than 1 January 2017, publish a report examining Union legislation with respect to the training of natural persons for the safe handling of alternative refrigerants to replace or reduce the use of fluorinated greenhouse gases and shall submit, if appropriate, a legislative proposal to the European Parliament and to the Council to amend the relevant Union legislation."* This report provides an analysis of the relevant Union legislation. It also assesses the training that is currently available in all Member States, the uptake of that training by service personnel and other current training initiatives that can be used as the basis for the wider promotion of training for alternative refrigerants.

This report was assisted by external technical work undertaken for the Commission including a questionnaire seeking input from Member States' authorities as well as extensive

¹ OJ L 150, 20.05.2014, p.195.

² Commission Staff Working Paper: Impact assessment - Review of Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases, 7.11.2012, SWD(2012) 364 final. http://ec.europa.eu/clima/policies/f-gas/legislation/docs/swd_2012_364_en.pdf.

³ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A policy framework for climate and energy in the period from 2020 to 2030, COM/2014/015 final: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0015>

⁴ Study on alternatives for high ambient temperatures, Öko-Recherche, November 2014: http://ec.europa.eu/clima/policies/f-gas/legislation/studies_en.htm

consultations with stakeholders⁵, including deliberations within the Consultation Forum established pursuant to Article 23 of Regulation (EU) No 517/2014.

2. EU Legislation and product standards related to training

2.1 Regulation (EU) No 517/2014 (F-gas Regulation)

Regulation (EU) No 517/2014 and related Commission Implementing Regulations⁶ set out very specific requirements at EU level for training and certification of technicians handling fluorinated greenhouse gas refrigerants. Many of them are based on measures already in place under the previous Regulation (EC) No 842/2006 and its Implementing Regulations from 2008. These requirements serve the main purpose of ensuring that greenhouse gas emissions from equipment are minimised⁷.

Since 1 January 2015 certified technicians must also have, in addition to technical knowledge and practical training on fluorinated greenhouse gases⁸, "*information on relevant technologies to replace or to reduce the use of fluorinated greenhouse gases and their safe handling.*" The intention is to provide technicians being trained in the use of fluorinated greenhouse gases with some general background about the properties of alternative refrigerants (i.e. CO₂, ammonia, hydrocarbons and HFOs⁹), and the characteristics of equipment designed to use them. More specific training requirements regarding the alternative refrigerants (which are not fluorinated greenhouse gases) are not included in the Regulation, as these alternative refrigerants are not covered by its scope.¹⁰

2.2 Other relevant EU legislation

On the other hand, other EU legislation aiming to assure the safe handling of equipment includes obligations on training related to alternative refrigerants (see Table 1). In addition to specific legislation that relates to risks such as flammability and pressure, wider product safety as well as health and safety legislation is relevant in this context.

Table 1: Other EU legislation relevant to the safe handling of alternative refrigerants to fluorinated greenhouse gases

Category	EU Legislation
Pressure	Pressure Equipment Directive 97/23/EC (and Recast 2014/68/EU)
Flammability /	ATEX 95 – Explosive Atmospheres Directive 2014/34/EU (repealing

⁵ European Union legislation relevant to training of personnel enabling the safe handling of alternative refrigerants, Ricardo (2015). http://ec.europa.eu/clima/policies/f-gas/legislation/docs/legislation_training_personnel_en.pdf

⁶ For refrigeration, air conditioning and heat pump equipment: Commission Implementing Regulation (EU) No 2015/2067 and Commission Regulation (EC) No 307/2008.

⁷ Relevant activities are installation, servicing, maintenance, repair, decommissioning of equipment, in addition to leak checking as well as recovery of fluorinated greenhouse gases at the end of the useful life.

⁸ Article 10(3)(e) of Regulation (EU) No 517/2014.

⁹ Hydrofluorolefins are unsaturated hydrofluorocarbons (HFCs) with very low GWP.

¹⁰ However, where fluorinated greenhouse gases are blended with alternative refrigerants such as hydrocarbons, CO₂ or HFOs, these mixtures are subject to all Regulation (EU) No 517/2014 training and certification requirements as well as any extra requirements related to the Safety Directives referred to below.

Explosive Atmospheres	Directive 94/9/EC ATEX 137 – Directive 99/92/EC on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres.
Health and Safety	Directive 89/391/EEC – Occupational Safety and Health Framework Directive (OSH)
Product Safety	Directive 2006/95/EC (and Recast 2014/35/EU) - Low Voltage Directive Directive 2004/108/EC (and Recast 2014/30/EU) - Electromagnetic Compatibility Directive Directive 2006/42/EC - Machinery Directive

At the EU level, Directive 89/391/EEC on Occupational Safety and Health Framework encourages measures to improve the safety and health of workers at work. It provides general requirements for the training of employees, including temporary staff/contractors who work on the same premises. Workers must receive training upon recruitment (before starting work), in the event of a transfer or a change of job, when work equipment is introduced for the first time or changed, and when new technology is introduced. Although these are general requirements, they are obviously relevant to aspects related to alternative refrigerants where the handling and use of these could pose a risk to workers. The point of introduction of new technologies is of particular relevance in this context. Particular occupational risks and safety issues are also covered by other specific directives such as those related to pressure equipment and explosive atmospheres.

The Pressure Equipment Directive 2014/68/EU, which is relevant to equipment using e.g. CO₂, refers to the training required by notified bodies, third party organisations and user inspectorates. The Explosive Atmosphere Directive 2014/34/EC and the Safety and Health Protection of Workers Directive 1999/92/EC is the key European legislation addressing safety requirements in relation to explosive atmospheres and for improving the safety and health protection of workers potentially at risk from explosive atmospheres. These requirements are relevant for flammable alternative refrigerants such as hydrocarbons or HFOs. Specific training requirements relate to staff responsible for conformance inspections. Directive 1999/92/EC also places a responsibility on employers to provide appropriate training for work in relation to risks from explosive atmospheres without specifically referencing alternative refrigerants but includes relevant aspects such as informing them of explosion hazards, protective measures taken, how the hazard arises, the correct way of working with equipment, personal protective equipment to be worn, and availability of operating instructions. The duty to provide training also extends to external contractors.

Furthermore, there are a number of product safety directives that include requirements for the placing of certain types of products on the market, and are designed to help promote the Single Market. These are generally aimed at the manufacturers, and therefore place requirements on them with regard to the product and provision of information on the product, rather than in relation to the training of those handling alternative refrigerants. Product safety legislation including Directives [2014/35/EU](#), [2014/30/EU](#) and Directive [2006/42/EC](#) do not provide specific training requirements in relation to the use and safe handling of alternative refrigerants, but do provide requirements for the training of personnel responsible for carrying out conformity assessments and co-operation on training activities between Member States competent authorities responsible for product safety.

All these pieces of legislation are Directives and thus leave some margin of implementation to the Member States. Therefore the approach taken for alternative refrigerants clearly differs from that described in the directly applicable Regulation for fluorinated greenhouse gases. By way of example, there are no specific EU minimum requirements identified in the relevant Directives affecting the alternative refrigerants and no mandatory EU certification schemes. Employers are expected to keep records of training given to staff, but there is no role defined at EU level for refrigeration certification bodies. The absence of EU prescriptive minimum standards and of an EU certification requirement may lead some companies to believe that there are no mandatory training requirements. This is definitely not the case.

It is also important to note that prescriptive training and competence requirements are given in two EN standards that apply to refrigerants, including both fluorinated greenhouse gases and their alternatives. In particular, EN13313 addresses the competence of personnel for refrigerating systems and heat pumps. It defines the activities related to refrigerating circuits and the associated competence profiles and establishes procedures and a framework for assessing the competence of persons who carry out these activities, including a certification scheme. This includes, for example, aspects related to alternative refrigerants such as flammability, toxicity and pressure, giving an indication of the level of competence for different parts of the work processes e.g. design, installation, operation, general maintenance, decommissioning etc. Another key standard for refrigerants is EN378, which includes (in EN378-4) training elements that are relevant to alternative refrigerants that are flammable.

In summary, the analysis of EU legislation shows that a number of EU Directives already require suitable training for personnel working on alternative refrigerants. There is also a mandatory requirement to ensure that staff handling alternative refrigerants receives adequate training to protect them from safety risks – in particular risks related to the use of flammable alternative refrigerants and risks related to use of high pressure equipment. These pieces of legislation place an obligation on employers to ensure that risks are properly assessed and that, as part of a risk mitigation process, appropriate training is given to staff. The requirements apply both to product designers working for equipment manufacturers and to technicians carrying out installation, maintenance and end-of-life decommissioning. Under the existing Directives it would already be illegal for an employer to allow an employee to work on systems with, for example, a flammable refrigerant unless they have adequate training. The mandatory training requirements for alternative refrigerants are less prescriptive

than those for fluorinated greenhouse gases, but if the requirements of Directives listed in Table 1 combined with the requirements in EN 13313 constitute a good legal framework for training requirements.⁵

The Consultation Forum meeting¹¹ held on 10th September 2015 therefore discussed the current legislation framework, as outlined above, with respect to the provision of training for alternative refrigerants and the preliminary conclusion that the current legal framework, although non-prescriptive at EU level, provides a sufficient legal basis for the provision of training for alternative refrigerants to assure their safe use. The members of the Consultation Forum generally accepted this view.⁵ However, some stakeholders pointed out that harmonised, detailed rules at EU level could potentially simplify training decisions for employers and a certification process could help monitor the uptake of training. Others cautioned that any additional legal requirements for alternative refrigerants might further impede their introduction and use.

3. Availability of training in Member States

Service personnel that are handling equipment with fluorinated greenhouse gases will likely also be the personnel that will provide these services on equipment using alternative refrigerants. Pursuant to the requirements of the previous Regulation on fluorinated gases (Regulation (EC) No 842/2006), all Member States have notified certification and training schemes for using equipment containing fluorinated greenhouse gases in the relevant sectors. On the basis of a survey¹² directed at Member State authorities, it was established that today a total of 160 000 trained and certified fluorinated gas technicians are working on stationary refrigeration, air conditioning and heat pump systems, working for a total of 40 000 certified companies. On average, there are 40 fluorinated gas trained technicians and 10 certified companies per 100 000 population. The market is dominated by numerous and very small companies.

Sixteen Member States reported having a central personnel and company register to provide access to lists of technicians and companies that have certification for fluorinated greenhouse gases. Central registers are helpful to end-users wishing to verify that they are using properly certified technicians. In Member States without a central register such checks need to be made through the relevant certification body.

The situation today with regard to the availability of training for alternative refrigerants is summarised in Table 2. A fairly high proportion (71%) of Member States have training available for ammonia (as this refrigerant has been in use for a long time already), but availability is much lower for other alternative refrigerants. The percentages of technicians trained in the different alternative refrigerants as a percentage of the total number of fluorinated gas trained technicians in the EU is very low (0-2.3%). However, unlike for fluorinated greenhouse gases, where there is a mandatory certification scheme providing

¹¹ http://ec.europa.eu/clima/events/articles/0106_en.htm

¹² Response rate: 22 Member States representing over 91% of EU population

Member State government officials with a means of obtaining accurate data for the number of certified technicians, this is not the case for alternative refrigerants. It is therefore likely that the actual numbers of those trained on alternative refrigerants are higher than those reported in the survey. Nonetheless, the uptake of training of alternative refrigerants appears to be still low.

Table 2: Analysis of training in climate-friendly alternative refrigerants to fluorinated greenhouse gases

	Ammonia	CO ₂	Hydrocarbons: small hermetic systems	Hydrocarbons: larger systems (split systems, chillers)	HFOs
Training available in country (% of Member States)	71%	52%	48%	35%	20%
Proportion of certified fluorinated gas personnel trained in alternative refrigerants	2.3%	2.2%	0.7%	0.05%	0%

Training involves theoretical knowledge as well as practical training on the relevant equipment. The latter aspect is more cost-intensive as it requires the establishment of sufficiently equipped training centres. Some relevant training centres exist already in Member States, with some 90 providing theoretical training and around 50 providing practical training identified in 14 Member States. The geographic distribution shows that the availability of such facilities is much better in some Member States than in others. The structure of the industry, with micro-enterprises being so dominant, is a potential barrier to the roll-out of training for climate-friendly alternatives. It is relatively hard for very small companies to fund the training required in the wide range of alternatives that are becoming available.

A number of Member States have reported initiatives to increase the uptake of training related to climate-friendly alternative refrigerants. Some Member States will include aspects of these alternative refrigerants in their training qualifications (United Kingdom, Spain), others are planning to set up additional specific training facilities (Germany, Netherlands) and some are funding projects on training know-how, promotion of alternative refrigerants and company awareness of training needs (Bulgaria, Estonia). Furthermore, some national training organisations are planning to improve training on alternative refrigerants (Finland).

4. Private sector and other initiatives

Despite the absence of prescriptive requirements for alternative refrigerants at EU level, industry has pursued specific initiatives with regards to training on climate-friendly alternative refrigerants, partly because of legal safety requirements and other requirements as

discussed in section 2 above. In this way, manufacturers of products that use alternative refrigerants provide, in most cases, training themselves as well as dedicated personnel to perform maintenance operations for the end-user. This is e.g. the case for the large centralised CO₂ supermarket refrigeration systems.

Furthermore, the Air-conditioning and Refrigeration European Association (AREA) has published a guide on minimum requirements for contractors' training and certification.¹³ These requirements are aligned with standard EN 13313 ("Refrigerating systems and heat pumps; competence of personnel"). The AREA material provides comprehensive training frameworks and suggested course structures for ammonia, CO₂ and hydrocarbons.

Finally, a firm foundation for future training activities, in particular for theoretical training, throughout the EU is being provided through the "Real Alternatives" project¹⁴ which is a multi-country training initiative that has been supported by the European Commission, the United Nations Environmental Programme and a number of companies. This programme has created a comprehensive body of training material including e-learning modules for climate-friendly alternative refrigerants which is available publicly on its website in six languages.

5. Barriers due to training availability

The training issue is being taken very seriously by the various stakeholders involved - from suppliers of equipment, service personnel to end-users and responsible authorities - and the awareness of the need for more and adequate training on equipment using alternative refrigerants is high. Nevertheless, there are a number of shortcomings that have been identified and which may act as barriers if not addressed.

5.1 Availability of appropriate training materials

There is good availability of training materials that can support training programmes related to alternative refrigerants (EN 13331 standard, AREA guidelines, the EU-funded Real Alternatives project, many national activities), many of them freely available to technicians in all Member States. This can provide a platform for the improved roll-out of training but besides the possible need for material in other languages they need incremental, continuous development to reflect changes such as the introduction of new standards, new alternative refrigerants and technology developments and improvements in understanding how to use climate-friendly alternative refrigerants. Translations into all relevant languages would also support a wider use across the EU. These on-going developments should be further encouraged. The key to success will be to encourage technicians across the EU to use the training resources that are already available.

¹³ *Low GWP Refrigerants: Guidance on minimum requirements for contractors' training & certification*, AREA Guidance Paper November 2014 <http://www.area-eur.be/system/files/Documents/AREA%20-%20Guidance%20training%20Low%20GWP%20refrigerants%20%282014%29.pdf>

¹⁴ <http://www.realalternatives.eu/about-u>, funded by EU Lifelong Learning Programme

5.2 Lack of practical training facilities

While the availability of existing materials such as relevant information documents and software for theoretical training (either via e-learning or classroom based) is reasonable, there appears to be a considerable shortage of practical training facilities for hands-on training on relevant equipment in some regions. The slow provision of an adequate number of practical training facilities is thought to be related to the investment cost to set up such facilities, as well as running costs. Relevant authorities at all levels may need to consider ways of encouraging more investment in such facilities, in cooperation with associations representing contractors and equipment providers, as well as colleges, vocational education centres, trade unions and private training schools.

5.3 Lack of trained engineers and technicians

Despite the availability of good training materials, it is clear that the currently known uptake of training is too low to match the medium and long term requirements of the HFC phase-down. There is a general lack of preparedness for alternative refrigerants including ammonia, CO₂, hydrocarbons and HFOs. This applies to both technicians that carry out installation and maintenance work and to professional engineers that specify and design equipment.

While the current use of the alternative refrigerants is relatively limited, an increased number of trained technicians need to match uptake of alternative refrigerants as the HFC phase-down becomes more and more challenging. Already in 2018 HFC availability (measured in CO₂ equivalent) must be reduced by 37% compared to 2015. By that time it will be important that a much higher proportion of technicians have been trained. In some regions the lack of trained service providers is an important factor for abstaining from a conversion to alternative refrigerants, e.g. to the use of CO₂ in commercial refrigeration. It will be important to encourage the uptake of training quickly, giving a role to relevant authorities, industry trade bodies, equipment manufacturers as well as training organisations. Awareness campaigns among end-users and the equipment distribution chain (e.g. wholesalers, supermarkets, large building operators) promoting the training and facilitating an exchange of best practices are needed. One possible way of achieving a multiplication of effort and addressing the existing geographic imbalance could be the use of train-the-trainer programmes. Besides equipment producers ensuring that service personnel is trained on technologies that are newly introduced, big end-users (i.e. large retailers) can have an important impact, notably by requiring that only duly trained technicians work with their systems. Some industry associations at a national level are considering to define minimum training requirements or establishing "skill card" systems on a voluntary basis to give technicians an official record of their training and skills profile.

6. Conclusions

In response to Article 21(6) of Regulation (EU) No 517/2014, the Commission examined the EU legislation with respect to the training of natural persons for safe handling of alternative refrigerants replacing fluorinated greenhouse gases. Based on this assessment it can be

concluded that, by and large, the legislative framework complemented by existing standards at the European level appears appropriate to assure safe handling of such equipment where these rules are followed. Further legislative action at EU level on this issue seems therefore not appropriate at this time.

Still, on the basis of input from Member States' authorities and other stakeholders, shortcomings were identified in practice as regards the existing training offer for the use of climate-friendly alternative technologies. In particular, a current lack of training facilities, the provision of practical training and the number of skilled personnel are apparent. More efforts are needed to ensure that the provision of training will meet the rising future demand.

In this context, based on preliminary findings of this report, the Commission already included training on alternative refrigerants as one of the key priorities in the 2016 call for proposals under the LIFE programme¹⁵. Also, there is increasing activity in this field by stakeholders including associations of technicians, private companies and authorities. Companies selling equipment with alternative refrigerants have an interest in promoting the skills to handle this equipment and could further facilitate the access to training on their equipment as well as cooperating with independent training centres. Technician associations are looking at new fields of work for their members and could similarly promote and facilitate the access to training. National authorities could use available funding programmes to support the setting up of relevant facilities and training programmes as well as raising awareness of existing rules and standards.

¹⁵ The LIFE programme is the EU's funding instrument for the environment and climate action. <http://ec.europa.eu/environment/life/about/index.htm>