Summary: Intervention & Options

Department /Agency:	Title:	
Defra	**Impact Assessment of the Fluorinated Greenhouse Gases Regulations 2009**	
Stage: Full	**Version:** Final	**Date: November 2008**
Related Publications: Full IA on minimum personnel qualifications, reporting, leakage checking, labelling, company certification and personnel registration requirements		

Available to view or download at:

http://www.

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What is the problem under consideration? Why is government intervention necessary?

As part of the European Union's obligations under the Kyoto Protocol, the Community has taken action to regulate fluorinated greenhouse gases (F gases) through EC Regulation No 842/2006 and ten associated Commission Regulations on certain fluorinated greenhouse gases ('The F Gas Regulation') in order to contain, prevent and thereby reduce emissions of F gases. Intervention is therefore required to meet these EC regulations that are designed to improve reporting, leakage checking, labelling, company certification and personnel registration requirements for equipment involving F gases in five industrial (F gas usage) sectors (a) fire protection, (b) mobile air-conditioning (MAC), (c) High Voltage (HV) switchgear and (d) solvent cleaning and (e) stationary refrigeration and air-conditioning (SRAC).

What are the policy objectives and the intended effects?

The principal objective of the EC Regulation is to contain, prevent and thereby reduce emissions of F gases covered by the Kyoto Protocol. This Regulation will make a significant contribution towards the European Community's Kyoto Protocol targets in helping to keep a track of F-Gas usage in different sectors, in order to help reduce its emissions.

What policy options have been considered? Please justify any preferred option.

The Regulations set minimum requirements that must be complied with. Doing nothing is not an option if the Government is to avoid possible legal action by the European Commission for alleged failure to meet its EU obligations in the Commission Regulations. The recommended option is that the Government complies with legal requirements. There were a few minor variations to this main option, especially in relation to the way that personnel and companies are certified. The different variations were compared during the consultation process. The recommended variation that resulted in the minimum legal requirements being complied with was taken forward following the consultation response. The evidence and expert opinion provided during the consultation has been used to propose and justify the preferred option presented in this final IA.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?

Article 10 of EC Regulation 842/2006 requires the EU to produce a report based on the experience of the application of the Regulation within five years of the Regulation coming into force 4 July 2011

Ministerial Sign-off For Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister:

Summary: Analysis & Evidence

Policy Option: 1	Description: **Implementation of F Gas Regulation EC 842/2006 and 10 associated Commission Regulations**

COSTS

ANNUAL COSTS

One-off (Transition)	Yrs
£ 96.8m – £165.3m	3
Average Annual Cost (excluding one-off)	
£ 71.3m – £155.1m	20

Description and scale of **key monetised costs** by 'main affected groups' 7 main F-Gas usage sectors affected: Fire protection; Refrigeration and air-conditioning (RAC); HV switchgear; Solvents; Mobile air-conditioning; F Gas fluid supply. RAC sector represents >80% of costs.

Total Cost (PV) £ 1,068m - 2,295m

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS

One-off	Yrs
£ none	
Average Annual Benefit (excluding one-off)	
£ 118m - £218m	20

Description and scale of **key monetised benefits** by 'main affected groups' 7 main F-Gas usage sectors affected: Fire protection; Refrigeration and air-conditioning (RAC); HV switchgear; Solvents; Mobile air-conditioning; F Gas fluid supply. RAC sector represents >95% of benefits

Total Benefit (PV) £ 1,613m - £2,991m

Other **key non-monetised benefits** by 'main affected groups' More reliable provision of desired "service" e.g. better refrigeration system reliability. Higher overall standards of preventive maintenance.

Key Assumptions/Sensitivities/Risks The degree of uncertainty is indicated by the large range of the net benefit range below and the low and high cost estimates in the main body (for instance leak checking, company and personnel certification). There is insufficient data at present to be more accurate, but industry experts agree that the costs are representative of the extreme high and low possibilities. An avoided social cost of electricity 4.82p per kWh has been used. A EUA allowance price schedule to value the carbon related to the electricity savings is provided in Annex A.

Price Base Year 2008	Time Period Years 20	**Net Benefit Range** (NPV) **£ 545m to £696m**	**NET BENEFIT** (NPV Best estimate) **£ 610m**

What is the geographic coverage of the policy/option?				GB	
On what date will the policy be implemented?				February 2009	
Which organisation(s) will enforce the policy?				see reg 3(3)	
What is the total annual cost of enforcement for these organisations?				£ 750k	
Does enforcement comply with Hampton principles?				Yes	
Will implementation go beyond minimum EU requirements?				No	
What is the value of the proposed offsetting measure per year?				£ n/a	
What is the value of changes in greenhouse gas emissions?				£ 52 million p.a.	
Will the proposal have a significant impact on competition?				No	
Annual cost (£-£) per organisation (excluding one-off)	Micro	Small	Medium	Large	
Are any of these organisations exempt?	No	No	N/A	N/A	

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase £ 25k Decrease £ 0 **Net** £ 25k

Key: **Annual costs and benefits: Constant Prices** **(Net) Present Value**

Evidence Base (for summary sheets)

Background

1. This document provides details of a Full Impact Assessment related to the introduction in GB of ten Commission Regulations (see chapter 2 of the annexed report for the full list of the ten Commission Regulations) that relate to the EC F Gas Regulation (EC 842/2006).

2. The principal objective of the EC Regulation is to contain, prevent and thereby reduce emissions of F gases covered by the Kyoto Protocol. This Regulation will make a significant contribution towards the European Community's Kyoto Protocol target by introducing cost-effective mitigation measures.

3. F gases are man-made gases that are used in a number of different sectors. The most commonly used F gases belong to a class of chemicals known as hydrofluorocarbons (HFCs). HFCs were virtually unused before 1990 but since then have been used to replace ozone-depleting substances. Other F gases are perfluorocarbons (PFCs), which are used in the fire fighting and electronics sectors, and sulphur hexafluoride (SF6), which has been used in diverse applications such as training shoes and as cover-gas in magnesium casting operations.

4. Although F gases do not damage the ozone layer like the chlorofluorocarbons (CFCs) that they replace, they are powerful greenhouse gases, are generally long-lived and are included in the basket of gases under the Kyoto Protocol

5. There has been uncertainty regarding the use of HFCs since the adoption of the Kyoto Protocol. The Government recognises that the successful phase out of ozone-depleting substances (ODS) under the Montreal Protocol is being achieved with a range of technologies, and accepts that HFCs are necessary to replace ODS in some applications. In view of this, the Government's position on HFCs is as follows:

    - HFC should only be used where other safe, technically feasible, cost-effective and more environmentally acceptable alternatives do not exist;

    - HFCs are not sustainable in the long term – the Government believes that continued technological developments will mean the HFCs may eventually be able to be replaced in applications where they are used;

    - HFC emission reduction strategies should not undermine commitments to phase-out ozone-depleting substances under the Montreal Protocol; and

    - HFC emissions will not be allowed to rise unchecked

6. An earlier consultation set out implementation options and proposals for Regulations prescribing offences and penalties applicable to infringements of EC Regulation 842/2006. Following further Commission Regulations, which flesh out the legal obligations in the EC Regulation in respect of further implementation measures, the government is seeking to transpose these minimum requirements and implement new qualfications for each sector, making use of the relevant transitional periods provided for in the relevant Commission Regulations.

7. The proposed Regulations prescribe offences and penalties applicable to infringements of EC Regulation 842/2006 on certain fluorinated greenhouse gases (F gases), and ten Commission Regulations establishing fleshed out legal requirements for companies and qualifications for personnel working in five industry sectors covered by EC Regulation 842/2006 as well as dealing with other requirements relating to leakage checking, reporting and labelling, together with proposed powers for authorised persons to enforce these Regulations.

8. Although these Commission Regulations have direct effect in all Member States, they will require some Regulations to be put in place in GB e.g. to create offences and penalties for failure to comply and to specify national qualification requirements. This Impact Assessment has been progressed to the "Final" stage following the Partial Impact Assessment which formed part of a consultation on the proposed Regulations which ended on the 3 October 2008. These proposed Regulations enable GB to comply with its EU Treaty obligations.

9. It is important to note that many of the requirements set out in the ten Commission Regulations have little flexibility in terms of options for implementation. In these circumstances we evaluated a single option in terms of the likely range of cost and environmental impact. However, in a few situations, especially in relation to the way that personnel and companies are certified and registered for stationary refrigeration, air conditioning and heat pump equipment and also for fire protection systems, there were different options that were compared during the consultation process. There are no company certification requirements in the EU legislation for any other sectors and so these were not considered.

10. The Regulations affect a number of sectors of the GB economy. The largest impacts relate to the use of F Gases in stationary refrigeration and air-conditioning (SRAC). There are also impacts for F Gases used in: (a) fire protection, (b) mobile air-conditioning (MAC), (c) HV switchgear and (d) solvent cleaning. There is a small impact for the F Gas fluid supply sector.

11. The financial value of the total benefits of the proposed measures outweighs the costs. Using a discounted cash flow analysis over a 20 year period, with a 3.5% discount rate there is:

    - A net present value (NPV) of between £545 million and £696 million ;
    - CO_2 emission reductions of between 1.6 and 2.8 million tonnes CO_2 equivalent per year.[1]

12. The figures are dominated by the SRAC sector which accounts for 96% to 98% of the NPV described above. The costs for implementation of the Regulations in SRAC are significant. There is a fixed cost of £79 million to £136 million plus annual costs of £76m to £161m. However, there are significant financial benefits in terms of (a) the monetary value of reduced F Gas usage (b) monetary value of reduced electricity consumption (c) the value of CO_2 equivalent not emitted from reductions in F gases, and (d) the value of decreased emissions resulting from electricity savings calculated using the projected EU Allowance price under the EU Emissions Trading Scheme, i.e. the revenue gained from selling permits for emissions. (See Annex 1 for the schedule of EU Allowance Prices). The discounted total value of the gross benefits ranges from £1.6bn to £3bn.

13. The fire protection, MAC and fluid supply sectors all have a small net cost (i.e. the costs are greater than the benefits). The solvent and HV switchgear sectors have a small net benefit. The key figures from a discounted cash flow analysis are summarised in the following table:

1 This includes carbon savings from HFC reductions and electricity savings

Summary of discounted cash flow analysis for each measure

Sector	NPV[2] minimum	NPV maximum	Range of tonnes of C02 saved (k tonnes) over 20 years	Range of PV of total costs (£k)
Fire Protection	-43,000	-10,000	77 - 153	11,650 – 46,400
SRAC	552,000	724,000	30,500 - 51, 550	1,041,600 – 2,228, 000
HV Switchgear	10,000	21,000	485 - 970	400 – 600
Solvents	190	340	10 - 20	30-100
MACs	-8,000	-6,500	285 - 570	15,000 – 19,500
Fluid Supply	-400	-200	n/a	250 - 400
Total (rounded) [3]	530,000	670,000	31, 350 - 53,263	

14. Options for mandatory registration of personnel working on SRAC systems have been evaluated. This option was presented in the Partial IA in order to generate views from the consultation stage, in relation to whether it would be worth pursuing as an option. The extra costs are very small compared to the overall total cost but may be seen as significant for smaller business and the benefits to them to be marginal. It is arguable that a registration scheme could be financially justified if the registration scheme gives rise to a small improvement to the quality of leak prevention work but more detailed study would be needed to quantify this. In addition industry experts have indicated that the current arrangements would allow for an abuse of the system (for instance individuals forging certificates to avoid being properly trained). This type of abuse would be much more difficult if there was a mandatory registration scheme.

15. The considerations and conclusions for a mandatory personnel registration scheme have been presented in section 2.4.4 of this Final IA.

2 This is reflecting the net benefits range on the summary: Analysis & Evidence page of this Impact Assessment (page 2). Net present Value based on 3.5% discount rate, 20 year period to 2028. A positive figure represents the benefits outweighing the costs. The figures include a shadow value for C02 equivalent emissions reductions due to a reduction in gases, and a value for C02 emissions saved due to electricity savings using the EUA Allowance price.

3 Note, total costs are rounded so that they do not imply a degree of accuracy greater than those possible in the SRAC figures, which dominate the total value.

16. Options for a more robust company registration scheme have been evaluated for SRAC and fire protection. The extra costs are very small compared to the overall total cost and could be financially justified if the more robust company certification scheme gives rise to a small improvement to the quality of leak prevention work. More detailed study would be needed to test out this proposition. Industry has indicated concern about a one-off registration process because of the speed with which companies change in terms of both size and activity. Many people are concerned that a one-off scheme would become unusable after a few years if some form of re-certification is not implemented. Furthermore, the costs involved are relatively but the benefits are believed (view of industry experts) to be important.

17. Costs estimates in this IA and the annexed report are incremental extra costs compared to "business-as-usual" practice. The costs have been assessed using a standard cost model approach, with estimates made of extra man-hours required for compliance and of typical man-hour costs.

18. The costs and benefits in this IA have been discounted over twenty years as many of the costs and benefits accrue over this timescale because the life of equipment using F Gases is often in excess of twenty years. For example, high voltage switchgear equipment installed today is likely to last over twenty years (page 86 section 5.2.2 of the report (annex 2), provides further details in this context).

19. In relation to the level of uncertainty mentioned in the data set out in the Key Assumptions/Sensitivities/Risks section, this is due to insufficient data at present to be more accurate. Judgments from industry experts have had to be made, but industry experts agree that the costs are representative of the extreme high and low possibilities. Therefore a mid point is the best estimate and this is what has been presented on page 2 in the NPV best estimate box.

20. The existence of the EU ETS and the newly proposed centrally set cap require that UK GHG emissions reductions in the ETS sectors are distinguished from UK GHG emissions reductions in the non-ETS sectors. A tonne of CO_2e abated in the ETS sectors is treated as a distinct unit from a tonne of CO_2e abated in the non-ETS sectors. Reductions in UK emissions in the ETS sectors deliver an economic benefit to the UK, but do not reduce global GHG emissions and should be valued at the 'market price of carbon' (that is the EUA price). Reductions in the non-ETS sector help the UK reach its binding target for emissions in the non-traded sector and should be valued using the Shadow Price of Carbon (SPC).

21. The benefits consist of the monetary value of reduced F gas usage, the monetary value of electricity savings, a valuation of the reduction in C02 due to a reduction in electricity usage (using the EUA Allowance price see Annex A) , and a valuation of the reduction in F gas emissions resulting in a reduction of C02 equivalent. The latter is valued using a schedule of shadow price of carbon ("SPC") values, using standard Government guidance. The SPC starts from £26.50 per tonne of Carbon Dioxide (CO2) in 2008 and rising 2% p.a. A discount rate of 3.5% has been used for discounted cash flow assessments. The SRAC sector is the only sector that features electricity savings.

22. **The above analysis indicates that for the entire set of measures, the cost of reducing emissions is below the weighted average shadow price of carbon for 97.6 to 98.1%% of emissions reductions.** Although the remaining 1.9% to 2.4% of emissions reductions measures are not cost effective, they are required to be implemented due to the EU Directive. (See pages 31 to 32). In addition the cost of reducing emissions in the SRAC is also below the weighted average EU allowance price.[4]

23. The following sections provide a summary of the information relating to sectors affected by the Commission requirements and are taken from a draft report undertaken by Enviros Consulting Limited on behalf of Defra and BERR. The report was carried out on behalf of Defra and BERR in the spring of 2008.

4 The SRAC is the only measure to have emission reductions in the traded sector, which is why the cost effectiveness of this was measured against the weighted average EU Allowance price.

24. The full draft report is annexed to this document and provides more detailed analysis of the costs and benefits in GB of implementing the ten Commission Regulations that specify various requirements in relation to EC Regulation 842/2006. Paragraph numbers in the following sections below reflect those in the annexed report. The Annexed report is structured as follows:

Chapter 2 provides background to the relevant Commission Regulations.

Chapter 3 addresses the impacts for the Fire Protection (FP) industry.

Chapter 4 addresses the impacts for the Stationary Refrigeration and Air-conditioning industry (SRAC).

Chapter 5 addresses the impacts for the High Voltage (HV) switchgear industry.

Chapter 6 addresses the impacts for the solvents industry.

Chapter 7 addresses the impacts for the Mobile Air-conditioning (MAC) industry.

Chapter 8 addresses the impacts for the F Gas fluid supply industry.

Chapter 9 provides a summary of the impacts for all sectors.

This impact assessment follows a similar format to the report. The impacts on each sector of the proposed changes have been analysed.

1. IMPACTS FOR FIRE PROTECTION

1.1 Background and Industry Structure

The fire protection sector (FP) refers to the use of HFCs as fire suppression fluids in fire protection systems. Most of the obligations under the F Gas Regulation relate to stationary fire protection systems that are permanently installed in premises requiring this specialised form of fire protection. A common application for HFC FP is to protect high value electronic equipment such as computer rooms or communication centres. There is a very small usage of HFCs in portable fire extinguishers. See section 3.1 of the annexed report for more details of the industry sector.

1.2 Labelling Requirements

1.2.1 Assessment of Labelling Impacts

Article 7 of the F Gas Regulation and Commission Regulation 1494/2007, establishing the form of the labels as regards products and equipment containing F gases, sets down requirements for labelling of new equipment placed on the market after April 1st 2008. The labelling requirements apply to stationary fire protection systems and also to portable fire extinguishers using HFC fluids.

All the filling of FP cylinders is carried out by 5 companies in GB. The costs of redesigning the current labels are estimated at £1,000 to £2,000 per company[5], totalling £5,000-£10,000 for labelling in the sector. Once the label is redesigned there is no additional cost associated with affixing the labels.

Environmental Impact and Benefits: HFC FP systems are already well labelled and the additional material is not likely to make a significant difference to the rate of leakage from the current levels. Hence, the labelling requirement will have no quantifiable environmental impact on the FP sector. However, good labels will help personnel servicing equipment readily identify the type of F Gas being used which should be of benefit.

1.3 Leak Checking Requirements

1.3.1 Assessment of Leak Checking Impacts

Commission Regulation1497/2007 sets down requirements for leak checking of stationary FP systems. Many of the requirements are already in place through standard preventative maintenance contracts with FP specialists.

Costs Costs have been estimated based on discussions with experts from the fire protection industry. It is estimated that there are 10,000 to 20,000 FP systems containing more than 3 kg of HFC in GB. The leakage checking requirements in EC Regulation 842/2006 on certain fluorinated greenhouse gases are set out in Article 3 of the Regulation and only apply to applications that contain 3kg or more of F gases. The frequency of the leakage checks depends on the charge (of F gas) in the application and the timetable for checking is set out in Article 3(2) of EC Regulation 842/2006. The incremental cost of meeting the leak checking requirements is estimated to be £0.7 to 2.8 million per year[6]. A one-off cost of £2 to 8 million is required for automatic leak detection systems[7]. These costs have been estimated based on discussions with experts from the fire protection industry.

Savings If leaks are reduced there will be a saving in terms of top up fluid being purchased. It is estimated (see paragraph below) that the emission reduction is 4,000 to

5 Based on actual examples of company labelling

6 Record keeping £50 to £100 per system. Leak checks in range of £200 to £400 per system. Minimum assumes 10% of 10,000 systems need leak tests. Maximum assumes 10% of 20,000 systems.

7 Minimum assumes £4,000 per system and 5% of 10,000 systems need upgrade of control system for automatic detection. Maximum assumes £10,000 and 5% of 20,000 systems.

8,000 tonnes CO_2 equivalent. This represents about 1 to 2 tonnes of HFC fluid, which has a direct financial value of about £10,000 to £20,000 per year.

Assuming the shadow cost of CO_2 equivalent emissions (£26.50 per tonne of CO_2 and rising by 2% p.a.) the environmental impact of these emissions is worth a further £100,000 to £300,000 per year.

Environmental Impact and Benefits: The implementation of better leak checking procedures will have only a small impact in the FP sector because current standards of leak checking are already good.

The most recent GB F Gas Emissions Inventory[8] shows that the F Gas emissions from the FP sector are around 350,000 tonnes CO_2 equivalent. This is equivalent to an actual emission of about 120 tonnes of F Gas (mainly HFC 227ae). This is made up of 3 types of release:

- Release during an actual fire.
- Accidental release due to faulty fire detection system.
- Leaks from the FP system.

The bulk of these emissions come from actual fires and from accidental release due to detection system faults. There is no field data that shows the exact split, but as great efforts are made during both design and maintenance to avoid leakage, FP industry experts believe that system leakage represents well below 10% of the total emissions. As 90% to 95% of systems are already maintained using service contracts with regular leak checks the improvements achieved through the new Regulation are estimated by industry experts to be in the range of 5% to 10% of current leakage emissions which is equivalent to around 4,000 to 8,000 tonnes CO_2 equivalent.

There is a small financial benefit of improved leak checking, related to reduced usage of F Gas, as described in the section above.

In addition there is the benefit that all FP systems will be regularly maintained, maximising their effectiveness. This is only a small additional benefit as most systems are already maintained in accordance with ISO 14250.

Note that these savings refer to the total set of regulations for this sector, not solely to those pertaining to leak checking requirements. The requirements relating to qualification and certification do not therefore add to these savings, but can be interpreted as being in place to ensure that these savings are realised, with more stringent options likely to increase the actual savings within the expected range.

1.4 Minimum Qualification Requirements

1.4.1 Impacts related to Certification of Personnel

The Commission Regulation defines minimum qualifications for personnel involved in the following activities with HFC FP systems:

a) Leakage checking of applications containing 3 kg or more of fluorinated greenhouse gases.

b) Recovery (from all stationary HFC FP systems and from HFC fire extinguishers).

c) Installation.

d) Maintenance or servicing.

All personnel involved in these activities will need to obtain a certificate showing they have passed an examination that meets the minimum requirements specified in the Annex to the Commission Regulation.

Costs for training: There will be some initial costs to develop suitable training courses and to equip training centres and train teachers and examiners. These set up costs will

8 AEAT, 2004

be recouped via the on-going costs of training. The cost of training has been estimated using costs for similar courses that currently exist. Training 500 to 600 (based on discussions with fire industry experts) FP personnel is estimated to cost £0.3 to 0.5 million[9], including the lost income while trainees are away from their workplace. This cost will be spread over a 2 year period.

Environmental benefits: Any environmental benefits linked to good quality leak testing have been counted in Section 1.3. No further benefits can be attributed to the provision of trained staff as this would create double counting.

1.4.2 Impacts related to Interim Certification of Personnel

The Commission Regulation provides the industry with an interim period to get the new personnel qualification which runs until July 2010.

As all operatives already need an in-house qualification to work on HFC FP systems they will all be deemed to hold an interim certificate and hence there are no extra costs related to interim personnel certification.

1.4.3 Impacts related to Certification of Companies

The Commission Regulation defines certification requirements for companies involved in the following activities with HFC FP systems:

a) Installation.

b) Maintenance or servicing.

To get a certificate companies must be able to show that they employ sufficient staff that hold personnel qualifications (as discussed in 1.4.2) and that they have appropriate equipment and procedures in place to enable their staff to minimise HFC emissions.

Company Certification Options: Two different approaches to company certification were considered during the consultation and these options were set out in the partial IA as follows:

a) A "minimalist" approach that meets the Commission Regulation requirements. This would be a one-off company certification, with a web based application form and self certification of data subject to random audit. A small number of companies would be audited in the first year, but there would be no further auditing in following years. The random audit process is essential if self certified data is to be used. This is considered a less costly process than requiring 100% external verification of data. A scheme based on self certified data without any kind of audit process would run a serious risk of abuse.

b) A more robust approach that would include regular re-registration. This process would have a number of benefits that are discussed in detail below. The frequency of re-registration creates a number of "sub-options" that need to be considered. More frequent re-registration makes the company list more accurate, but adds to the administrative burden and cost for each organisation on the register. Initial discussions with industry indicate that annual or 2-yearly re-registration is unnecessarily frequent, so options for 3-yearly and 5-yearly re-registration have been evaluated.

Costs for company certification: Costs have been estimated in discussion with industry experts and by comparison with similar schemes. Costs for 3 options have been estimated with the following assumptions:

Option 1: Meets minimum legal requirements. One-off company certification. Simple web based application process based on "self-certification subject to random audit". Audit of

9 Minimum assumes 500 personnel, £200 course fee, £50 certificate plus travel and lost earnings. Maximum allows for 600 personnel and more training time.

4% of companies only in first year, 2% with a half day visit and 2% by desk research. No re-certification[10].

Option 2: Improved scheme with 3-yearly re-certification. More robust application process, although still based on "self-certification subject to risk-based audit". Audit of 6% of companies per year, 3% with a half day visit and 3% by desk research. Re-certification every 3 years[11].

Option 3: As Option 2, except re-certification is every 5 years.

Comments on Option 1: There are around 200 GB based companies that supply, install and maintain HFC FP systems. Further details and background regarding these companies is set out in section 3.1 (paragraph 3) of the annexed report. The overall costs for operating a minimalist scheme are estimated, based on the assumptions outlined above, to be between £29,000 and £48,000 for the 200 companies being certified.

Comments on Option 2: The overall costs for Option 2 are estimated, based on the assumptions outlined above, to be between £39,000 and £58,000 for 200 companies being first certified plus an on-going average cost of recertification £20,000 to £30,000 (see table in annexed report section 3.5.4 for more details). An on-going risk-based audit programme will be maintained under Option 2 (unlike Option 1 where audits are only carried out in the first year). This process will help ensure that companies provide accurate data when they apply for certification.

Comments on Option 3: The overall costs for Option 3 are very similar to Option 2. The initial process is identical; hence the initial application costs are equal. Hence, the costs of Options 2 and 3 can be treated as approximately equal.

The benefits of Option 2 over Option 1 are:

a) The company data is kept up to date, reflecting the changing circumstances of each company.
b) There are funds available to ensure that on-going risk-based audits are carried out. This will put pressure on companies to comply properly with the F Gas Regulation and the terms of the Company Certificate.
c) The up to date list can be used by FP operators to check that their maintenance work is being done by a certified company.
d) The up to date list can be used by stakeholders such as Defra to contact certified companies and keep them informed of important issues related to the Regulation.
e) The up to date list can be used by Regulators to check for compliance.

Option 3 as the preferred option – Those consultees who responded to consultation question eighteen in the consultation document ("Do you have any comments on how the company certification schemes should be operated (i.e. renewal or non-renewal)?"), agreed that renewal represented the best option. In general, respondents agreed that a sensible renewal period should be agreed but did not specifically comment on the figures presented in the Partial IA for each of the options.

On the basis of these responses, Option 3 has been carried forward as the preferred option and the costs associated with this are those that were set out in the Partial IA.

10 The Option 1 company certification scheme will need to cover the costs of setting up and managing an administration system, processing each application to check that data is complete and provides sufficient evidence to meet the certification requirements. It must also fund the process of auditing a small proportion of companies (4%) during the first year. The total costs are estimated in the range of £29,000 to £48,000. These costs are spread across 200 companies, hence a cost per company in the range of £145 to £240.

11 The Option 2 scheme assumes a more comprehensive application form (which will require extra processing time) and a slightly larger number of risk-based audits (6%) – both these measures are intended to make the scheme more "robust" to deliver quality improvements. The on-going costs enable the scheme infrastructure to be maintained, provide an on-going audit process and also allows for re-certification every 3 years.

Quantifying the benefits of Option 3 Company Certification: It is reasonable to expect that, within the range of benefits estimated in Section 1.3 that the benefits will be higher for Option 3 than for Option 1 as this provides a more robust regime for companies that carry out the crucial tasks related to FP system maintenance and the five yearly re-certification would be less of a burden to industry. The rationale for the longer re-certification period within this sector is based on the limited number of companies involved. The range of benefits from the overall package of requirements is between £110,000 and £220,000 per year, including (a) HFC fluid savings, (b) value of CO_2 not emitted (see savings in section 1.3.1 for more details). The range of environmental benefit is between 4,000 and 8,000 tonnes CO_2 equivalent per year. The extra annual cost for Option 3 over Option 1 is less than £30,000. It is impossible to exactly quantify the increased savings under option 3, but it is clear that if a more robust company scheme makes an improvement to the quality of leak prevention activities that the environmental benefits and cost savings could out weigh the costs incurred. In addition it is very difficult to estimate at present the difference in savings because there is so little data available about the effectiveness of current training courses. However industry experts have indicated that it is reasonable to postulate that a more rigorous system will improve the overall quality of training and that this will result in further cost-effective leakage reduction.

1.4.4 Impacts related to Interim Certification of Companies

Article 7 of Commission Regulation 304/2008 requires companies carrying out installation or maintenance or servicing to hold a certificate to confirm that it has the skilled personnel and equipment to carry out work with adequate expertise so that emissions are avoided/minimised.

The European Commission and a majority of Member States agreed that a very light touch company certification requirement was needed, as the 2006 Regulation has only one reference to certification programmes for companies in Article 5.1. At present, there is no legal requirement in GB for companies to be certified. The Government therefore intends to provide for transitional arrangements in the proposed Regulations involving a certification body issuing “interim” certificates to companies. Stationary refrigeration and air-conditioning companies would then have until July 2011 to obtain a certificate and FP companies would have until July 2010.

The Commission Regulation provides the FP industry with an interim period to get the new company certification which runs until July 2010. In GB there is no existing certification scheme, so no companies can be deemed to hold a certificate.

The alternative option in the Commission Regulation is: “Companies employing personnel holding a certificate for the activities for which certification is required shall be issued with an interim certificate by an entity designated by the Member State”. This is the only route available for GB FP sector and will require an organisation to set up a scheme to issue interim certificates to up to 200 companies.

Costs for interim company certification: An interim certificate will be based on an approach similar to the “minimalist” scheme described above, but will exclude any site audits. The costs need to allow for initial set up of a certification scheme and for promotion of the scheme around the FP industry. The cost is estimated to be between £100 and £200 per company, which is equivalent to £20,000 to £40,000.

Environmental benefits: Any environmental benefits linked to good quality leak testing have been counted in Section 1.3. No further benefits can be attributed to company certification as this would create double counting.

1.5 Summary of Costs and Benefits for Fire Protection

The costs for each aspect of FP have been discussed in sections 1.1 to 1.4 above. These are identified in terms of initial one-off costs plus on-going annual costs. Table 1.1 summarises the costs. The costs of different options for personal and company certification are reflected in the minimum and maximum costs of each element.

Table 1.1 Costs Related to Fire Protection

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	0	0	0	0
Labelling	5	10	0	0
Leak checking	2,000	8,000	700	2,800
Personnel certification	300	500	0	0
Company certification[12]	50	90	0	0
FP Total (rounded)[13]	2,400	8,600	700	2,800
Optional Company re-certification	10	10	20	30
Options total as % of FP total[14]	+0.4%	+0.1%	+2.9%	+1%

Cost Savings and Environmental Benefits

The cost savings and environmental benefits for FP were discussed in Section 3.4 above. These were calculated as follows:

- Annual cost savings of £10,000 to £20,000 (for reduced fluid consumption).
- A further benefit of £100,000 to £300,000 for the value of CO_2 equivalent not emitted

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028 (see Para 17 in the background section of this IA for more details). This analysis shows:

- An NPV figure of between £10 milion and £43 million.
- A net cost of between £152 and £305 for each tonne of CO_2 equivalent saved.

12 Company certification includes the certification costs £29k to £48k plus interim certification costs of £20k to £40k

13 Note, total costs are rounded so that they do not imply a degree of accuracy greater than those possible in the FP leak checking figures, which dominate the total value

14 option for re-registration. The % refers to the optional cost (e.g. £10k) as a percentage of the FP total above (e.g. £2,400k)

2. IMPACTS FOR STATIONARY REFRIGERATION AND AIR- CONDITIONING

2.1 Background and Industry Structure

The stationary refrigeration and air-conditioning sector (SRAC) refers to the use of 3 types of stationary system that utilise similar basic technologies:

- Refrigeration systems, used to cool products and spaces to temperatures below ambient.
- Air-conditioning systems, used to cool spaces to a temperature close to ambient.
- Heat pump systems, used to recover waste heat at a low temperature and deliver useful heat to a product or space at a higher temperature.
    - In relation to the F Gas Regulation this is a large and highly complex sector with millions of end users. See section 4.1 of the annexed report for more details on the sector.

2.2 Labelling Requirements

2.2.1 Assessment of Labelling Impacts

Article 7 of the F Gas Regulation and Commission Regulation1494/2007 set down requirements for labelling of new equipment place on the market after April 1st 2008. The labelling requirements apply to all SRAC systems.

The labelling requirement will affect Original Equipment Manufacturers (OEMs) producing factory built systems and contractors building bespoke systems on site. It is estimated that around 5,000[15] UK based companies will have to adapt their current labels. In addition all imported equipment will need to have a suitable label. The costs of redesigning the current labels are estimated at below £1,000 per company[16]. For site built systems there will be an additional on-going cost if labels were not previously fitted. The overall cost of compliance with the labelling requirements is estimated to include a one-off initial cost of £3 to 5 million plus on-going costs of around £1 to 2 million per year[17].

Environmental Impact and Benefits: Many HFC SRAC systems are already well labelled and for these systems the additional labelling requirement is not likely to reduce the rate of leakage from the current levels. However, it is the site built bespoke systems that are most prone to leakage and these are the systems that are least likely to have a label. On these systems a label will help both the operator and service engineers by:

- Clarifying exactly which refrigerant and F gas refrigerant type is in use
- Specifying the refrigerant charge, and hence the leak testing frequency.
- Ensuring that the correct refrigerant quantity is filled into the system after servicing. This could lead to improved efficiency.

It is clear that there are some non-tangible benefits as described above. These could translate into some environmental benefits, especially if energy efficiency is improved by ensuring the correct refrigerant charge is in a system after maintenance. It is very difficult to quantify these benefits separately from those discussed in Section 2.3 below. The overall balance of costs and benefits is assessed in Section 2.5 for all SRAC impacts.

15 Based on discussions with industry experts

16 Based on actual examples of labelling

17 First cost based on 5,000 companies needing to design new labels. On going costs of £10 to £20 per system for an estimated 100,000 new systems per year (these are for site built systems – factory built systems are already labelled, so no extra cost to use new label design.

2.3 Leak Checking Requirements

2.3.1 Assessment of Leak Checking Impacts

Commission Regulation1516/2007 sets down requirements for leak checking of stationary SRAC systems. Some of the requirements are already in place through standard preventative maintenance contracts with SRAC contractors. However, many smaller installations are not checked on a regular basis. These will need an annual visit by a qualified leak tester. For almost all systems the requirement for a formal system of record keeping will be a cost burden.

Overall Costs: It is estimated that there are in excess of 1 million SRAC systems in GB that contain more than 3 kg of HFC refrigerant. The incremental costs of the new leak checking requirements are highly dependent on the existing leak testing regimes that are in place and the number of large systems already fitted with leak detection systems. Many of the 1 million systems are already fitted with leak detection systems. We estimate an initial one-off cost of £50 to 100 million[18] plus on-going costs of £75 to 160 million[19] per year.

Savings and Other Benefits:

There are 2 tangible savings that should occur through a rigorous and well implemented leak testing regime. Firstly, there will be a direct reduction in the cost of refrigerant used to top up equipment. Secondly, and more importantly, there will be a reduction in the energy consumption as many plants run inefficiently if they have lost refrigerant. In addition to these quantifiable benefits end users should make further savings related to fewer emergency call outs and lower consequential losses that could follow from an unexpected plant failure due to leakage.

If leaks are reduced there will be a saving in terms of top up fluid being purchased. It is estimated (see paragraph below) that the emission reduction is 1 to 1.5 million tonnes CO_2 equivalent. This represents about 500 to 750 tonnes of HFC fluid, which has a monetary value of £5 million to £7 million per year.

Using the standard Government guidance on valuing CO_2 emissions savings[20] for reduced gas emissions, the environmental impact of these emissions is worth a further £630 million to £950 million in total.

If leaks are reduced there will also be a benefit in terms of reduced energy consumption. The reduced electricity use ranges from 1,400 to 2,800 million kWh of electricity. This has a value of £67 million to £135 million per year[21].

It is estimated that the emission reduction resulting from the reduced electricity usage is 0.6 to 1.2 million tonnes CO_2 equivalent. The monetary value of the decreased carbon emissions resulting from electricity savings is calculated using the projected EU Allowance price under the EU Emissions Trading Scheme, i.e. the revenue gained from selling permits for emissions. (See Annex 1 for the schedule of EU Allowance Prices).

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18 Based on installation of automatic leak detection systems costing between £3,000 and £5,000 being fitted to between 16,000 and 20,000 systems

19 Based on record keeping for 1 million plants and discussions with industry experts: (at £20 to £40 per plant), extra leak detection work for 50% to 70% of plants (at £80 to £120 per plant) and extra leak repair work for 10% to 15% of plants (at £150 to £250 per plant).

20 http://www.defra.gov.uk/environment/climatechange/research/carboncost/pdf/HowtouseSPC.pdf

21 Assuming an avoided social cost of electricity of 4.82 p/kWh. The variable social cost of electricity has been used to value electricity savings. Reduced demand for electricity will save expenditure on generation and to a limited extent reduce transmission and distribution costs, however some costs such as billing, and maintaining a distribution network would remain even where there have been large demand reductions. The retail price has not been used, as it includes an element for tax, which is a transfer, not a social cost. Also, the 4.82p/kWh value excludes the value of EUAs saved, which are accounted for separately in this IA.

This gives rise to a further benefit of £323 million to £649 million in total, discounted over 20 years.

Hence the total discounted benefits, including the value of CO_2 equivalent not emitted through F gas emissions reductions and reduced electricity is in the range of £1.5 bn to £2.9bn in total.

Environmental Impact: The implementation of better leak checking procedures could have a significant environmental benefit as there is good potential to reduce historic levels of leakage from SRAC systems. The environmental benefits include both "direct" savings (i.e. reduced emissions of HFC refrigerants) and "indirect" savings (i.e. reduced energy consumption).

The most recent GB F Gas Emissions Inventory[22] shows that the F Gas emissions from the SRAC sector are around 3.5 million tonnes CO_2 equivalent. This is equivalent to an actual emission of about 2,000 tonnes of F Gas (assuming an average GWP of 1750). It is estimated that the new leak checking regime will reduce current emissions by around 50% in some sectors (e.g. supermarkets). The total saving could be in the range 1 to 1.5 million tonnes CO_2 equivalent[23].

The 1999 GBF Gas Emissions Inventory[24] showed that the energy consumption related to refrigeration systems gave rise to emissions of around 27 million tonnes CO_2 equivalent. This includes some sectors that will not be affected by the leak testing regimes (e.g. domestic refrigerators and MACs). Making an allowance for this we estimate that plants that will be affected by leak testing account for an energy related emission of about 19 million tonnes CO_2 equivalent (Based on work from March Consulting, 1999). The leak testing regime will give rise to some directly related efficiency improvements (because plants with too little refrigerant lose efficiency). There will also be indirect benefits because the leak test will involve a comprehensive inspection of equipment and it is likely that other efficiency opportunities will often be spotted (e.g. blocked air cooled condensers). According to industry experts it is conservative to expect energy savings in the range of 3% to 6% through the leak testing regime. This is equivalent to a saving of 0.6 to 1.2 million tonnes CO_2 equivalent.

Note that these savings refer to the total set of regulations for this sector, not solely to those pertaining to leak checking requirements. However, the requirements relating to qualification and certification do not therefore add to these savings, but can be interpreted as being in place to ensure that these savings are realised, with more stringent options likely to increase the actual savings within the expected range.

2.4 Minimum Qualification Requirements

2.4.1 Introduction to Minimum Qualifications

Commission Regulation 303/2008 is entitled: "Minimum requirements and the conditions for mutual recognition for the certification of companies and personnel as regards stationary refrigeration, air conditioning and heat pump equipment containing certain fluorinated greenhouse gases". It sets down requirements for minimum qualifications to be held by personnel carrying out certain activities on SRAC equipment. It also refers to

22 AEAT 2004

23 Based on discussions with industry experts: 40% to 60% leak reduction for supermarkets, 10% to 20% for industrial refrigeration and split system air-conditioning and 15% to 30% for small commercial split system refrigeration.

24 March Consulting, 1999

certification of companies and to interim arrangements for both personnel and companies. Each of these areas is discussed in a separate section below.

2.4.2 Impacts related to Certification of Personnel

The Commission Regulation defines minimum qualifications for personnel involved in the following activities with HFC SRAC systems:

a) Leakage checking of applications containing 3 kg or more of fluorinated greenhouse gases and of applications containing 6 kg or more of fluorinated greenhouse gases with hermetically sealed systems, which are labelled as such.

b) Recovery.

c) Installation.

d) Maintenance or servicing.

All personnel involved in these activities will need to obtain a certificate showing they have passed an examination that meets the minimum requirements specified in the Annex to the Commission Regulation.

Costs for training: There will be some initial costs to develop suitable training courses and to equip training centres and train teachers and examiners. The cost of training has been estimated using costs for existing refrigeration courses and staff numbers estimated from discussions with industry experts. The cost of training 25,000 to 35,000 staff in Categories I &II is estimated to be £25 to 30 million[25], including the lost income while trainees are away from their workplace. This cost will be spread over a 3 year period.

Environmental benefits: Environmental benefits linked to good quality leak testing have been counted in Section 2.3. No further benefits can be attributed to staff training as this would create double counting.

2.4.3 Impacts related to Interim Certification of Personnel

The Commission Regulation provides the SRAC industry with an interim period to get the new qualification which runs until July 2011.

In GB the relevant existing qualification scheme for systems above 3 kg is either the City and Guilds 2078 or the CITB 206710. As all operatives already need one of these qualifications to work on HFC SRAC systems they will all be deemed to hold an interim certificate and hence there are no extra costs related to interim certification for systems above 3 kg.

In GB the relevant existing qualification scheme for systems below 3 kg include (a) the above qualifications, or (b) an in-house training course or (c) relevant pre-existing professional experience. Personnel qualified via (a) or (b) will be deemed to hold an interim certificate and hence there are no extra costs related to interim certification. However, personnel relying on (c), pre-existing professional experience will need to be issued with an interim certificate. There are no accurate figures available on the number of personnel that will need an interim certificate via option (c). Assuming that the number is in the range 1,000 to 3,000 the total cost of providing interim certificates for engineers working on systems below 3 kg will be a one off cost in the range £30,000 to £150,000[26].

2.4.4 Options Related to Mandatory SRAC Personnel Registration

This section deals with process that goes beyond the minimum requirements (see Para 14 in the background section for more details as to the reasoning behind this). This option was presented in the Partial IA in order to generate views during the consultation stage, in relation to whether it would be worth pursuing as an option. The costs described above

25 Minimum assumes 20,000 Category I and 5,000 Category II personnel. One third of Category I does training in 1 day (£150 course fee, £50 certificate plus £250 for travel and lost earnings). Others need 2 or 4 days of training. Half of category II trainees only need 1 day training; remainder need 2 days. Maximum assumes 25,000 Category I and 10,000 Category II personnel.

26 This assumes that the cost per certificate is in the range of £30 to £50. Figures based on discussions with industry experts

assume that the training is a “one-off” process and that certificates are issued by the relevant Certification Body to each successful trainee. Some stakeholders in the SRAC industry have expressed an interest in a central registration scheme for personnel holding a Category I or II SRAC F Gas certificate. The key benefits include:

a) Employers could confirm personnel qualifications prior to taking on new members of staff.

b) Employers could use the register to simplify company certification and the register.

c) Customers could easily confirm personnel qualifications of personnel carrying out maintenance work.

d) The register can help discourage fraudulent use of forged certificates.

e) Stakeholders such as Defra and industry Trade Associations could use the list to make contact with trained personnel to keep them informed of any changes in legislation or to industry “best practice”, although existing networks can also be effective.

There are 2 main options related to personnel registration, both of which go beyond the minimum requirements in the Regulation. These are:

Option (a) A one-off registration, made immediately after a training certificate is received.

Option (b) A scheme that requires initial registration plus periodic re-registration, e.g. every 3 year or every 5 years.

The minimum cost registration option is Option (a). Based on similar schemes, one could expect the registration fee to be in the range of £15 to £20, hence the overall cost impact for the SRAC industry will be £400,000 to £700,000 as a one-off initial cost. A scheme with re-registration has additional benefits. It could ensure that the list of trained staff does not get out of date and it enables checks to be made that personnel are up to date with changes since previous registration. The cost of re-registration, for a large scheme, could be in the range of £10 to £15. If this is done once every 3 years this is equivalent to an annual cost of £3 to £5, which gives a range of £75,000 to £175,000 per year for the whole SRAC industry.

Quantifying the benefits of Mandatory Personnel Registration: Any environmental benefits linked to good quality leak testing have been counted in Section 2.3. Views will be gathered through the consultation process in terms of the likely impacts of this option and whether this option is worth pursuing. No further benefits can be attributed to personnel registration as this would create double counting. Within the range of benefits estimated in Section 2.3 the benefits may be highest with mandatory registration via Option (b) as this provides the most robust regime for ensuring that only trained personnel work on F Gas systems. The range of benefits for leak prevention, in terms of cost saving, is between £135 million and £257 million per year. The range of environmental benefit is between 1.6 and 2.7 million tonnes CO_2 equivalent per year. The extra cost for a mandatory registration scheme is a one off cost between £0.4 and 0.7 million plus an average annual re-registration cost of less than £0.2 million. It is impossible however to quantify with any reliability at this stage the benefits related to personnel registration.

Preferred option related to mandatory SRAC Personnel Registration: Based on the consultation responses received, there does appear to be some support for a mandatory SRAC Personnel Registration. However, no specific regulatory provisions were consulted upon and this is an issue that will need to be considered further and could be subject to a further consultation in the future. Further details are available in the published consultation summary and Government response.

2.4.5 Impacts related to Certification of Companies

The Commission Regulation defines certification requirements for companies involved in the following activities with HFC SRAC systems:

a) Installation.

b) Maintenance or servicing.

To get a certificate companies must be able to show that they employ sufficient staff that hold personnel qualifications (as discussed in 2.4.3 above) and that they have appropriate equipment and procedures in place to enable their staff to minimise HFC emissions.

Company Certification Options: Two different approaches to company certification were considered during the consultation:

a) A "minimalist" approach that meets the Commission Regulation requirements. This would be a one-off company certification, with a web based application form and self certification of data subject to random audit. A small number of companies could be audited in the first year, but there would be no further auditing in following years. The random audit process is essential if self certified data is to be used. This is considered a less costly process than requiring 100% external verification of data. A scheme run with self certified data without any kind of audit process would run a serious risk of abuse.

b) A more robust approach that would include regular re-registration. This process has a number of benefits that are discussed in detail below. The frequency of re-registration creates a number of "sub-options" that need to be considered. More frequent re-registration makes the company list more accurate, but adds to the administrative burden and cost for each organisation on the register. Initial discussions with refrigeration industry indicate that annual or 2-yearly re-registration is unnecessarily frequent, so options for 3-yearly and 5-yearly re-registration have been evaluated.

It is possible to make the minimalist scheme the legal requirement and offer the robust scheme as a voluntary option. However, in these circumstances the types of company that most require a strong regime to improve their standards are likely to opt for the cheaper minimalist option. If a more robust mechanism is favoured by the industry it would be better to make it mandatory.

Costs for company certification: Costs for 3 options have been estimated with the following assumptions:

Option 1: Meets minimum legal requirements. One-off company certification. Very simple web based application process based on "self-certification subject to random audit". Audit of 4% of companies only in first year, 2% with a half day visit and 2% via desk research. No re-certification[27].

Option 2: Improved scheme with 3-yearly re-certification. More robust application process, although still based on "self-certification subject to risk-based audit". Audit of 6% of companies per year, 3% with a half day visit and 3% via desk research[28].

Option 3: As Option 2, except re-certification is every 5 years.

Comments on Option 1: The overall costs for operating a minimalist scheme are estimated to be between £0.35 million and £0.55 million for 5,000 companies being certified.

27 The Option 1 company certification scheme will need to cover the costs of setting up and managing an administration system, processing each application to check that data is complete and provides sufficient evidence to meet the certification requirements. It must also fund the process of auditing a small proportion of companies (4%) during the first year. The total costs are estimated in the range of £350,000 to £550,000. These costs are spread across 5,000 companies, hence a cost per company in the range of £70 to £110.

28 The Option 2 scheme assumes a more comprehensive application form (which will require extra processing time) and a slightly larger number of risk-based audits (6%) – both these measures are intended to make the scheme more "robust" to deliver quality improvements. The on-going costs enable the scheme infrastructure to be maintained, provide an on-going audit process and also allows for re-certification every 3 years.

Comments on Option 2: The overall costs for Option 2 are estimated to be between £0.47 million and £0.7 million for 5,000 companies being first certified plus an on-going annual average cost of between £0.25 million and £0.35 million. The re-certification process will keep the list of registered companies up to date and provide valuable on-going information to the SRAC industry and to Government. A risk-based audit programme will be maintained under Option 2 (unlike Option 1 where audits are only carried out in the first year). This process will help ensure that companies provide accurate data when they apply for certification.

Comments on Option 3: The overall costs for Option 3 are very similar to Option 2. The initial process is identical; hence the initial application costs are equal. The costs of Options 2 and 3 can be treated as approximately equal. Option 3 has been displayed as it shows that 3 and 5 yearly re-registrations do not differ greatly.

The benefits of Option 2 over Option 1 are:

a) The company data is kept up to date, reflecting the changing circumstances of each company (e.g. growth or contraction of their refrigeration maintenance activities).
b) There are funds available to ensure that on-going risk-based audits are carried out. This will put pressure on companies to comply properly with the F Gas Regulation and the terms of the Company Certificate.
c) The up to date list can be used by refrigeration plant operators to check that their maintenance work is being done by a certified company.
d) The up to date list can be used by stakeholders such as Defra to contact certified companies and keep them informed of important issues related to the Regulation.
e) The up to date list can be used by Regulators to check for compliance.

Option 2 as the preferred option – Those consultees who responded to consultation question sixteen in the consultation document ("Do you have any comments on how the company certification schemes should be operated (i.e. renewal or non-renewal)?"), agreed that renewal represented the best option. In general, respondents agreed that a sensible renewal period should be agreed but did not specifically comment on the figures presented in the Partial IA for each of the options.

On the basis of these responses, Option 2 has been carried forward as the preferred option and the costs associated with this are those that were set out in the Partial IA.

Quantifying the benefits of Option 2 Company Certification: Any environmental benefits linked to good quality leak testing have been counted in Section 2.3. No further benefits can be attributed to company certification as this would create double counting. It is reasonable to expect that, within the range of benefits estimated in Section 2.3 that the benefits will be higher for Option 2 than for Option 1 as this provides a more robust regime for companies that carry out the crucial tasks related to refrigeration plant maintenance. The range of benefits for leak prevention, in terms of cost saving is between £135 million and £257 million per year. The range of environmental benefit is between 1.6 and 2.7 million tonnes CO_2 equivalent per year. The extra annual cost for Option 2 over Option 1 is less than £0.35 million. It is impossible to exactly quantify the improvement, but it is clear that if a more robust company scheme only makes a small improvement to the quality of leak prevention activities that the environmental benefits and cost savings will easily out weigh the costs incurred. In addition it is very difficult to apply rigour at present about the difference in savings because there is so little data available about the effectiveness of current training courses. However industry experts have indicated that it is reasonable to postulate that a more rigorous system will improve the overall quality of training.

2.4.6 Impacts related to Interim Certification of Companies

The Commission Regulation provides the industry with an interim period to get the new company certification which runs until July 2011. In GB there is no existing certification scheme, so no companies can be deemed to hold a certificate.

The alternative option in the Commission Regulation is: "Companies employing personnel holding a certificate for the activities for which certification is required shall be issued with an interim certificate by an entity designated by the Member State". This is the only route available for the GB SRAC sector and will require an organisation to set up a scheme to issue interim certificates to up to 8,000 companies.

Costs for interim company certification: The costs for interim certification will be lower than those required for the Option 1 certification scheme described above because there is no audit requirement and there is less application data to check. However, there will be some extra cost for a "marketing" budget to try and ensure that all companies get information about the certification requirements. It is estimated that an interim certificate will cost between £50 and £100, implying an overall cost of between £250,000 and £500,000.

Environmental benefits: Any environmental benefits linked to good quality leak testing have been counted in Section 2.3. No further benefits can be attributed to interim company certification as this would create double counting.

2.5 Summary of Costs and Benefits for SRAC

The costs for each aspect of SRAC have been discussed in sections 2.1 to 2.4 above. These are identified in terms of initial one-off costs plus on-going annual costs. Table 2.1 summarises the costs. The costs of different options for personal and company certification are reflected in the minimum and maximum costs of each element.

Table 2.1 Costs Related to SRAC

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	0	0	0	0
Labelling	3,000	5,000	1,000	2,000
Leak checking	50,000	100,000	75,000	160,000
Personnel certification	25,000	30,000	0	0
Company certification[29]	600	1,050	0	0
SRAC Total (rounded)[30]	79,000	136,000	76,000	161,000
Optional mandatory personnel registration	400	700	75	175
Optional company re-certification	120	150	250	350
Options total as % of SRAC total	+0.6%	+0.6%	+0.4%	+0.3%

Cost Savings and Environmental Benefits

The cost savings and environmental benefits for SRAC were discussed in Section 2.3 above. These were calculated as follows:

29 Company certification includes the certification costs £350k to £550k plus interim certification costs of £250k to £500k

30 Note, total costs are rounded so that they do not imply a degree of accuracy greater than those possible in the SRAC leak checking and personnel registration figures, which dominate the total value.

- Annual cost savings of £72 to £140 million (allowing for reduced refrigerant consumption and reduced electricity use).
- A further total discounted benefit of £1.7bn to £3.1bn for the value of CO_2 equivalent not emitted through electricity savings and reduced gas emissions

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028 (see Para 17 on the background section for more details). This analysis shows:

- A net present value (i.e. a saving to the economy) of between £552 million and £724 million.

3. IMPACTS FOR HIGH VOLTAGE SWITCHGEAR

3.1 Background and Industry Structure

The HV switchgear sector refers to the use of sulphur hexafluoride (SF_6) in high voltage switchgear. In electricity transmission systems above 11,000 volts, circuit breakers insulated with SF_6 gas instead of air are often the most compact and cost effective option. See section 5.1 of the annexed report for more details of the sector.

3.2 Labelling Requirements

3.2.1 Assessment of Labelling Impacts

Article 7 of the F Gas Regulation and Commission Regulation1494/2007 sets down requirements for labelling of new equipment placed on the market after April 1st 2008. The labelling requirements in Article 7 apply to SF_6 HV switchgear equipment.

The costs of redesigning the current labels are estimated at below £2,000 per company. Once the label is redesigned there is no additional cost associated with affixing the labels.

Environmental Impact and Benefits: SF_6 HV switchgear systems are already well labelled and the additional material is not likely to reduce the rate of leakage from the current levels. However, the labelling of lower voltage SF_6 switchgear may well be helpful in assisting in identifying SF_6 as a problem for end of life disposal on industrial sites.

3.3 Minimum Qualification Requirements

Commission Regulation 305/2008 is entitled: "Minimum requirements and the conditions for mutual recognition for the certification of personnel recovering certain fluorinated greenhouse gases from high-voltage switchgear". It sets down requirements for minimum qualifications to be held by personnel carrying out certain activities on GIS Gas Insulated Switchgear equipment.

3.3.1 Impacts related to Certification of Personnel

The Commission Regulation defines minimum qualifications for personnel involved in gas recovery from SF_6 switchgear systems: All personnel involved in this activity will need to obtain a certificate showing they have passed an examination that meets the minimum requirements specified in the Annex to the Commission Regulation.

Costs for training: The total cost of training is estimated as a one-off cost of between £400,000 and £600,000[31].

Environmental benefits: The main benefit to be achieved through training is the recognition of the impact of leakage of gas on first fill and the requirement to recover gas during maintenance and at end of life. The most recent GB emissions inventory shows that emissions from SF_6 HV Switchgear are around 500,000 tonnes CO_2 equivalent per year. Better trained operatives working may be able to achieve emission reductions of between 5% and 10%. This would equate to 1 to 2 tonnes of fluid and 25,000 to 50,000 tonnes CO_2 equivalent. There would be a small financial saving of between £10,000 and £20,000 for the reduced use of fluid.

Assuming the shadow cost of CO_2 emissions (£26.50 per tonne of $CO_2$and rising at 2% p.a.) the environmental impact of these emissions is worth a further £650,000 to £1,300,000 per year.

31 Calculation based on discussions with industry experts: Assuming 600-700 staff require training, at a typical course cost fee of £260 per staff. Also staff loss time of work estimated between 10-15 hours at a rate of £40 per hour. Therefore for min range (600*260)+ (600*10*40) for max range (700*260)+(700*10*40).

3.4 Summary of Costs and Benefits for SF_6 HV Switchgear

The costs for each aspect of SF_6 HV Switchgear have been discussed in sections 3.1 to 3.3 above. These are identified in terms of initial one-off costs plus on-going annual costs. Table 3.1 summarises the costs.

Table 3.1 Costs Related to SF_6 HV Switchgear

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	n/a	n/a	n/a	n/a
Labelling	5	10	0	0
Leak checking	n/a	n/a	n/a	n/a
Personnel certification	400	600	0	0
Company certification	n/a	n/a	n/a	n/a
Total	400	600	0	0

Cost Savings and Environmental Benefits

The cost savings and environmental benefits for HV Switchgear were estimated as follows:

- Annual cost savings of £10,000 to £20,000 for reduced SF_6 consumption.
- A further (undiscounted) benefit of £16 million to £32 million in total for the value of CO_2 equivalent not emitted, i.e. between 25,000 to 50,000 tonnes CO_2 equivalent per year.

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028 (see Para 17 on the background section for more details). This analysis shows:

- A net present value (i.e. a saving to the economy) of between £10 million and £21 million.

4. IMPACTS FOR SOLVENTS

4.1 Background and Industry Structure

A relatively small number of specialist manufacturers (examples include companies making metal or glass components for precision equipment that needs to be cleaned to a very high standard) use solvents containing F gases for cleaning purposes. Until recently it was thought that there was little or no use of F Gas solvents in GB. However, the work for the Partial Impact Assessment identified a small market which could grow. Growth may be influenced by other regulatory issues that affect alternative solvents. We estimate between 50 and 100 companies currently using F gas solvents. See section 6.1 of the annexed report for more details.

4.2 Minimum Qualification Requirements

Commission Regulation 306/2008 is entitled: "Minimum requirements and the conditions for mutual recognition for the certification of personnel recovering certain fluorinated greenhouse gas-based solvents from equipment". It sets down requirements for minimum qualifications to be held by personnel carrying out certain activities on solvent cleaning equipment.

4.2.1 Impacts related to Certification of Personnel

The Commission Regulation defines minimum qualifications for personnel involved in recovery activities with F Gas solvent systems. All personnel involved in this activity will need to obtain a certificate showing they have passed an examination that meets the minimum requirements specified in the Annex to the Commission Regulation.

Use of End User Specific Training: It is recommended that this sector should rely on training that specifically relates to the equipment in a particular end user factory. The processes used in each factory vary considerably and it is important that technicians are trained to understand the particular equipment concerned. Commission Regulation 306/2008 recognises this situation and states:

"Entities manufacturing or operating equipment containing fluorinated greenhouse gas based solvents could be designated as evaluation or certification bodies, or both, provided that they fulfil the relevant requirements".

This is a sensible approach and will minimise the costs involved as staff already receive in-house training. A small modification to current in-house training courses should be sufficient to meet the requirements of the Regulation.

Costs for training: Assuming that the training can be provided in house as a supplement to the existing requirements (as already specified in the GB Regulation) the extra costs for training are minimal. It is estimated through discussions with industry experts that the extra costs are between £20,000 and £50,000[32]. There could be further costs in the range of £200 to £500 per end user Company for an external body to help each end user establish their status as a Certification Body. This will give rise to further costs in the range £10,000 to £50,000.

Environmental benefits:

There will only be minimal environmental benefit as the current GB Regulation already requires in house training and the extra requirements in Commission Regulation 306/2008 are not likely to make much improvement to current emission rates. It is possible that losses will decrease by between 5% and 10%, which is a saving of between 500 and 1,000 tonnes CO_2 equivalent. There will be little or no cost saving, as the value of the fluid saved will be offset by the cost of incinerating the extra quantity of waste fluid.

32 This assumes that an extra 2 to 3 hours of in-house training will meet the extra requirements specified in CR 306/2008. Low figure: 200 people * 2 hours * £40 per hour = £16,000 – rounded up to £20,000. High figure: 400 people * 3 hours * £40 per hour = £48,000 – rounded up to £50,000 (estimates based on discussions with industry experts)

Assuming the shadow cost of CO_2 emissions (£26.50 per tonne of CO_2 and rising by 2% p.a.) The environmental impact of these emissions is worth £320m to £640m in total.[33]

4.3 Summary of Costs and Benefits for Solvents

The costs for each aspect of F Gas solvent usage have been discussed in section 4.2 above. These are identified in terms of initial one-off costs plus on-going annual costs. Table 4.1 summarises the costs.

Table 4.1 Costs Related to F Gas Solvents

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	n/a	n/a	n/a	n/a
Labelling	n/a	n/a	n/a	n/a
Leak checking	n/a	n/a	n/a	n/a
Personnel certification	30	100	0	0
Company certification	n/a	n/a	n/a	n/a
Total	30	100	0	0

Cost Savings and Environmental Benefits

The cost savings and environmental benefits for solvents were estimated as follows:

- An (undiscounted) benefit of emissions reductions equivalent to £320m to £640m in total for the valu of CO_2 equivalent not emitted, i.e. between 500 to 1,000 tonnes CO_2 equivalent per year.

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028. This analysis shows:

- A net present value (i.e. a saving to the economy) of between £0.19 million and £0.34 million.

33 This figure is undiscounted

5. IMPACTS FOR MOBILE AIR-CONDITIONING

5.1 Background and Industry Structure

The mobile air-conditioning sector (MAC) refers to the use of air-conditioning in cars and small vans. MAC systems have become increasingly popular in cars sold in the GB market during the last 10 years. The current market penetration is 80% of new cars sold during 2007. It is estimated that around 15 million cars registered in GB are fitted with a MAC. All MACs installed in new cars since 1994 use HFC 134a as the refrigerant. A typical car MAC contains about 0.75 kg of HFC 134a. See section 7.1 of the annexed report for more details of the sector.

5.2 Minimum Qualification Requirements

Commission Regulation 307/2008 is entitled: "Minimum requirements for training programmes and the conditions for mutual recognition of training attestations for personnel as regards air conditioning systems in certain motor vehicles containing certain fluorinated greenhouse gases". It sets down requirements for minimum qualifications to be held by personnel carrying out certain activities on MAC equipment.

5.2.1 Impacts related to Certification of Personnel

The Commission Regulation defines minimum qualifications for personnel involved in recovery activities with HFC FP systems.

All personnel involved in this activity will need to obtain a certificate showing they have passed an examination that meets the minimum requirements specified in the Annex to the Commission Regulation.

Costs for training and examination: Many candidates already have sufficient knowledge to obtain the new qualification with little extra training. A half day course including an element of training to cover the new theoretical knowledge, a theory exam and a practical assessment should be sufficient[34]. Some candidates will need more training before the exam – a one day course including the exam should be sufficient.

The costs, including training, examination, certification, loss of earnings and travel, for those undergoing a half day course are estimated to be around £400. This is based on costs for similar courses already available.

The costs, including training, examination, certification, loss of earnings and travel, for those undergoing a full day course are estimated to be around £700. This is based on costs for similar courses already available.

Assuming that 80% of candidates have a half day course and 20% take a full day course the overall cost to train 50,000 personnel will be in the range of £15 to 20 million, spread over a 2 year period (Personnel estimates have been arrived at through discussions with industry experts).

Environmental Impact and Benefits: It is expected that standards of refrigerant recovery will rise through better training and awareness. A good training programme will also ensure that personnel carry out good leak repairs and do not let cars back on the road with a leak. The training will also make personnel more aware of the ban on non-refillable containers.

The most recent GB F Gas Emissions Inventory (AEAT, 2004) shows that the F Gas emissions from the MAC sector are around 1.5 million tonnes CO_2 equivalent. This is equivalent to an actual emission of about 1100 tonnes of F Gas per year (all HFC 134a). This is made up of 4 types of release:

- Slow leaks during car use.
- Release of whole charge during certain car accidents.

34 This view has been arrived at through discussions with industry experts

- Emissions due to poor recovery during plant servicing.
- Emissions due to poor recovery at end of vehicle life.

With around 15 million cars on the road it is calculated[35] that over 90% of emissions come from slow leakage [36] during car use plus accident damage. The remainder (10%) represents losses through poor recovery. This amounts to 150 ktonnes CO_2 equivalent. As the majority of companies already use recovery equipment the potential for reduced emissions via better training is relatively small. A saving in the range of 10% to 20% (of the 10%) is reasonable[37], which is equivalent to 15 to 30 ktonnes CO_2 equivalent.

Cost Savings

There is no direct cost savings linked to these environmental benefits. Although there will be some reduced consumption of new refrigerant this saving is offset by the increased generation of recovered refrigerant that will need to be sent for reprocessing or destruction. These costs are approximately equal, so there is no net saving.

5.3 Summary of Costs and Benefits for MACs

The costs for MAC have been discussed in section 5.2. These are identified in terms of initial one-off costs plus on-going annual costs. Table 5.1 summarises the costs.

As discussed above, the environmental benefits are mainly in terms of reduced direct HFC emissions.

Table 5.1 Costs Related to MAC

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	n/a	n/a	n/a	n/a
Labelling	n/a	n/a	n/a	n/a
Leak checking	n/a	n/a	n/a	n/a
Personnel certification	15,000	20,000	0	0
Company certification	n/a	n/a	n/a	n/a
Total	15,000	20,000	0	0

Cost Savings and Environmental Benefits

The cost savings and environmental benefits for SRAC were discussed in Section 5.2 above.

A (undiscounted) benefit of emissions reductions equivalent to £10m to £32m in total for the value of CO_2 equivalent not emitted.

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35 This is based on average leak rates of 60g per car per year (research by European Commission) plus 1% (Estimate from Motor Industry) of cars having an accidental total loss of charge per year. This gives leakage of 1,000 tonnes of HFC 134a, which is over 90% of the total.

36 It should be noted that the rate of slow leakage is being addressed by other legislation (The MAC Directive). New cars will need to have leak rates below 40 g per year (and, after 2011, the use of HFC 134a in new cars will be gradually phased out). The F Gas Regulation only addresses the refrigerant recovery issue for MACs.

37 Estimates arrived at through discussions with industry experts

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028 (see Para 17 on the background section for more details). This analysis shows:

- A net present cost (i.e. a cost to the economy) of between £6.5 million and £8 million.

6. IMPACTS FOR FLUID SUPPLIERS

6.1 Background and Industry Structure

The section addresses the impacts on companies that manufacture and sell F Gas fluids. The key obligations for these companies relate to labelling of containers and reporting of quantities manufactured, imported and exported. See section 8.1 of the annexed report for more details on the sector.

6.2 Fluid Reporting Requirements

6.2.1 Assessment of Reporting Impacts

Commission Regulation1493/2007 sets down requirements for reporting of F Gases produced in the EU, imported into the EU (from a country outside the EU) and exported from the EU.

The two manufacturers plus Air Products (who export recovered SF_6 to America for recycling) will definitely need to report annually under the CR 1493/2007 requirements. In addition, other distributors may choose to import from outside of the EU dependent on market conditions.

The reporting is reasonably simple in format. Each affected company will only require a few days of extra administrative work per year to keep the necessary records. It has been estimated that the total cost of annual reporting will be £15,000 to £25,000.

Environmental Impact and Benefits: The reporting requirement will have no direct environmental impact on the fluid supply sector.

6.2.2 Summary of Impact for Reporting in Fluid Supply

Costs: £15,000 to £25,000per year.

Benefits: none

6.3 Labelling Requirements

6.3.1 Assessment of Labelling Impacts

Commission Regulation1494/2007sets down requirements for labelling of new equipment and products placed on the market after April 1st 2008. The labelling requirements in Article 7 of the F Gas Regulation specifically apply to F Gas

The majority of filling of F Gas cylinders is carried out by the 10 primary distribution companies in GB. The costs of redesigning the current labels are estimated at below £2,000 per company. Once the label is redesigned there is no additional cost associated with affixing the labels.

Environmental Impact and Benefits: European F Gas containers are already well labelled and the additional material is not likely to reduce the rate of leakage from the current levels. Hence, the labelling requirement will have no direct environmental impact on the FP sector. However, the requirement for labelling may help in policing imports and this remains to be seen.

6.3.2 Summary of Impact for Product Labelling in Fluid Suppliers

The distributors are following the format of the labels used by the manufacturers. There is small cost impact for the redesign of labels used by 10 companies. This is estimated as a one-off cost of between £10,000 and £20,000. On-going costs will be negligible.

There is no measurable environmental benefit for these labels.

6.4 Summary of Costs and Benefits for Fluid Suppliers

The costs for each aspect of fluid supply have been discussed in sections 6.2 to 6.3 above. These are identified in terms of initial one-off costs plus on-going annual costs. Table 6.1 summarises the costs.

Table 6.1 Costs Related to Fluid Suppliers

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	0	0	15	25
Labelling	10	20	0	0
Leak checking	n/a	n/a	n/a	n/a
Personnel certification	n/a	n/a	n/a	n/a
Company certification	n/a	n/a	n/a	n/a
Total	10	20	15	25

Cost Savings and Environmental Benefits

There is no cost savings related to the fluid supply sector.

There are no measurable environmental benefits related to the fluid supply sector.

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028 (see Para 17 on the background section for more details). This analysis shows:

- A net present cost (i.e. a cost to the economy) of between £0.2 million and £0.4 million.

Specific Impact Tests

Competition Assessment

This standard competition assessment test concludes that the proposed Regulations may not have significant impacts on competition. The test is designed to consider internal GB competition rather than the effects of the policy on the competitiveness of GB businesses versus non-GB businesses. Given that all Member States in the EU are required to transpose at least the minimum requirements of the Commission Regulations, then the minimum transposition would not be expected to put GB businesses at a competitive disadvantage in relation to other EU businesses, although this general assumption does not take account of the differences in the structure of the economy between different Member States.

The proposed Regulations replace existing GB Regulations (the Fluorinated Greenhouse Gases Regulations 2008) that is being revoked and replaced in order to create offences and penalties applicable to ten Commission Regulations which establish fleshed out legal requirements for companies and personnel qualifications for personnel working in the five sectors covered by EC Regulation 842/2006 on certain fluorinated greenhouse gases. Since this change does not affect the types of firms that come under the scope of the proposed legislation or the general nature of the provisions that apply, impacts on existing market structures as a result of these required changes is likely to be minimal.

The costs associated with this legislation will not affect some firms more substantially than others or change the number or size of firms. Costs to both existing and new businesses will also be the same.

Small Firms Impact Test

The proposal affects businesses in a variety of industry sectors, many of which contain small businesses.

It is anticipated that the impact of the proposed Regulations will be minor. During the negotiation of EC Regulation 842/2006 and the subsequent GB Regulations prescribing offences and penalties associated with infringements of the EC Regulation, all small businesses that were affected were contacted. The Regulatory Impact Assessment conducted for both the EC Regulation and the subsequent GB Regulations concluded that, with the exception of the ban of the use of SF_6 in magnesium die-casting and the frequency of inspections in the refrigerant industry (less frequent for users of smaller amounts of F gases), the proposal treated small businesses in the same way as other businesses in the same sector. The Commission also concluded that the measures in the EC Regulation will not have a disproportionate effect on SMEs.

In conclusion, trade associations and small firms in the sectors likely to be affected by the proposals have been contacted and it has not been possible to identify any specific disproportionate impact on small firms as a result of the EC Regulation 842/2006 and the new Commission Regulations which flesh out the legal requirements set out in the EC Regulation 842/2006. The Partial IA did ask for any unidentified impacts or unintended consequences of the proposals on small firms to be identified during the consultation period. None were identified and so it has been assumed that no further work is required to review this position.

Legal Aid

The Proposed Regulations do create new criminal sanctions for non-compliance with the minimum qualification and certification requirements set out in the relevant Commission Regulations for personnel and companies working with fluorinated greenhouse gases. The creation of these new offences is necessary in order to comply with the ten new Commission Regulations which are directly applicable in all Member States.

There are no existing offences under the criminal law that already catch the actions for which new offences are being created.

The penalties applicable to infringements of the proposed Regulations are set out in regulation 53 of the proposed Regulations.

We have sought to agree the consequences with the Ministry of Justice and have completed stage one - establishing the nature and extent of impact – of the Impact Assessment test. Ministry of Justice (MOJ) officials have assessed the likely impact and have determined that no impacts can be identified to any area of MOJ business

Carbon Assessment

The carbon emission reductions are estimated as between 1.6 and 2.8 million tonnes CO_2 equivalent per year.

Other Environmental Issues

The principal objective of the EC Regulation is to prevent and thereby reduce emissions of F gases covered by the Kyoto Protocol. This Regulation will make a significant contribution towards the European Community's Kyoto Protocol target by introducing cost-effective mitigation measures and to prevent distortion of the internal market.

The main focus is on the containment and recovery of F gases, together with harmonised restrictions on the marketing and use of F gases in applications where containment of F

gases is difficult to achieve or the use of F gases is considered inappropriate and suitable alternatives exist.

The proposed Regulations will therefore have positive implications in relation to climate change and emissions of F gases.

Health Impact Assessment

The proposed Regulations will not directly impact on health or well being and will not result in health inequalities.

Race /Disability/Gender

There are no limitations on meeting the requirements of the proposed Regulations on the grounds of race, disability or gender. The proposed Regulations do not impose any restriction or involve any requirement which a person of a particular racial background, disability or gender would find difficult to comply with. Conditions apply equally to all individuals and businesses involved in the activities covered by the proposed Regulations.

Human Rights

The proposed Regulations are consistent with the Human Rights Act 1998.

Rural Proofing

The proposed Regulations will not directly impact on those who are based in rural areas.

Climate Change Policy Cost-Effectiveness Indicator

All Impact Assessments that estimate changes in CO2 emissions in excess of either (i) 0.1MtCO2e average per year for appraisal of less than 20 years, or (ii) 2.0MtCO2e over the lifetime of appraisal of more than 20 years are required by PSA Delivery Agreement 27, Indicator 6 to undergo a Climate Change Policy Cost-Effectiveness analysis. This involves measuring the proportion of tonnes of CO2 abated, for which the cost falls below the Shadow Price of Carbon. The measures collectively in this Impact Assessment fall into the category of 2.0MT C02e over the lifetime of the appraisal. The analysis has been undertaken for all measures. For each measure, the cost effectiveness indicator is calculated as follows:

Cost effectiveness = (Present value of costs - present value of non-CO2 benefits) /lifetime tones of CO2 saved = £x saved (or incurred) for every tonne of CO2 reduced. The tonnes saved relate only to avoided F-Gas emissions. The non C02 benefits include the value of decreased emissions resulting from electricity savings calculated using the projected EU Allowance price under the EU Emissions Trading Scheme. The current weighted average discounted shadow price of carbon is calculated separately for each measure.

The following table summarises the Cost effectiveness indicator for each measure:

Sector	Cost effectiveness indicator £ per tonne of C02 saved	Tonnes[38] of C02 saved (k tonnes)	Weighted average discounted shadow price of carbon	% of emissions below the SPC

38 This refers to emissions reductions for HFC savings only, not electricity savings.

Fire Protection	129 to 560	77 to 153	21.5	0
SRAC	-17.9 to -10.3	19,100 to 28,600	21.5	100
HV Switchgear	-22.4	485 to 970	21.6	0
Solvents	-25.7 to -27.8	9.5 to 19.5	21.5	100
MACs	73.5 to 34	285 to 570	21.6	0
Fluid Supply	n/a	0	n/a	n/a
Total (rounded) [39]		30,313		**98.1 to 97.6**

The above analysis indicates that for the entire set of measures, the cost of reducing emissions is below the shadow price of carbon for 97.6 to 98.1% of emissions reductions. Although the remaining 1.9 to 2.4% % of emissions reductions measures are not cost effective, they are required to be implemented due to the EU Directive.

The SRAC includes emissions reductions from electricity savings, therefore the cost effectiveness in the traded sector has also been calculated; that is the proportion of tonnes of CO2 abated, for which the cost falls below the EU allowance price. The formula is the same as the above, for the non-traded, with the exception that CO2e emissions saved in the non-traded sector would be excluded and replaced by CO2e savings in the traded sector, from both the numerator (NPV) and the denominator. The table below shows the cost effectiveness for the SRAC:

Sector	**Cost effectiveness indicator £ per tonne of C02 saved**	**Tonnes[40] of C02 saved (k tonnes)**	**Weighted average discounted EU Allowance price**	**% of emissions below the EUA**
SRAC	-11.2 to -3.8	11,400 to 22,950	25.5	100

39 Note, total are rounded so that they do not imply a degree of accuracy greater than those possible in the SRAC figures, which dominate the total value.

40 This includes all emission reductions from electricity savings

Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

Type of testing undertaken	*Results in Evidence Base?*	*Results annexed?*
Competition Assessment	Yes	No
Small Firms Impact Test	Yes	No
Legal Aid	Yes	No
Sustainable Development	No	No
Carbon Assessment	Yes	No
Other Environment	Yes	No
Health Impact Assessment	Yes	No
Race Equality	Yes	No
Disability Equality	Yes	No
Gender Equality	Yes	No
Human Rights	Yes	No
Rural Proofing	Yes	No

Annexes

Annex 1 EU Allowance price schedule

The values for the EU Allowance used for the period 2008 to 2020 are as follows:

Table 1: Valuations for EU allowances 2008 -2012 (£/tCO2)

2008	2009	2010	2011	2012
16.26	16.72	17.21	17.73	18.38

Table 2: Valuations for EU allowances 2013-2020 (£/tCO2, 2008 prices) in an EU 20% world

2013	2014	2015	2016	2017	2018	2019	2020
26.60	27.27	27.95	28.65	29.36	30.10	30.85	31.62

Table 1 above provides valuations for allowances from 2008 - 2012 based on future contract prices. Table 2 provides valuations for allowances from 2013 -2052. These valuations are based on the EU commission's forecast price adjusted to take account of the cost of carry.

Annex 2 Impact Assessment Report

A DRAFT REPORT BY ENVIROS CONSULTING LIMITED: JUNE 2008

DEFRA & BERR

EC REGULATION 842/2006 - PARTIAL IA ON MINIMUM PERSONNEL QUALIFICATIONS, REPORTING, LEAKAGE CHECKING, LABELLING, COMPANY CERTIFICATION AND PERSONNEL REGISTRATION REQUIREMENTS

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EXECUTIVE SUMMARY

1. This document provides details of an Impact Assessment related to the introduction in the GB of 10 Commission Regulations that relate to the EC F Gas Regulation (EC 842/2006).

2. The Impact Assessment was carried out on behalf of Defra and BERR in the spring of 2008.

3. The Regulations affect a number of sectors of the GB economy. The largest impacts relate to the use of F Gases in stationary refrigeration and air-conditioning (SRAC). There are also impacts for F Gases used in: (a) fire protection, (b) mobile air-conditioning (MAC), (c) HV switchgear and (d) solvent cleaning. There is a small impact for the F Gas fluid supply sector.

4. The financial value of the total benefits of the proposed measures outweighs the costs. Using a discounted cash flow analysis over a 20 year period, with a 3.5% discount rate there is:

   - A net present value (NPV) of between £534.8 million and £675.6 million (i.e. a net benefit to the GB economy)
   - CO_2 emission reductions of between 1.6 and 2.8 million tonnes CO_2 equivalent per year.

5. The benefits consist of the monetary value of reduced F gas usage, the monetary value of electricity savings, a valuation of the reduction in C02 due to a reduction in electricity usage, and a valuation of the reduction in F gas emissions resulting in a reduction of C02 equivalent. The latter is valued using a schedule of shadow price of carbon ("SPC") values, using standard Government guidance. The SPC starts from £26.50 per tonne of Carbon Dioxide (CO2) in 2008 and rising 2% p.a. A discount rate of 3.5% has been used for discounted cash flow assessments. The SRAC sector is the only sector that features electricity savings.

6. The fire protection, MAC and fluid supply sectors all have a small net cost (i.e. the costs are greater than the benefits). The solvent and HV switchgear sectors have a small net benefit. The key figures from a discounted cash flow analysis are summarised in Table ES 1 below.

7 Options for mandatory registration personnel working on SRAC systems have been evaluated. The extra costs are very small compared to the overall total cost but may be seen as significant for smaller business and the benefits to them to be marginal. It is arguable that a registration scheme could be financially justified if the registration scheme gives rise to a small improvement to the quality of leak prevention work but more detailed study would be needed to quantify this.

8. Options for a more robust company registration scheme have been evaluated for SRAC and fire protection. The extra costs are very small compared to the overall total cost and could be financially justified if the more robust company certification scheme gives rise to a small improvement to the quality of leak prevention work. More detailed study would be needed to test out this proposition.

Table ES 1 Summary of Discounted Cash Flow Assessments

Sector	NPV[41] minimum	NPV maximum	Range of tonnes of C02 saved (k tonnes) over 20 years	Range of PV of total costs (£k)
Fire Protection	-43,000	-10,000	77 - 153	11,650 – 46,400
SRAC	540,000	700,000	30,500 - 51, 550	1,041,600 – 2,228, 000
HV Switchgear	10,000	21,000	485 - 970	400 – 600
Solvents	190	340	10 - 20	30-100
MACs	-8,000	-6,500	285 - 570	15,000 – 19,500
Fluid Supply	-400	-200	n/a	250 - 400
Total (rounded) [42]	530,000	670,000	31, 350 - 53,263	

41 This is reflecting the net benefits range on the summary: Analysis & Evidence page of this Impact Assessment (page 2). Net present Value based on 3.5% discount rate, 20 year period to 2028. A positive figure represents the benefits outweighing the costs. The figures include a shadow value for C02 equivalent emissions reductions due to a reduction in gases, and an value for C02 emissions saved due to electricity savings using the EUA Allowance price.

42 Note, total costs are rounded so that they do not imply a degree of accuracy greater than those possible in the SRAC figures, which dominate the total value.

1. INTRODUCTION

This report has been prepared for Defra and BERR by Enviros Consulting. The report provides information for an Impact Assessment in Great Britain of 10 new Commission Regulations that relate to EU Regulation 842/2006, (referred to in this report as the "F Gas Regulation"). The study was carried out by Enviros from February to April 2008.

Project Objectives

The F Gas Regulation Regulatory Committee has agreed 10 Commission Regulations that flesh out some of the implementation requirements of the F Gas Regulation. Although these Commission Regulations have direct effect, they will require some regulations to be put in place in GB e.g. to create offences and penalties for failure to comply and to specify national qualification requirements. This Impact Assessment will from part of a consultation on the proposed Regulations. The objective of this project is to provide Defra and BERR with a draft Impact Assessment.

Analysis of Options and Costs

It is important to note that many of the requirements set out in the ten Commission Regulations have little flexibility in terms of options for implementation. In these circumstances we have evaluated a single option in terms of the likely range of cost and environmental impact. However, in a few situations, especially in relation to the way that personnel and companies are certified and registered for stationary refrigeration, air conditioning and heat pump equipment and also for fire protection systems, there are different options that need to be compared during the consultation process. There are no company certification requirements in the EU legislation for any other sectors and so these have not been considered

Costs estimates in this report are incremental extra costs compared to "business-as-usual" practice. The cost of carbon emissions used in 2008 is the "shadow price" of £26.50 per tonne of CO_2. Standard government figures are used for subsequent years (rising to £39.40 in 2028) A discount rate of 3.5% has been used for discounted cash flow assessments.

Report Structure

Chapter 2 provides background to the relevant Commission Regulations.

Chapter 3 addresses the impacts for the Fire Protection (FP) industry.

Chapter 4 addresses the impacts for the Stationary Refrigeration and Air-conditioning industry (SRAC).

Chapter 5 addresses the impacts for the High Voltage (HV) switchgear industry.

Chapter 6 addresses the impacts for the solvents industry.

Chapter 7 addresses the impacts for the Mobile Air-conditioning (MAC) industry.

Chapter 8 addresses the impacts for the F Gas fluid supply industry.

Chapter 9 provides a summary of the impacts for all sectors.

The Appendices include a Glossary of Terms in **Appendix 1**.

2. BACKGROUND TO THE COMMISSION REGULATIONS

In this Chapter we summarise the key aspects of the relevant Commission Regulations that are being assessed in this project.

Each of these Commission Regulations includes more detailed requirements that flesh out the requirements of the F Gas Regulation, 842/2006. The 10 Commission Regulations that form the scope of this Impact Assessment are as follows:

CR Number and Reference in F Gas Regulation	**Content**	**Applicability**
1493/2007 Article 6	Annual reporting requirements for F Gases produced, imported or exported from the EU	Fluid suppliers that produce, import or export more than 1 tonne per year of F Gases.
1494/2007 Article 7	Labelling of new products and equipment.	Companies selling SRAC, FP and GIS equipment containing F Gases and selling F Gas in containers.
1497/2007 Article 3	Leak checking requirements in fire protection systems	Companies operating FP systems containing F Gases.
1516/2007 Article 3	Leak checking requirements in SRAC and heat pumps	Companies operating SRAC systems containing F Gases.
303/2008 Article 5	Minimum qualifications in SRAC and heat pumps	Personnel and companies carrying out F Gas handling and leak checks related to SRAC
304/2008 Article 5	Minimum qualifications in fire protection systems	Personnel and companies carrying out F Gas handling and leak checks related to FP
305/2008 Article 5	Minimum qualifications in HV switchgear equipment	Personnel and companies carrying out F Gas recovery related to HV switchgear equipment
306/2008	Minimum qualifications in solvent systems	Personnel and companies carrying out F Gas recovery

Article 5		related to Solvents
307/2008 Article 5	Minimum qualifications in MAC systems	Personnel and companies carrying out F Gas recovery related to MAC
308/2008 Article 5	Notification of minimum qualifications	Defra

3. IMPACTS FOR FIRE PROTECTION

3.1 Background and Industry Structure

The fire protection sector (FP) refers to the use of HFCs as fire suppression fluids in fire protection systems. Most of the obligations under the F Gas Regulation relate to stationary fire protection systems that are permanently installed in premises requiring this specialised form of fire protection. A common application for HFC FP is to protect high value electronic equipment such as computer rooms or communication centres. There is a very small usage of HFCs in portable fire extinguishers.

The structure of the industry is as follows:

1) **Fluid Suppliers.** All HFC FP fluids are imported into the GB. This is mostly done via fluid importers such as DuPont. The dominant fluid is HFC 227ae[43], with about 75% of the market for chemical gas extinguishing systems. HFC 125 is used in some systems (previously sold as a replacement fluid for the now withdrawn Halon systems), with about 20% of the market. HFC 23 is used in less than 5% of systems.
2) **Primary Equipment Suppliers.** There are 5 companies that supply most of the key components of FP systems i.e. the cylinders containing the HFC FP fluid and directly associated equipment such as specialised release valves. It is these 5 companies that carry out the "F Gas handling" activities on the cylinders e.g. initial filling and pressurising, refill of discharged cylinders and fluid recovery.
3) **System installers and maintenance companies.** There are around 200 GB based companies that supply, install and maintain HFC FP systems. They purchase the HFC cylinders and other key components from the primary suppliers. System installers do not add HFC fluid to the FP cylinders. If a cylinder needs recharging (e.g. after a fire or after a leak) the cylinder is disconnected from the FP system and returned to a primary equipment supplier. It is estimated that there are 200 companies carrying out this type of work with HFC FP systems who employ about 500 personnel [44] involved in activities such as leak testing.
4) **Pipework installers.** Some companies carryout pipe installation for the pipework that connects the cylinders to the discharge nozzles within the area being protected. It should be noted that this pipework is normally empty and does not represent a potential source of leakage. These companies work on behalf of system installers and do not carry out any activities that need special training under the F Gas Regulation.

43 Also known by the Trade Names FM200, FE-227 or NAF-227
44 Based on discussions with Fire Industry experts.

5) **End Users.** The "Operator" (as defined by the F Gas Regulation) will usually be the end user company that owns the room or building that is being protected. End users can be found in a wide range of commercial and industrial sectors, usually related to their use of computer and telecommunications equipment. For most end users a FP system is one of many "office infrastructure" systems and is not a core business activity. As such the knowledge of the F Gas Regulation is probably quite low amongst end users, who will be heavily dependent on their maintenance company for advice.

Existing Practices Related to Emission Prevention

A FP system spends most of its life "unused". It needs to be fully effective in the unusual circumstance of a fire. If a FP cylinder suffered from a leak it would soon become ineffective – a situation that is not acceptable, especially as HFC FP systems are usually used in situations where the consequential losses after a fire are particularly high.

The industry has solved this problem through the use of highly reliable valves and fittings that do not accidentally leak in normal circumstances. Only valves that comply with EN 12094/4 should be used. This ensures that FP systems are highly leak tight.

Good quality hardware is usually backed up by a planned maintenance programme to check the system components on a regular basis. Hence, for many FP installations, leak checks are already carried out on a regular basis – this is often more frequent than the leak checking requirements of the F Gas Regulation. ISO 14250 defines requirements for checking FP systems, including leak checks every 6 months. This is a voluntary code that is thought to be widely followed.

3.2 Fluid Reporting Requirements

3.2.1 Assessment of Reporting Impacts

Article 6 of the F Gas Regulation and CR 1493/2007 sets down requirements for reporting of F Gases produced in the EU, imported into the EU (from a country outside the EU) and exported from the EU.

Production: There is no production of F Gases for fire protection (FP) in the GB, so there is no impact.

Imports: Currently most imports of relevant F Gases are carried out by fluid supply companies, especially DuPont. Impact for these companies is dealt with in Chapter 8. It is possible that some of the 5 main FP system suppliers could import F Gas directly from a supplier outside the EU. In this situation there would be a requirement to report if the annual imports were above 1 tonne. The cost impact of preparing such a report for the Commission is minimal (less than 1 day of effort per year) and can be considered a de minimus amount in this impact

assessment. However, it is important that companies are made aware of the reporting obligation.

It is worth noting a potential double counting issue that needs to be avoided in the import reporting process. The reporting obligation only applies to fluid being imported from outside the EU. One of the main suppliers of FP F Gases into the GB is DuPont, which is based in Switzerland, which is not in the EU. A direct purchase by a FP company might be made via a contract with the Swiss company (rather than a GB subsidiary) and the FP company may decide it must report the import. However, the supplier might bring the F Gas into a depot in an EU Member State before shipping to the customer in the GB – and may also report the same import to the Commission.

Exports: As with imports, it is possible that some of the 5 main companies are exporting more than 1 tonne of F Gas fluid. The costs of reporting are very low, but it is important that companies are made aware of the reporting obligation.

Environmental Impact and Benefits: The reporting requirement will have no direct environmental impact on the FP sector. There are no other benefits within the FP industry, but the data will be helpful to both the Commission and Member State Governments to track usage and assess potential levels of F Gas emissions.

3.2.2 Summary of Impact for Reporting in Fire Protection

There is no cost impact or environmental impact for this CR in the FP Sector.

3.3 Labelling Requirements

3.3.1 Assessment of Labelling Impacts

Article 7 of the F Gas Regulation and CR 1494/2007 sets down requirements for labelling of new equipment placed on the market after April 1st 2008. The labelling requirements apply to stationary fire protection systems and also to portable fire extinguishers using HFC fluids.

The label specified in CR 1494/2007 must show some basic information including the name of the F Gas and the quantity of F Gas installed in the equipment. The label must include the text “Contains fluorinated greenhouse gases covered by the Kyoto Protocol”.

For FP systems and extinguishers the label needs to be affixed to each pressure cylinder containing HFCs. It is already normal practice for each cylinder to be labelled, but existing labels will not meet the new requirements in the F Gas Regulation. The new obligations can be met by either:

- Redesigning the existing label to ensure that the new information is clearly shown.
- Affixing a second “F Gas” label with the relevant information.

All the filling of FP cylinders is carried out by 5 companies in the GB. The costs of redesigning the current labels are estimated at £1,000 to £2,000 per company[45]. Once the label is redesigned there is no additional revenue cost associated with affixing the labels.

Environmental Impact and Benefits: HFC FP systems are already well labelled and the additional material is not likely to make a significant difference to the rate of leakage from the current levels. Hence, the labelling requirement will have no quantifiable environmental impact on the FP sector. However, good labels will help personnel servicing equipment readily identify the type of F Gas being used which should be of benefit.

3.3.2 Summary of Impact for Product Labelling in Fire Protection

There is small cost impact for the redesign of labels used by 5 companies. This is estimated as a one-off cost of £5,000 to £10,000. On-going costs will be negligible.

There is no measurable environmental benefit for these labels.

3.4 Leak Checking Requirements

3.4.1 Assessment of Leak Checking Impacts

CR 1497/2007 sets down requirements for leak checking of stationary FP systems. Many of the requirements are already in place through standard preventative maintenance contracts with FP specialists.

The only extra impact that will affect most operators is the requirement for a formal system of record keeping. This goes beyond the records kept currently. The extra costs for each system could involve up to 1 hour per year of technician time and up to 1 hour per year for the operator to confirm that the records are in place and that follow up actions have been taken[46].

In addition to these record keeping activities there will be extra work required for those installations that are not currently checked on preventative maintenance programme. This is thought to only represent 5% to 10% of installations. The extra cost for each system would involve about 4 hours of technician time for a site visit and a leak check (this includes an allowance for travel).

Automatic leak detection systems will be required on all systems containing >300 kg of HFC. Many such systems already have the

45 Based on actual examples of company labelling

46 Based on discussions with Fire Industry experts.

sensors fitted but may not be connected into an appropriate control panel. Therefore some systems will require modification of the cylinder assembly which may require returning to the filling company and others may require the wiring and control panel to be updated or changed to accommodate the requirement. New systems will require the sensor to be fitted and appropriate wiring and control panels used. One of the major panel suppliers includes the facility as standard. There is little data available on the number of large FP systems that will require an upgrade.

Costs

Costs have been estimated based on discussions with experts from the fire protection industry. It is estimated that there are 10,000 to 20,000 FP systems containing more than 3 kg of HFC in the GB. The incremental cost of meeting the leak checking requirements is estimated to be £0.7 to 2.8 million per year[47]. A one-off cost of £2 to 8 million is required for automatic leak detection systems[48].

47 Record keeping £50 to £100 per system. Leak checks in range of £200 to £400 per system. Minimum assumes 10% of 10,000 systems need leak tests. Maximum assumes 10% of 20,000 systems.

48 Minimum assumes £4,000 per system and 5% of 10,000 systems need upgrade of control system for automatic detection. Maximum assumes £10,000 and 5% of 20,000 systems.

Savings

If leaks are reduced there will be a saving in terms of top up fluid being purchased. It is estimated (see paragraph below) that the emission reduction is 4,000 to 8,000 tonnes CO_2 equivalent. This represents about 1 to 2 tonnes of HFC fluid, which has a direct financial value of about £10,000 to £20,000 per year.

Assuming the shadow cost of CO_2 equivalent emissions (£26.50 per tonne of CO_2 and rising by 2% p.a.) the environmental impact of these emissions is worth a further £100,000 to £300,000 per year.

Environmental Impact and Benefits:

The implementation of better leak checking procedures will have only a small impact in the FP sector because current standards of leak checking are already good, as described in Section 3.1 above.

The most recent GB F Gas Emissions Inventory[49] shows that the F Gas emissions from the FP sector are around 350,000 tonnes CO_2 equivalent. This is equivalent to an actual emission of about 120 tonnes of F Gas (mainly HFC 227ae). This is made up of 3 types of release:

- Release during an actual fire.
- Accidental release due to faulty fire detection system.
- Leaks from the FP system.

The bulk of these emissions come from actual fires and from accidental release due to detection system faults. There is no field data that shows the exact split, but as great efforts are made during both design and maintenance to avoid leakage, FP industry experts believe that system leakage represents well below 10% of the total emissions. As 90% to 95% of systems are already maintained using service contracts with regular leak checks the improvements achieved through the new Regulation are estimated by industry experts to be in the range of 5% to 10% of current leakage emissions which is equivalent to around 4,000 to 8,000 tonnes CO_2 equivalent.

There is a small financial benefit of improved leak checking, related to reduced usage of F Gas, as described in the section above.

In addition there is the benefit that all FP systems will be regularly maintained, maximising their effectiveness. This is only a small additional benefit as most systems are already maintained in accordance with ISO 14250.

49 AEAT, 2004

3.4.2 Summary of Impact for Leak Checking in Fire Protection

Net annual costs for leak testing (i.e. annual costs minus annual savings) are estimated at between £0.6 to 2.7 million plus a on-off cost for automatic leak detection of £3 to 10 million.

Environmental benefits include an annual emission reduction of approximately 4,000 to 8,000 tonnes CO_2 equivalent. Financial benefits, including the value of CO_2 not emitted, are in the range of £110,000 to £220,000 per year.

3.5 Minimum Qualification Requirements

3.5.1 Introduction to Minimum Qualifications

CR 304/2008 is entitled: "Minimum requirements and the conditions for mutual recognition for the certification of companies and personnel as regards stationary fire protection systems and fire extinguishers containing certain fluorinated greenhouse gases". It sets down requirements for minimum qualifications to be held by personnel carrying out certain activities on FP equipment. It also refers to certification of companies and to interim arrangements for both personnel and companies. Each of these requirements is discussed in a separate section below.

3.5.2 Impacts related to Certification of Personnel

The Commission Regulation defines minimum qualifications for personnel involved in the following activities with HFC FP systems:

a) Leakage checking of applications containing 3 kg or more of fluorinated greenhouse gases.

b) Recovery (from all stationary HFC FP systems and from HFC fire extinguishers).

c) Installation.

d) Maintenance or servicing.

All personnel involved in these activities will need to obtain a certificate showing they have passed an examination that meets the minimum requirements specified in the Annex to the Commission Regulation.

Current Industry Qualifications: There is no existing course for F Gas FP systems. The 2008 Fluorinated Gases Regulations currently allow use of an in-house qualification. There is a current qualification that is quoted in the Ozone Regulations (this used to be the BFPSA[50]

50 British Fire Protection Systems Association (now part of FIA)

Certificate; it is now referred to as the FIA[51] Certificate) but this qualification relates to Halons not F Gases.

Future Plans: The FIA / BAFE[52] are currently working on a new F Gas Competency Certificate. This will meet the minimum requirements set out in the Commission Regulation. It is expected to be available from summer 2008. The Certificate can be obtained by attending a one day course, which would incorporate the required assessment as well as training.

Number of personnel: Approximately 500 to 600 staff will require this qualification for work on stationary FP systems. Currently there is only minimal use of HFCs in portable systems, but training requirements would rise if use of such systems increases.

Training Capacity required: Interim qualifications are valid in FP until July 2010. Assuming that a course is available by July 2008 then the industry will have 2 years available to get staff qualified. This will require a training capacity of about 5 trainees per week. There should be sufficient training capacity already available to meet this target.

Costs for training: There will be some initial costs to develop suitable training courses and to equip training centres and train teachers and examiners. These set up costs will be recouped via the on-going costs of training. The cost of training has been estimated using costs for similar courses. Training 500 to 600 FP personnel is estimated to cost £0.3 to 0.5 million[53], including the lost income while trainees are away from their workplace. This cost will be spread over a 2 year period.

Environmental benefits: Any environmental benefits linked to good quality leak testing have been counted in Section 3.4. No further benefits can be attributed to the provision of trained staff as this would create double counting.

3.5.3 Impacts related to Interim Certification of Personnel

The Commission Regulation provides the industry with an interim period to get the new personnel qualification which runs until July 2010.

In the interim period personnel holding an attestation issued under existing qualification schemes shall be deemed holders of an interim certificate.

51 Fire Industry Association

52 Fire safety organisation, providing training

53 Minimum assumes 500 personnel, £200 course fee, £50 certificate plus travel and lost earnings. Maximum allows for 600 personnel and more training time.

In the GB the relevant existing qualification scheme is an in-house qualification.

As all operatives already need an in-house qualification to work on HFC FP systems they will all be deemed to hold an interim certificate and hence there are no extra costs related to interim personnel certification.

3.5.4 Impacts related to Certification of Companies

The Commission Regulation defines certification requirements for companies involved in the following activities with HFC FP systems:

a) Installation.

b) Maintenance or servicing.

To get a certificate companies must be able to show that they employ sufficient staff that hold personnel qualifications (as discussed in 3.5.2) and that they have appropriate equipment and procedures in place to enable their staff to minimise HFC emissions.

Current Company Scheme: There is no existing scheme for Company Certification that meets the requirements of the F Gas Regulation.

Future Plans: The FIA / BAFE are currently working on a new F Gas Company Certification Scheme. This will meet the minimum requirements set out in the Commission Regulation. It is expected to be available from early 2009. The Company Certificate can be obtained by submitting an application form and providing evidence that ensures the company is meeting the company certification requirements.

Company Certification Options: Two different approaches to company certification are currently being considered:

c) A “minimalist” approach that meets the CR requirements. This would be a one-off company certification, with a web based application form and self certification of data subject to random audit. A small number of companies would be audited in the first year, but there would be no further auditing in following years. The random audit process is essential if self certified data is to be used. This is considered a less costly process than requiring 100% external verification of data. A scheme based on self certified data without any kind of audit process would run a serious risk of abuse.

d) A more robust approach that would include regular re-registration. This process would have a number of benefits that are discussed in detail below. The frequency of re-registration creates a number of “sub-options” that need to be considered. More frequent re-registration makes the company list more accurate, but adds to the administrative burden and cost for each organisation on the register. Initial discussions with industry indicate that annual or 2-yearly re-registration is unnecessarily frequent, so options for 3-yearly and 5-yearly re-registration have been evaluated.

It is possible to make the minimalist scheme the legal requirement and offer the robust scheme as a voluntary option. However, in these circumstances the types of company that most require a strong regime to improve their standards are likely to opt for the cheaper minimalist option. If a more robust mechanism is favoured by the industry it would be better to make it mandatory.

Number of companies: It is estimated that up to 200 companies will require a company certificate.

Costs for company certification: Costs for 3 options have been estimated with the following assumptions:

Option 1: Meets minimum legal requirements. One-off company certification. Simple web based application process based on "self-certification subject to random audit". Audit of 4% of companies only in first year, 2% with a half day visit and 2% by desk research. No re-certification[54].

Option 2: Improved scheme with 3-yearly re-certification. More robust application process, although still based on "self-certification subject to random audit". Audit of 6% of companies per year, 3% with a half day visit and 3% by desk research. Re-certification every 3 years[55].

Option 3: As Option 2, except re-certification is every 5 years.

Costs have been estimated in discussion with industry experts and by comparison with similar schemes. The average costs per company, assuming that 200 companies are certified are estimated as follows:

	Initial Application Fee, £		Annual cost for recertification, £ (averaged across re-certification period)	
	Minimum	Maximum	Minimum	Maximum
Option 1	£145	£240	£0	£0

54 The Option 1 company certification scheme will need to cover the costs of setting up and managing an administration system, processing each application to check that data is complete and provides sufficient evidence to meet the certification requirements. It must also fund the process of auditing a small proportion of companies (4%) during the first year. The total costs are estimated in the range of £29,000 to £48,000. These costs are spread across 200 companies, hence a cost per company in the range of £145 to £240.

55 The Option 2 scheme assumes a more comprehensive application form (which will require extra processing time) and a slightly larger number of random audits (6%) – both these measures are intended to make the scheme more "robust" to deliver quality improvements. The on-going costs enable the scheme infrastructure to be maintained, provide an on-going audit process and also allows for re-certification every 3 years.

Option 2	£195	£290	£100	£150
Option 3	£195	£290	£90	£140

Comments on Option 1: The overall costs for operating a minimalist scheme are estimated to be between £29,000 and £48,000 for 200 companies being certified. It is worth noting that costs for new entrants to the industry after the initial 200 companies have been certified could rise as the number of applications per year will be very low once the 200 existing companies have been certified (probably less than 10 per year) and it will be necessary to cover the costs of an on-going certification scheme.

Comments on Option 2: The overall costs for Option 2 are estimated to be between £39,000 and £58,000 for 200 companies being first certified plus an on-going average cost of £20,000 to £30,000. The on-going fees will fund on-going random audits and will help the scheme operator keep their infrastructure in place. The re-certification process will keep the list of registered companies up to date and provide valuable on-going information to the FP industry and to Government. An on-going random audit programme will be maintained under Option 2 (unlike Option 1 where audits are only carried out in the first year). This process will help ensure that companies provide accurate data when they apply for certification.

Comments on Option 3: The overall costs for Option 3 are very similar to Option 2. The initial process is identical; hence the initial application costs are equal. The on-going process requires the same annual audit expenditure and management infrastructure. The only saving is that the relatively small cost of processing re-applications is once every 5 years instead of every 3 years. Hence, the costs of Options 2 and 3 can be treated as approximately equal.

If Option 2 is chosen in favour of Option 1 the extra costs need to be justified in terms of extra benefits. The benefits of Option 2 over Option 1 are:

f) The company data is kept up to date, reflecting the changing circumstances of each company.

g) There are funds available to ensure that on-going random audits are carried out. This will put pressure on companies to comply properly with the F Gas Regulation and the terms of the Company Certificate.

h) The up to date list can be used by FP operators to check that their maintenance work is being done by a certified company.

i) The up to date list can be used by stakeholders such as Defra to contact certified companies and keep them informed of important issues related to the Regulation.

j) The up to date list can be used by Regulators to check for compliance.

Quantifying the benefits of Option 2 Company Certification: Any environmental benefits linked to good quality leak testing have been counted in Section 3.4. No further benefits can be attributed to company certification as this would create double counting. However, the savings achieved will depend on the quality of leak testing and leak repair. It is reasonable to expect that, within the range of benefits estimated in Section 3.4 that the benefits will be higher for Option 2 than for Option 1 as this provides a more robust regime for companies that carry out the crucial tasks related to FP system maintenance. The range of benefits, in terms of cost saving is between £110,000 and £220,000 per year, including (a) HFC fluid savings, (b) value of CO_2 not emitted. The range of environmental benefit is between 4,000 and 8,000 tonnes CO_2 per year. The extra annual cost for Option 2 over Option 1 is less than £30,000. It is impossible to exactly quantify the improvement, but it is clear that if a more robust company scheme makes an improvement to the quality of leak prevention activities that the environmental benefits and cost savings could out weigh the costs incurred.

3.5.5 Impacts related to Interim Certification of Companies

The Commission Regulation provides the FP industry with an interim period to get the new company certification which runs until July 2010. In the interim period companies certified under existing certification schemes shall be deemed holders of an interim certificate. In the GB there is no existing certification scheme, so no companies can be deemed to hold a certificate.

The alternative option in the Commission Regulation is: “Companies employing personnel holding a certificate for the activities for which certification is required shall be issued with an interim certificate by an entity designated by the Member State”. This is the only route available for the GB FP sector and will require an organisation to set up a scheme to issue interim certificates to up to 200 companies. It is expected that a scheme of this type will be set up by FIA.

Costs for interim company certification: An interim certificate could be based on an approach similar to the “minimalist” scheme described above, but could exclude any site audits. The costs need to allow for initial set up of a certification scheme and for promotion of the scheme around the FP industry. The cost is estimated to be between £100 and £200 per company, which is equivalent to £20,000 to £40,000.

Environmental benefits: Any environmental benefits linked to good quality leak testing have been counted in Section 3.4. No further benefits can be attributed to company certification as this would create double counting.

3.5.6 Summary of Impact for Minimum Qualifications in Fire Protection

Total costs for the “legal minimum” activities discussed in 3.5 are estimated as a one off cost of between £350,000 and £590,000.

An option for more robust company certification, including re-certification every 3 to 5 years would add a first cost of £10,000 and an on-going annual cost between £20,000 and £30,000. These extra costs are small compared to the minimum costs and provide useful benefits to employers, end users and other stakeholders.

There are no further environmental benefits for the minimum qualifications.

3.6 Summary of Costs and Benefits for Fire Protection

The costs for each aspect of FP have been discussed in sections 3.2 to 3.5 above. These are identified in terms of initial one-off costs plus on-going annual costs. Table 3.1 summarises the costs.

Table 3.1 Costs Related to Fire Protection

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	0	0	0	0
Labelling	5	10	0	0
Leak checking	2,000	8,000	700	2,800
Personnel certification	300	500	0	0
Company certification	50	90	0	0
FP Total (rounded)[56]	2,400	8,600	700	2,800
Optional company re-certification	10	10	20	30
Options total as % of FP total	+0.4%	+0.1%	+2.9%	+1%

Cost Savings and Environmental Benefits

The cost savings and environmental benefits for FP were discussed in Section 3.4 above. These were calculated as follows:

- Annual cost savings of £10,000 to £20,000 (for reduced fluid consumption).
- A further saving of £100,000 to £200,000 for the value of CO_2 not emitted

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028. This analysis shows:

56 Note, total costs are rounded so that they do not imply a degree of accuracy greater than those possible in the FP leak checking figures, which dominate the total value

- A NPV of between -£10 million and -£43 million.
- A net cost of between £152 and £305 for each tonne of CO_2 saved.

4. IMPACTS FOR STATIONARY RAC

4.1 Background and Industry Structure

The stationary refrigeration and air-conditioning sector (SRAC) refers to the use of 3 types of stationary system that utilise similar basic technologies:

- Refrigeration systems, used to cool products and spaces to temperatures below ambient.
- Air-conditioning systems, used to cool spaces to a temperature close to ambient.
- Heat pump systems, used to recover waste heat at a low temperature and deliver useful heat to a product or space at a higher temperature.

In relation to the F Gas Regulation this is a large and highly complex sector with millions of end users. The structure of the industry is as follows:

1) **Equipment Manufacturers and Suppliers.** This includes GB based manufacturers and also importers of equipment being sold into the SRAC sector.

2) **Installation and Maintenance Contractors.** Many parts of the SRAC industry are dependent on contractors who install complete systems at end user premises and provide personnel to carry out both preventative and emergency maintenance. It is worth noting that there are 2 basic types of SRAC systems. These are:

   a) Small integral systems such as domestic refrigerators or small retail display cabinets. These are simply "plugged in" to an electricity supply and require little or no specialist installation work or maintenance.

   b) Larger systems, often with refrigeration components located in different locations. For example a "split system air-conditioning unit" with a cooler inside a room and a condensing unit located outside the building. Systems of this type require installation by expert contractors and often require regular on-going maintenance.

   Systems in category (a) are almost always below the 3 kg size threshold for record keeping and leak detection. The main F Gas Regulation obligations for these systems relate to labelling and F Gas recovery. Maintenance is usually only done on an emergency basis.

   Many systems in category (b) will be above the 3 kg threshold and will require regular leak testing and record keeping. Smaller

systems in this category are not currently checked or maintained on a regular basis. Larger systems will usually be subject to a regular maintenance contract.

3) **End Users.** The "Operator" (as defined by the F Gas Regulation) will usually be the end user company that owns the product or space that requires cooling together with the associated SRAC equipment. End users can be found in a wide range of commercial and industrial sectors. There are also large numbers of end users in the domestic sector. The obligations in the F Gas Regulation have most impact on systems with at least 3 kg of F Gas refrigerant. In most cases this exempts domestic end users although if a large domestic dwelling is fitted with split system air-conditioning it could be above the size threshold. Within the commercial and industrial markets some of the most important end user sectors for SRAC equipment include:

    - Supermarkets and other food retailers.
    - Industrial sites, especially in food & drink manufacture, chemical manufacture and cold storage.
    - Buildings requiring air-conditioning, including offices, restaurants and pubs, leisure facilities and public sector buildings such as hospitals and central government buildings.

Existing Practices Related to Emission Prevention

Not all parts of the SRAC sector have a particularly strong track record in relation to leak prevention, albeit there have been noticeable improvements in recent years.

Some types of equipment are not prone to leakage. In particular this applies to small hermetically sealed systems, which can often run for 10 to 20 years without significant leakage. Other factory built systems such as large water chillers are also reasonably leak tight – in recent years many chiller manufacturers have improved their designs to reduce the risk of leakage.

"Split system" refrigeration plants have extensive runs of refrigerant pipework connecting different system components, such as evaporators, condensers and compressors. Of necessity, this refrigerant pipework must be site assembled and has numerous joints and connections. Systems of this type are much more prone to leakage. Historically leaks from this type of system have been treated as a "necessary evil". It is recognised that good design and good preventative maintenance can improve this situation. This is an expected outcome of the F Gas Regulation.

4.2 Fluid Reporting Requirements

Article 6 of the F Gas Regulation and CR 1493/2007 sets down requirements for reporting of F Gases produced in the EU, imported into the EU (from a country outside the EU) and exported from the EU.

The vast majority of refrigerant used by the SRAC sector is produced or imported by major HFC suppliers. They have reporting requirements that are assessed in Chapter 8 of this document. It is possible that OEMs producing refrigeration and air-conditioning equipment could import refrigerant directly from outside the EU. It is not thought that this practice is currently occurring, but if more than 1 tonne per year were to be imported, the Article 6 requirements would apply.

The cost of compliance is negligible compared to other costs being estimated for the SRAC sector. These reporting obligations would produce no measurable reduction in F Gas emission. Hence, there is no cost impact or environmental impact related to reporting in the SRAC sector.

4.3 Labelling Requirements

4.3.1 Assessment of Labelling Impacts

Article 7 of the F Gas Regulation and CR 1494/2007 set down requirements for labelling of new equipment place on the market after April 1st 2008. The labelling requirements apply to all SRAC systems.

The label specified in CR 1494/2007 must show some basic information including the name of the F Gas and the quantity of F Gas installed in the equipment. The label must include the text “Contains fluorinated greenhouse gases covered by the Kyoto Protocol”.

For SRAC systems the label needs to be affixed adjacent to service points for charging the system. It is already normal practice for most factory built SRAC systems to be labelled with a label that shows the refrigerant type and quantity (although current labels will not precisely meet the new EC requirements). The use of “system labels” is not so widespread on site built bespoke equipment. In this situation individual components such as evaporators or compressors are likely to have a label fitted by the OEM that produced the component, but the contractor does not always fit a system label that shows the total quantity of refrigerant in the system.

For factory built systems the new obligations can be met by either:

- Redesigning the existing label to ensure that the new information is clearly shown.
- Affixing a second “F Gas” label with the relevant information.

For site built bespoke equipment contractors will need to ensure that a suitable label is always fitted in an appropriate location. In most cases

the quantity of refrigerant will need to be added to the label after the system has been installed as this figure is not accurately known until the installation is complete.

The labelling requirement will affect OEMs producing factory built systems and contractors building bespoke systems on site. It is estimated that around 5,000 GB based companies will have to adapt their current labels. In addition all imported equipment will need to have a suitable label. There could be some language issues for OEMs producing equipment that could be sold in many different EU Member States.

The costs of redesigning the current labels are estimated at below £1,000 per company[57]. For factory built systems there is no additional revenue cost associated with affixing the newly designed labels. However, for site built systems there will be an additional revenue cost if labels were not previously fitted. The overall cost of compliance with the labelling requirements is estimated to include a one-off initial cost of £3 to 5 million plus on-going revenue costs of around £1 to 2 million per year[58].

Environmental Impact and Benefits: Many HFC SRAC systems are already well labelled and for these systems the additional labelling requirement is not likely to reduce the rate of leakage from the current levels. However, it is the site built bespoke systems that are most prone to leakage and these are the systems that are least likely to have a label. On these systems a label will help both the operator and service engineers by:

- Clarifying exactly which refrigerant and F gas refrigerant type is in use
- Specifying the refrigerant charge, and hence the leak testing frequency.
- Ensuring that the correct refrigerant quantity is filled into the system after servicing. This could lead to improved efficiency.

It is clear that there are some non-tangible benefits as described above. These could translate into some environmental benefits, especially if energy efficiency is improved by ensuring the correct refrigerant charge is in a system after maintenance. It is very difficult to quantify these benefits separately from those discussed in Section 4.4 below. The overall balance of costs and benefits is assessed in Section 4.6 for all SRAC impacts.

57 Based on actual examples of labelling

58 First cost based on 5,000 companies needing to design new labels. On going costs of £10 to £20 per system for an estimated 100,000 new systems per year (these are for site built systems – factory built systems are already labelled, so no extra cost to use new label design.

4.3.2 Summary of Impact for Product Labelling in SRAC

There is a cost impact for the redesign of labels used by 5,000 OEM and installation companies. This is estimated as a one-off cost of £3 to 5 million. On-going costs will be higher for those companies that do not currently fit a system label to site built bespoke systems. This will add around £1 to 2 million to the annual costs of new plant installation.

The environmental benefit for labels is included in the overall benefits of leak reduction described in Section 4.4.

4.4 Leak Checking Requirements

4.4.1 Assessment of Leak Checking Impacts

CR 1516/2007 sets down requirements for leak checking of stationary SRAC systems. Some of the requirements are already in place through standard preventative maintenance contracts with SRAC contractors. However, many smaller installations are not checked on a regular basis. These will need an annual visit by a qualified leak tester. For almost all systems the requirement for a formal system of record keeping will be a cost burden.

Records

The extra costs for record keeping could involve up to 1 hour per year of technician time per system and 1 hour per year for the operator to confirm that the records are in place and that follow up actions have been taken.

Leak tests

The extra costs for leak testing will be dependent on (a) whether regular leak tests are already carried out, (b) whether a regular maintenance visit is already being made and (c) the complexity of each system. Many large systems are already checked and hence there is no extra cost apart from record keeping. The range of leak testing cost for systems not currently checked is[59]:

- Minimum in-house technician cost per small system: £20
- Minimum external technician cost per small system, inc. travel: £50
- Possible cost for a large distributed system: £500

Leak repairs

If a leak test discovers a leak then a repair must be carried out. If the leak is small then the repair can be considered an extra cost. However, for larger leaks a plant failure would occur at some future time and an emergency repair carried out. The minimum cost of repairing a leak is

59 Cost estimates based on discussions with SRAC industry experts.

likely be around £200 as in most cases refrigerant will need to be removed or pumped down into a receiver vessel and following the repair the system will need to be pressure tested with nitrogen and evacuated before refrigerant is refilled into the system. This process will typically take a minimum of half a day. For larger systems a leak repair could cost up to 5 times this amount.

Leak testing systems

Permanent leak testing systems will be mandatory on systems containing more than 300 kg of refrigerant. We estimate that there are between 20,000 and 40,000 systems that fall into this category. Many are already fitted with leak detection systems. The typical cost of a new system will be around £5,000. All leak detection systems will require annual testing. This can be scheduled at the time of one of the twice-yearly leak checks and will add about £100 to annual costs.

Overall Costs

It is estimated that there are in excess of 1 million SRAC systems in the GB that contain more than 3 kg of HFC refrigerant. The incremental costs of the new leak checking requirements are highly dependent on the existing leak testing regimes that are in place and the number of large systems already fitted with leak detection systems. We estimate an initial one-off cost of £50 to 100 million[60] plus on-going costs of £75 to 160 million[61] per year.

Savings and Other Benefits

There are 2 tangible savings that should occur through a rigorous and well implemented leak testing regime. Firstly, there will be a direct reduction in the cost of refrigerant used to top up equipment. Secondly, and more importantly, there will be a reduction in the energy consumption as many plants run inefficiently if they have lost refrigerant. In addition to these quantifiable benefits end users should make further savings related to less emergency call outs and less consequential losses that could follow from an unexpected plant failure due to leakage.

If leaks are reduced there will be a saving in terms of top up fluid being purchased. It is estimated (see paragraph below) that the emission reduction is 1 to 1.5 million tonnes CO_2 equivalent. This represents

60 Based on installation of automatic leak detection systems costing between £3,000 and £5,000 being fitted to between 16,000 and 20,000 systems

61 Based on record keeping for 1 million plants (at £20 to £40 per plant), extra leak detection work for 50% to 70% of plants (at £80 to £120 per plant) and extra leak repair work for 10% to 15% of plants (at £150 to £250 per plant).

about 500 to 750 tonnes of HFC fluid, which has a value of £5 million to £7 million per year.

If leaks are reduced there will also be a saving in terms of reduced energy consumption. It is estimated (see paragraph below) that the emission reduction is 0.6 to 1.2 million tonnes CO_2 equivalent. This represents about 1,400 to 2,800 million kWh of electricity, which has a value of £67 million to £135 million per year[62].

Using the standard Government guidance on valuing CO_2 emissions savings[63] for reduced gas emissions, the environmental impact of these emissions is worth a further £630 million to £950 million in total.

The value of the decreased emissions resulting from electricity savings is calculated using the projected EU Allowance price under the EU Emissions Trading Scheme, i.e. the revenue gained from selling permits for emissions. This gives rise to a further benefit of £300 million to £600 million in total.

Environmental Impact

The implementation of better leak checking procedures could have a significant environmental benefit as there is good potential to reduce historic levels of leakage from SRAC systems. The environmental benefits include both "direct" savings (i.e. reduced emissions of HFC refrigerants) and "indirect" savings (i.e. reduced energy consumption).

The most recent GB F Gas Emissions Inventory[64] shows that the F Gas emissions from the SRAC sector are around 3.5 million tonnes CO_2 equivalent. This is equivalent to an actual emission of about 2,000 tonnes of F Gas (assuming an average GWP of 1750). It is estimated that the new leak checking regime will reduce current emissions by around 50% in some sectors (e.g. supermarkets). The total saving could be in the range 1 to 1.5 million tonnes CO_2 equivalent[65].

The 1999 GB F Gas Emissions Inventory[66] showed that the energy consumption related to refrigeration systems gave rise to emissions of around 27 million tonnes CO_2. This includes some sectors that will not be affected by the leak testing regimes (e.g. domestic refrigerators and MACs). Making an allowance for this we estimate that plants that will be affected by leak testing account for an energy related emission of

62 Assuming an electricity price of 4.82 p/kWh

63 http://www.defra.gov.uk/environment/climatechange/research/carboncost/pdf/HowtouseSPC.pdf

64 AEAT 2004

65 Based on 40% to 60% leak reduction for supermarkets, 10% to 20% for industrial refrigeration and split system air-conditioning and 15% to 30% for small commercial split system refrigeration.

66 March Consulting, 1999

about 19 million tonnes CO_2 equivalent. The leak testing regime will give rise to some directly related efficiency improvements (because plants with too little refrigerant lose efficiency). There will also be indirect benefits because the leak test will involve a comprehensive inspection of equipment and it is likely that other efficiency opportunities will often be spotted (e.g. blocked air cooled condensers). It is conservative to expect energy savings in the range of 3% to 6% through the leak testing regime. This is equivalent to a saving of 0.6 to 1.2 million tonnes CO_2 equivalent.

4.4.2 Summary of Impact for Leak Checking in SRAC

Costs incurred include:

One-off costs of £50 to 100 million.

Annual costs of £75 to 160 million.

Cost savings include:

Annual refrigerant savings of £5 to 7 million.

Annual electricity savings of £67 to 135 million.

Annual value of CO_2 equivalent not emitted between £40 and 70 million.

Environmental benefits include a saving of 1.6 to 2.7 million tonnes CO_2 equivalent (including direct F Gas emission reductions and indirect CO_2 savings from reduced electricity consumption)..

It should be noted that the environmental savings (and cost savings) described in section 4.4 will be affected by the effectiveness of labelling (see 4.3) and technician qualifications (see 4.5). It is very difficult to distinguish amount of saving in each of these areas. To avoid any double counting all the savings related to leak checking are included in the figures presented in this section.

4.5 Minimum Qualification Requirements

4.5.1 Introduction to Minimum Qualifications

CR 303/2008 is entitled: “Minimum requirements and the conditions for mutual recognition for the certification of companies and personnel as regards stationary refrigeration, air conditioning and heat pump equipment containing certain fluorinated greenhouse gases”. It sets down requirements for minimum qualifications to be held by personnel carrying out certain activities on SRAC equipment. It also refers to certification of companies and to interim arrangements for both personnel and companies. Each of these areas is discussed in a separate section below.

4.5.2 Impacts related to Certification of Personnel

The Commission Regulation defines minimum qualifications for personnel involved in the following activities with HFC SRAC systems:

a) Leakage checking of applications containing 3 kg or more of fluorinated greenhouse gases and of applications containing 6 kg or more of fluorinated greenhouse gases with hermetically sealed systems, which are labelled as such.

b) Recovery.

c) Installation.

d) Maintenance or servicing.

All personnel involved in these activities will need to obtain a certificate showing they have passed an examination that meets the minimum requirements specified in the Annex to the Commission Regulation.

The Commission Regulation refers to 4 different standards of minimum qualification for SRAC personnel. These are:

Category I: certificate holders may carry out all the activities listed above.

Category II: certificate holders may carry out leakage checking provided that it does not entail breaking into the refrigeration circuit containing fluorinated greenhouse gases. Category II certificate holders may carry out all the activities listed above in relation to refrigeration, air conditioning and heat pump equipment containing less than 3 kg, or, if hermetically sealed systems which are labelled as such are concerned, less than 6 kg of fluorinated greenhouse gases;

Category III: certificate holders may carry out recovery in relation to refrigeration, air conditioning and heat pump equipment containing less than 3 kg, or, if hermetically sealed systems which are labelled as such are concerned, less than 6 kg of fluorinated greenhouse gases;

Category IV: certificate holders may carry out leak checking provided that it does not entail breaking into the refrigeration circuit containing fluorinated greenhouse gases.

Current SRAC Industry Qualifications

Under the Ozone Regulations, personnel handling ODS refrigerants need one of the following qualifications:

a) City and Guilds 2078

b) CITB 206710

These qualifications have been available for 12 years and it is estimated that over 25,000 personnel have obtained the qualifications during this time.

Under the GB 2008 Fluorinated Gases Regulations the above qualifications are specified for as the minimum requirement for work on SRAC systems with >3 kg of refrigerant. For systems below 3 kg, the above qualifications are desirable, but 2 alternative options are specified in the GB Regulation:

- An in-house qualification.
- Personnel who carried out unsupervised work on SRAC systems below 3 kg before February 15th 2008.

The regime prescribed in the GB 2008 Fluorinated Gases Regulations is only sufficient for a short interim period. The new Commission Regulation (CR 303/2008) specifies minimum qualifications that go beyond the content of the 2 qualifications described above. All GB personnel working on SRAC containing HFCs will need new qualifications by the end of a 3 year interim period that ends in July 2011.

Future Plans: ACRIB[67] is currently working with City and Guilds and CITB[68] to specify new qualifications that meet the new requirements. The new courses are expected to be available by summer 2008. The qualifications are to be designed so that trainees can select which of the 4 categories of skill level described above they wish to qualify for. The exam will include theoretical questions and also practical examination of key techniques. For Category I the exam itself is expected to take around 4 hours to complete. Experienced personnel may be able to learn the new material in half a day and hence complete training and examination in 1 day. However, for most personnel it is estimated that training and examination will take 2 to 4 days.

Number of personnel: It is estimated by SRAC industry experts that 20,000 to 25,000 personnel will require the Category I qualification to work on SRAC systems above 3 kg. In addition they estimate a further 5,000 to 10,000 staff who only work on very small systems (mostly in the domestic sector) will need to take the Category II qualification.

Training Capacity required: Interim qualifications are valid in SRAC until July 2011. Assuming that a course is available by July 2008 then the industry will have 3 years available to get staff qualified. This will require a training capacity of 150 to 175 trainees per week for Category I plus a further 30 to 60 trainees per week for Category II. It is believed that there is sufficient training capacity in the GB to meet these requirements providing that the majority of existing training centres equip themselves to be able to deliver the new qualifications.

Costs for training: There will be some initial costs to develop suitable training courses and to equip training centres and train teachers and examiners. These set up costs will be recouped via the on-going costs

67 Air-conditioning and Refrigeration Industry Board

68 Construction Industry Training Board

of training. The cost of training has been estimated using costs for existing refrigeration courses. The cost of training 25,000 to 35,000 staff in Categories I &II is estimated to be £25 to 30 million[69], including the lost income while trainees are away from their workplace. This cost will be spread over a 3 year period.

Environmental benefits: Environmental benefits linked to good quality leak testing have been counted in Section 4.4. No further benefits can be attributed to staff training as this would create double counting.

4.5.3 Impacts related to Interim Certification of Personnel

The Commission Regulation provides the SRAC industry with an interim period to get the new qualification which runs until July 2011.

In the interim period personnel holding an attestation issued under existing qualification schemes shall be deemed holders of an interim certificate.

In GB the relevant existing qualification scheme for systems above 3 kg is either the City and Guilds 2078 or the CITB 206710. As all operatives already need one of these qualifications to work on HFC SRAC systems they will all be deemed to hold an interim certificate and hence there are no extra costs related to interim certification for systems above 3 kg.

In GB the relevant existing qualification scheme for systems below 3 kg include (a) the above qualifications, or (b) an in-house training course or (c) relevant pre-existing professional experience. Personnel qualified via (a) or (b) will be deemed to hold an interim certificate and hence there are no extra costs related to interim certification. However, personnel relying on (c), pre-existing professional experience will need to be issued with an interim certificate. There are no accurate figures available on the number of personnel that will need an interim certificate via option (c). Assuming that the number is in the range 1,000 to 3,000 the total cost of providing interim certificates for engineers working on systems below 3 kg will be a one off cost in the range £30,000 to £150,000[70].

4.5.4 Options Related to Mandatory SRAC Personnel Registration

The costs described above assume that the training is a “one-off” process and that certificates are issued by the relevant Certification Body to each successful trainee. At present there are two certification bodies but there is no central register of certified personnel. On the

69 Minimum assumes 20,000 Category I and 5,000 Category II personnel. One third of Category I does training in 1 day (£150 course fee, £50 certificate plus £250 for travel and lost earnings). Others need 2 or 4 days of training. Half of category II trainees only need 1 day training; remainder need 2 days. Maximum assumes 25,000 Category I and 10,000 Category II personnel.

70 This assumes that the cost per certificate is in the range of £30 to £50.

other hand, an employer or a customer wanting to check an individual's qualification can request sight of the certificate held by the person concerned or check with the certification body that a certificate has been issues to the person concerned.

Some stakeholders in the SRAC industry have expressed an interest in a central registration scheme for personnel holding a Category I or II SRAC F Gas certificate (ACRIB already run a small voluntary scheme). This would allow access to a verified list of trained personnel. The registration scheme could also include a photo identity card to confirm qualification status, including which category of qualification has been certified. The key benefits of such a published list include:

f) Employers could confirm personnel qualifications prior to taking on new members of staff (it is an obligation under the F Gas Regulation to only employ trained staff for SRAC F Gas handling activities).

g) Employers could use the register to simplify company certification (see 4.5.5 below), and the register this would be useful where audit checks were being made by the certification body.

h) Customers could easily confirm personnel qualifications of personnel carrying out maintenance work (it is an obligation under the F Gas Regulation for operators to only use qualified staff for SRAC F Gas handling activities).

i) The register can help discourage fraudulent use of forged certificates.

j) Stakeholders such as Defra and industry Trade Associations could use the list to make contact with trained personnel to keep them informed of any changes in legislation or to industry "best practice", although existing networks can also be effective.

There are 2 main options related to personnel registration, both of which go beyond the minimum requirements in the Regulation. These are:

Option (a) A one-off registration, made immediately after a training certificate is received.

Option (a) A scheme that requires initial registration plus periodic re-registration, e.g. every 3 year or every 5 years.

In both cases the scheme would only be of maximum benefit if a list of qualified personnel is kept up to date and openly published (e.g. on a website) for inspection by potential employers or customers. The Registration Body would need some on-going funds to maintain such a list and keep it up to date.

The minimum cost registration option is Option (a). Based on similar schemes, such as the existing ACRIB voluntary register (and allowing for a a larger scheme – the ACRIB register currently has around 5,000

members whilst a mandatory register will have 25,000 to 35,000 members) one could expect the registration fee to be in the range of £15 to £20, hence the overall cost impact for the SRAC industry will be £400,000 to £700,000 as a one-off initial cost. In most cases this cost would be paid by employers on behalf of their staff.

It can be argued that a scheme with periodic re-registration has some additional benefits. It could ensure that the list of trained staff does not include people that no longer work in the industry or have retired. This is important to users of the published register as after, say, 10 years many people that originally registered are no longer available to do SRAC work. Also, the re-registration process enables checks to be made that personnel are up to date with any important changes that have occurred since previous registration. The cost of re-registration, for a large scheme, could be in the range of £10 to £15. If this is done once every 3 years this is equivalent to an annual cost of £3 to £5, which gives a range of £75,000 to £175,000 per year for the whole SRAC industry. On the other hand, personnel already registered may feel that re-registration provides no additional benefits for them or their employer, and this perception may make re-registration unpopular. Alternative approaches could be to leave personnel on the register until they ask to be removed, or for the registration body to contact personnel to ask if they still wish to be on the register.

It is worth noting that a voluntary registration scheme is likely to be ineffective as the key benefits described above are only achieved if a very high proportion of personnel are registered. This is unlikely to occur unless registration is mandatory.

Quantifying the benefits of Mandatory Personnel Registration: Any environmental benefits linked to good quality leak testing have been counted in Section 4.4. No further benefits can be attributed to personnel registration as this would create double counting. However, the savings achieved will depend on the quality of leak testing and leak repair. It is arguable that, within the range of benefits estimated in Section 4.4 that the benefits may be highest with mandatory registration via Option (b) as this provides the most robust regime for ensuring that only trained personnel work on F Gas refrigeration systems. The range of benefits for leak prevention, in terms of cost saving, is between £135 million and £257 million per year, including (a) refrigerant savings, (b) energy savings and (c) value of CO_2 equivalent not emitted. The range of environmental benefit is between 1.6 and 2.7 million tonnes CO_2 equivalent per year. The extra cost for a mandatory registration scheme is a one off cost between £0.4 and 0.7 million plus an average annual re-registration cost of less than £0.2 million. It is impossible however to quantify with any reliability at this stage the benefits related to personnel registration.

4.5.5 Impacts related to Certification of Companies

The Commission Regulation defines certification requirements for companies involved in the following activities with HFC SRAC systems:

a) Installation.

b) Maintenance or servicing.

To get a certificate companies must be able to show that they employ sufficient staff that hold personnel qualifications (as discussed in 4.5.3 above) and that they have appropriate equipment and procedures in place to enable their staff to minimise HFC emissions.

Current Company Scheme: There is a REFCOM company scheme that fulfils all the F Gas Regulation certification requirements. However, this scheme "goes beyond" the requirements and is only used by a small proportion of the GB contracting industry. Approximately 250 companies are registered in the REFCOM scheme, out of an estimated 8,000 companies in the industry. This is only 3% coverage.

Future Plans: REFCOM are reviewing the structure of their registration scheme and the requirements of the Commission to design a new scheme that could provide company registration for the whole industry. It is expected to be available from 2009. The Company Certificate will be obtained by submitting an application form and providing evidence that ensures the company is meeting the F Gas requirements. The scheme will include a random sample of site visits to ensure that company submissions are accurate.

Company Certification Options: Two different approaches to company certification are currently being considered:

c) A "minimalist" approach that meets the CR requirements. This would be a one-off company certification, with a web based application form and self certification of data subject to random audit. A small number of companies could be audited in the first year, but there would be no further auditing in following years. The random audit process is essential if self certified data is to be used. This is considered a less costly process than requiring 100% external verification of data. A scheme run with self certified data without any kind of audit process would run a serious risk of abuse.

d) A more robust approach that would include regular re-registration. This process has a number of benefits that are discussed in detail below. The frequency of re-registration creates a number of "sub-options" that need to be considered. More frequent re-registration makes the company list more accurate, but adds to the administrative burden and cost for each organisation on the register. Initial discussions with refrigeration industry indicate that annual or 2-yearly re-registration is

unnecessarily frequent, so options for 3-yearly and 5-yearly re-registration have been evaluated.

It is possible to make the minimalist scheme the legal requirement and offer the robust scheme as a voluntary option. However, in these circumstances the types of company that most require a strong regime to improve their standards are likely to opt for the cheaper minimalist option. If a more robust mechanism is favoured by the industry it would be better to make it mandatory.

Number of companies: It is estimated that up to 8,000 companies might require this certificate. However, there is some uncertainty about the number of "one man operations" included in this figure and the proportion of these that operate as registered companies (as opposed to someone simply working as a self employed contractor or sub-contractor). This could mean that only around 5,000 companies will need to obtain a certificate. It should also be noted that the rules for company certification seem to apply to end users employing trained personnel as well as to refrigeration contracting companies. This might add several hundred more companies to the list of those requiring a company certificate.

Costs for company certification: Costs for 3 options have been estimated with the following assumptions:

Option 1: Meets minimum legal requirements. One-off company certification. Very simple web based application process based on "self-certification subject to random audit". Audit of 4% of companies only in first year, 2% with a half day visit and 2% via desk research. No re-certification[71].

Option 2: Improved scheme with 3-yearly re-certification. More robust application process, although still based on "self-certification subject to random audit". Audit of 6% of companies per year, 3% with a half day visit and 3% via desk research. Re-certification every 3 years[72].

Option 3: As Option 2, except re-certification is every 5 years.

71 The Option 1 company certification scheme will need to cover the costs of setting up and managing an administration system, processing each application to check that data is complete and provides sufficient evidence to meet the certification requirements. It must also fund the process of auditing a small proportion of companies (4%) during the first year. The total costs are estimated in the range of £350,000 to £550,000. These costs are spread across 5,000 companies, hence a cost per company in the range of £70 to £110.

72 The Option 2 scheme assumes a more comprehensive application form (which will require extra processing time) and a slightly larger number of random audits (6%) – both these measures are intended to make the scheme more "robust" to deliver quality improvements. The on-going costs enable the scheme infrastructure to be maintained, provide an on-going audit process and also allows for re-certification every 3 years.

The average costs per company, assuming that 5,000 companies need to be certificated are estimated as follows:

	Initial Application Fee, £		Annual cost for recertification, £ (averaged across re-certification period)	
	Minimum	Maximum	Minimum	Maximum
Option 1	£70	£110	£0	£0
Option 2	£95	£140	£50	£70
Option 3	£95	£140	£40	£60

Comments on Option 1: The overall costs for operating a minimalist scheme are estimated to be between £0.35 million and £0.55 million for 5,000 companies being certified. It is worth noting that costs for new entrants to the industry after the initial companies have been certified could rise as the number of applications per year will be low once the 5,000 existing companies have been certified (probably less than 100 per year) and it will be necessary to cover the costs of an on-going certification scheme.

Comments on Option 2: The overall costs for Option 2 are estimated to be between £0.47 million and £0.7 million for 5,000 companies being first certified plus an on-going annual average cost of between £0.25 million and £0.35 million. The on-going fees will fund on-going random audits and will help the scheme operator keep their infrastructure in place. The re-certification process will keep the list of registered companies up to date and provide valuable on-going information to the SRAC industry and to Government. An on-going random audit programme will be maintained under Option 2 (unlike Option 1 where audits are only carried out in the first year). This process will help ensure that companies provide accurate data when they apply for certification.

Comments on Option 3: The overall costs for Option 3 are very similar to Option 2. The initial process is identical; hence the initial application costs are equal. The on-going process requires the same annual audit expenditure and management infrastructure. The only saving is that the relatively small cost of processing re-applications is once every 5 years instead of every 3 years. The costs of Options 2 and 3 can be treated as approximately equal.

If Option 2 is chosen in favour of Option 1 the extra costs need to be justified in terms of extra benefits. The benefits of Option 2 over Option 1 are:

f) The company data is kept up to date, reflecting the changing circumstances of each company (e.g. growth or contraction of their refrigeration maintenance activities).

g) There are funds available to ensure that on-going random audits are carried out. This will put pressure on companies to comply properly with the F Gas Regulation and the terms of the Company Certificate.

h) The up to date list can be used by refrigeration plant operators to check that their maintenance work is being done by a certified company.

i) The up to date list can be used by stakeholders such as Defra to contact certified companies and keep them informed of important issues related to the Regulation.

j) The up to date list can be used by Regulators to check for compliance.

Quantifying the benefits of Option 2 Company Certification: Any environmental benefits linked to good quality leak testing have been counted in Section 4.4. No further benefits can be attributed to company certification as this would create double counting. However, the savings achieved will depend on the quality of leak testing and leak repair. It is reasonable to expect that, within the range of benefits estimated in Section 4.4 that the benefits will be higher for Option 2 than for Option 1 as this provides a more robust regime for companies that carry out the crucial tasks related to refrigeration plant maintenance. The range of benefits for leak prevention, in terms of cost saving is between £135 million and £257 million per year, including (a) refrigerant savings, (b) energy savings and (c) value of CO_2 equivalent not emitted. The range of environmental benefit is between 1.6 and 2.7 million tonnes CO_2 equivalent per year. The extra annual cost for Option 2 over Option 1 is less than £0.35 million. It is impossible to exactly quantify the improvement, but it is clear that if a more robust company scheme only makes a small improvement to the quality of leak prevention activities that the environmental benefits and cost savings will easily out weigh the costs incurred.

4.5.6 Impacts related to Interim Certification of Companies

The Commission Regulation provides the industry with an interim period to get the new company certification which runs until July 2011. In the interim period companies certified under existing certification schemes shall be deemed holders of an interim certificate. In the GB there is no

existing certification scheme, so no companies can be deemed to hold a certificate.

The alternative option in the Commission Regulation is: “Companies employing personnel holding a certificate for the activities for which certification is required shall be issued with an interim certificate by an entity designated by the Member State”. This is the only route available for the GB SRAC sector and will require an organisation to set up a scheme to issue interim certificates to up to 8,000 companies.

Costs for interim company certification: The costs for interim certification will be lower than those required for the Option 1 certification scheme described above because there is no audit requirement and there is less application data to check. However, there will be some extra cost for a “marketing” budget to try and ensure that all companies get information about the certification requirements. It is estimated that an interim certificate will cost between £50 and £100, implying an overall cost of between £250,000 and £500,000.

Environmental benefits: Any environmental benefits linked to good quality leak testing have been counted in Section 4.4. No further benefits can be attributed to interim company certification as this would create double counting.

4.5.7 Summary of Impact for Minimum Qualifications in SRAC

Total costs for the “legal minimum” activities discussed in 4.5 are estimated as a one off cost of between £26 million and £31 million spread across 3 years.

An option for mandatory registration of personnel would add a first cost of between £400,000 and £700,000 and an on-going annual cost between £75,000 and £175,000. These extra costs are small compared to the minimum costs and provide useful benefits to employers, end users and other stakeholders. The extra costs should be more than compensated for by increased cost savings and improved environmental benefit.

An option for more robust company certification, including re-certification every 3 to 5 years would add a first cost of between £120,000 and £150,000 and an on-going annual cost between £250,000 and £350,000. These extra costs are small compared to the minimum costs and provide useful benefits to employers, end users and other stakeholders. The extra costs should be more than compensated for by increased cost savings and improved environmental benefit.

There are no further environmental benefits or cost savings for the minimum qualifications beyond those already described in Section 4.4. However, as described above it is reasonable to expect a higher level of environmental and cost saving within the range stated if the regime of personnel and company certification is well implemented and robust.

4.6 Summary of Costs and Benefits for SRAC

The costs for each aspect of SRAC have been discussed in sections 4.2 to 4.5 above. These are identified in terms of initial one-off costs plus on-going annual costs. Table 4.1 summarises the costs.

As discussed above, the environmental benefits are mainly in terms of reduced direct HFC emissions and indirect energy related CO_2 emissions. There are cost savings attributable to both these emission reductions, in terms of reduced consumption of HFC refrigerants for plant servicing and reduced use of electricity due to plant efficiency improvements. It is very difficult to segregate these benefits between 3 of the categories analysed in this part of the report i.e. labelling, leak testing and minimum qualifications. For this reason the benefits are treated together for the whole of SRAC.

Table 4.1 Costs Related to SRAC

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	0	0	0	0
Labelling	3,000	5,000	1,000	2,000
Leak checking	50,000	100,000	75,000	160,000
Personnel certification	25,000	30,000	0	0
Company certification	600	1,050	0	0
SRAC Total (rounded)[73]	79,000	136,000	76,000	161,000
Optional mandatory personnel registration	400	700	75	175
Optional company re-certification	120	150	250	350
Options total as % of SRAC total	+0.6%	+0.6%	+0.4%	+0.3%

Cost Savings and Environmental Benefits

The cost savings and environmental benefits for SRAC were discussed in Section 4.4 above. These were calculated as follows:

- Annual cost savings of £72 to 140 million (allowing for reduced refrigerant consumption and reduced electricity use).
- Environmental benefits of 1.6 to 2.7 million tonnes CO_2 equivalent per year.

73 Note, total costs are rounded so that they do not imply a degree of accuracy greater than those possible in the SRAC leak checking and personnel registration figures, which dominate the total value.

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028. This analysis shows:

- A net present value (i.e. a saving to the economy) of between £540 million and £700 million.
- A net saving of £4.2 for each tonne of CO_2 equivalent saved.

4.7 Changes to Ozone Regulations

The new F gas qualifications, which are being developed, will also cover working with ozone-depleting substances. The Ozone-Depleting Substances (Qualifications) Regulations (SI 2006/1510), as amended, will need to be revoked and remade to take these new qualifications into account so that holders of these qualifications can continue to work with ozone-depleting substances. It is highly unlikely that new personnel will work only with ozone-depleting substances, so they would always need a qualification that permitted them to work with F gases. The costs to industry and benefits to the environment should be zero.

5. IMPACTS FOR HV SWITCHGEAR

5.1 Background and Industry Structure

The HV switchgear sector refers to the use of SF_6 in high voltage switchgear. In electricity transmission systems above 11,000 volts, circuit breakers insulated with SF_6 gas instead of air are often the most compact and cost effective option.

There are 2 basic types of SF_6 HV switchgear:

- Larger circuit breakers used on very high voltage systems contain a large quantity of SF_6 (a new sub-station installation such as one currently being installed at a power station can hold up to 25 tonnes of SF_6); referred to as Gas Insulated Switchgear (GIS). New GIS devices are usually filled with SF_6 on site. GIS can be serviced in situ, which may occasionally require SF_6 recovery and/or top up.
- Smaller circuit breakers used on lower voltage systems are hermetically sealed and only contain a small quantity of SF_6 (typically up to 30 kg). These devices cannot be serviced on site as they are completely sealed.

The structure of the industry is as follows:

1) **Fluid Suppliers.** All SF_6 used in HV switchgear is imported. The main importer is Air Products. Other suppliers include BOC and Solvay. They supply fluid both to the equipment manufacturers and to end users.
2) **Equipment Suppliers.** There are four main manufacturing companies that supply the SF_6 HV switchgear systems used in the GB. Companies manufacturing LV switchgear are more numerous. Some units are manufactured in the GB but many are imported. The smaller units are always pre-charged with SF_6 in the factory. Larger units can be pre-charged or filled during site installation. BEAMA looks after the interests of the GB based equipment manufacturers.
3) **System installers and maintenance companies.** There are a small number of specialist companies that fit SF_6 HV switchgear equipment in transmission systems and provide follow up maintenance services.
4) **End Users.** There are 3 distinct groups of end users:
   - In terms of volume of gas used, the majority of end use is by electricity transmission and distribution companies. This includes the National Grid Company and 7 other high voltage and lower voltage distribution companies. These 8 companies operate numerous items of SF_6 switchgear located at many separate locations (electricity sub-stations). The National Grid Company is by far the largest user of SF_6.

- The second largest group of users are power station operators.
- A small proportion of SF_6 HV switchgear is used by companies outside the electricity industry at sites that receive electricity at high voltage. These systems are sometimes maintained by the local electricity distribution company, but it is likely that there are some installations maintained by local engineers, unaware that they have SF_6 on site.

Existing Practices Related to Emission Prevention

The electricity industry is aware of the high GWP of SF_6 and has made significant investments in recent years to minimise leakage of SF_6. The main users in electricity transmission and distribution companies are members of the Energy Networks Association and they have collaborated to set up a code of good practice and a reporting mechanism. This allows the use of SF_6 by the main end users to be carefully monitored. The electricity transmission companies already report SF_6 emissions to Ofgem and there is a performance standard that promotes leakage reduction. A similar arrangement is being considered for lower voltage distribution companies.

5.2 Labelling Requirements

5.2.1 Assessment of Labelling Impacts

Article 7 of the F Gas Regulation and CR 1494/2007 sets down requirements for labelling of new equipment placed on the market after April 1st 2008. The labelling requirements in Article 7 apply to SF_6 HV switchgear equipment that contains SF_6.

The label specified in CR 1494/2007 must show some basic information including the name of the F Gas, the quantity in the equipment and also the text “Contains fluorinated greenhouse gases covered by the Kyoto Protocol”.

For SF_6 HV switchgear systems the label needs to be affixed to each switch system that contains SF_6. It is already normal practice for each switch to be labelled. The new obligations can be met by either:

- Redesigning the existing label to ensure that the new information is clearly shown.
- Affixing a second “F Gas” label with the relevant information.

The manufacture of SF_6 HV switchgear equipment used in the GB is carried out by four companies. One of these has GB based manufacturing facilities – the others are importers of equipment manufactured elsewhere in Europe. The costs of redesigning the current labels are estimated at below £2,000 per company. Once the label is redesigned there is no additional revenue cost associated with

affixing the labels. There are some language issues for OEMs producing equipment that is sold in many different EU Member States.

There are a number manufacturers of lower voltage switchgear containing SF_6. These are also affected by the regulation. Three of these companies have GB based manufacturing.

Environmental Impact and Benefits: SF_6 HV switchgear systems are already well labelled and the additional material is not likely to reduce the rate of leakage from the current levels. Hence, the labelling requirement will have no direct environmental impact on the HV GIS sector. However, the labelling of lower voltage SF_6 switchgear may well be helpful in assisting in identifying SF_6 as a problem for end of life disposal on industrial sites.

5.2.2 Summary of Impact for Product Labelling in GIS

There is small cost impact for the redesign of labels used by 4 companies. This is estimated as a one-off cost of between £5,000 and £10,000 for the GB. On-going costs will be negligible.

There is a small environmental benefit for these labels based on increasing the likelihood that the lower voltage switchgear will be identified as containing SF_6 at end of life and will thus be disposed of properly rather than sent for scrap. This will be a long term impact. Switchgear installed today is likely to last for at least 20 years.

5.3 Minimum Qualification Requirements

5.3.1 Introduction to Minimum Qualifications

CR 305/2008 is entitled: “Minimum requirements and the conditions for mutual recognition for the certification of personnel recovering certain fluorinated greenhouse gases from high-voltage switchgear”. It sets down requirements for minimum qualifications to be held by personnel carrying out certain activities on GIS equipment.

5.3.2 Impacts related to Certification of Personnel

The Commission Regulation defines minimum qualifications for personnel involved in the following activities with SF_6 GIS systems:

a) Recovery

All personnel involved in this activity will need to obtain a certificate showing they have passed an examination that meets the minimum requirements specified in the Annex to the Commission Regulation.

Current Industry Qualifications:

There are no current suitable external industry qualifications. Most personnel are trained in-house. EA Technology runs a one day course on using SF_6 filled switchgear costing £260. Private contractors such as

Grosvenor Power also run training courses which could be adapted to cover the requirements of the regulation.

Future Plans: The Distributed Network Operators are keen to run their own accredited in-house courses, but provision will need to be made for other users such as power generators, contractors and private network operators.

Number of personnel: As the requirement is only to train personnel involved in activities where there is a risk of leakage, and this is mostly on original filling and at end of life, the minimum number of personnel needing training could be quite low. As a minimum, the companies requiring training would be as follows:

	Companies	Total personnel
Manufacturers	4	40
Contractors	~10	100
Fluid Supply & Recovery	3	15
Network Operators	8	480
Totals	25	635

Allowing for some other companies there is a requirement for training between 600 and 800 engineers.

Training Capacity required: The personnel training requirements for SF_6 HV switchgear must be in place by 4th July 2009. The earliest possible date for the agreement of suitable training providers and certification bodies is Summer 2008, and these will not be confirmed in GB legislation until early 2009. Hence there will be only 6 to 12 months available to get relevant personnel qualified. This will require a training capacity of 15 to 30 staff per week. It is not certain that sufficient training capacity exists for this sector.

Costs for training:

The EA Technology course costs £260 per engineer and can easily be adapted to meet the requirements of the regulation. Additional costs include administration of certification, course development and lost income while engineers are being trained. The total cost of training is estimated as a one-off cost of between £400,000 and £600,000.

Environmental benefits:

The main benefit to be achieved through training is the recognition of the impact of leakage of gas on first fill and the requirement to recover

gas during maintenance and at end of life. One engineer commented to us that in 10 years of installing GIS he has never installed a whole site without at least one leak. Further, the industry is expecting to see an increased use of GIS over the next few years as the use of Air Insulated Switchgear (AIS) is replaced by GIS. This is because GIS is much more compact than AIS and as land costs increase it is more economic to use GIS. Also the use of GIS on an existing AIS site means that planning permission is not needed as a site upgrade can be fitted into the same footprint.

It is estimated that around 150 tonnes of gas will be installed in new equipment during the next two years. A reduction in leakage during plant installation of 1% of this would represent a reduction of 35,000 tonnes CO_2 equivalent emission.

The most recent GB emissions inventory shows that emissions from SF_6 HV Switchgear are around 500,000 tonnes CO_2 equivalent. This equates to annual emissions of about 20 tonnes of fluid. Better trained operatives working within the requirements of the F Gas Regulation may be able to achieve emission reductions of between 5% and 10%. This would equate to 1 to 2 tonnes of fluid and 25,000 to 50,000 tonnes CO_2 equivalent. There would be a small financial saving of between £10,000 and £20,000 for the reduced use of fluid.

5.4 Summary of Costs and Benefits for SF_6 HV Switchgear

The costs for each aspect of SF_6 HV Switchgear have been discussed in sections 5.2 to 5.3 above. These are identified in terms of initial one-off costs plus on-going annual costs. Table 5.1 summarises the costs.

Table 5.1 Costs Related to SF_6 HV Switchgear

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	n/a	n/a	n/a	n/a
Labelling	5	10	0	0
Leak checking	n/a	n/a	n/a	n/a
Personnel certification	400	600	0	0
Company certification	n/a	n/a	n/a	n/a
Total	400	600	0	0

Cost Savings and Environmental Benefits

The cost savings and environmental benefits for HV Switchgear were estimated as follows:

- Annual cost savings of £10,000 to £20,000 for reduced SF_6 consumption.
- Environmental benefits of 25,000 to 50,000 tonnes CO_2 equivalent per year.

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028. This analysis shows:

- A net present value (i.e. a saving to the economy) of between £10 million and £21 million.
- A net cost of between £8.5 for each tonne of CO_2 saved.

6. IMPACTS FOR SOLVENTS

6.1 Background and Industry Structure

A relatively small number of specialist manufacturers use solvents containing F gases for cleaning purposes. Examples include companies making metal or glass components for precision equipment that needs to be cleaned to a very high standard.

Until recently it was thought that there was little or no use of F Gas solvents in the GB. However, the work for this Impact Assessment has identified a small market which could grow. Growth may be influenced by other regulatory issues that affect alternative solvents.

We estimate there are between 50 and 100 companies currently using F gas solvents with most of these companies having a single small cleaning process. A few companies are larger users with a number of solvent cleaning lines.

According to industry experts, around 100 tonnes F gas solvents were sold into the GB market during 2007. This includes around 3 tonnes of PFCs. The rest of the F gases are blends of HFC-4310mee and/or HFC-365mfc with non F gas fluids. Manufacturers and trade names used include:

DuPont - Vertrel (blends with HFC-4310mee)

Solvay Fluor – Solvokane (blends with HFC-365mfc)

Petroferm - Lenium 'F' Series

The HFC blends have GWPs varying from less than 150 up to a 1,000. The market for F gas solvents is increasing as manufacturers move away from carcinogenic solvents and sales are expected to double in the next two years.

The main use for F gas solvents is degreasing of metal prior to precision coating. Other uses include the optics and electronics sectors. Industry practice currently involves the solvent being poured into a bath. The solvent is then cycled around the system and reused until the boiling point rises to unacceptable levels. The solvent is then heated to remove impurities and the recovered solvent reused (a distillation process). The boiled down residue is sent for incineration as are the activated carbon filters used in the vapour recovery units.

There is little good data about who uses these solvents or the actual level of atmospheric emissions. The solvent using equipment is designed to minimise evaporative losses (via use of refrigerated condenser coils above solvent baths). Dirty solvent is distilled and re-

used. It is believed that the bulk of the annual consumption is used to replace the dirty residue solvent that is sent for incineration. It is estimated that less than 10% of solvent used is actually emitted to atmosphere. This is equivalent to an emission of less than 10,000 tonnes of CO_2 equivalent, which is about 0.2% of the total GB F Gas emissions.

The Solvent Emissions Directive requires any manufacturers using more than 2 tonnes of F gas solvent per annum for metal cleaning to register their process with the Environment Agency. This has resulted in many users of such solvents trying to consume less than 2 tonnes per year.

6.2 Minimum Qualification Requirements

6.2.1 Introduction to Minimum Qualifications

CR 306/2008 is entitled: “Minimum requirements and the conditions for mutual recognition for the certification of personnel recovering certain fluorinated greenhouse gas-based solvents from equipment”. It sets down requirements for minimum qualifications to be held by personnel carrying out certain activities on solvent cleaning equipment.

6.2.2 Impacts related to Certification of Personnel

The Commission Regulation defines minimum qualifications for personnel involved in the following activities with F Gas solvent systems:

a) Recovery

All personnel involved in this activity will need to obtain a certificate showing they have passed an examination that meets the minimum requirements specified in the Annex to the Commission Regulation.

Current Industry Qualifications:

There are no current suitable external industry qualifications that meet the requirements specified in CR 306/2008. Most personnel are trained in-house. The GB 2008 Fluorinated Gases Regulations currently allow use of an in-house qualification.

Future Plans: Currently there is no coordinating body in the F Gas solvent sector, hence there are no current plans identified in relation to provision of training to meet the F Gas Regulation requirements.

Number of personnel: There is no data available on number of staff requiring training. It is estimated that between 50 and 100 companies use F Gas solvents. It is reasonable to assume that between 100 and 400 personnel could require a certificate.

Use of End User Specific Training: It is recommended that this sector should rely training that specifically relates to the equipment in a

particular end user factory. The processes used in each factory vary considerably and it is important that technicians are trained to understand the particular equipment concerned. CR 306/2008 recognises this situation and states:

"Entities manufacturing or operating equipment containing fluorinated greenhouse gas based solvents could be designated as evaluation or certification bodies, or both, provided that they fulfil the relevant requirements".

This is a sensible approach and will minimise the costs involved as staff already receive in-house training. A small modification to current in-house training courses should be sufficient to meet the requirements of the Regulation.

The Secretary of State will need to approve the status of each relevant company as a Certification Body. This will require some coordination. Ideally some external body should be identified to prepare an outline training syllabus and to check that the in-house training proposed by each end user uses this syllabus to meet the requirements of the Regulation.

Costs for training:

Assuming that the training can be provided in house as a supplement to the existing requirements (as already specified in the GB Regulation) the extra costs for training are minimal. It is estimated that the extra costs are between £20,000 and £50,000[74]. There could be further costs in the range of £200 to £500 per end user company for an external body to help each end user establish their status as a Certification Body. This will give rise to further costs in the range £10,000 to £50,000.

Environmental benefits:

There will only be minimal environmental benefit as the current GB Regulation already requires in house training and the extra requirements in CR306/2008 are not likely to make much improvement to current emission rates.

It is possible that losses will decrease by between 5% and 10%, which is a saving of between 500 and 1,000 tonnes CO_2 equivalent. There will be little or no cost saving, as the value of the fluid saved will be offset by the cost of incinerating the extra quantity of waste fluid.

74 This assumes that an extra 2 to 3 hours of in-house training will meet the extra requirements specified in CR 306/2008.

6.3 Summary of Costs and Benefits for Solvents

The costs for each aspect of F Gas solvent usage have been discussed in section 6.2 above. These are identified in terms of initial one-off costs plus on-going annual costs. Table 6.1 summarises the costs.

Table 6.1 Costs Related to F Gas Solvents

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	n/a	n/a	n/a	n/a
Labelling	n/a	n/a	n/a	n/a
Leak checking	n/a	n/a	n/a	n/a
Personnel certification	30	100	0	0
Company certification	n/a	n/a	n/a	n/a
Total	30	100	0	0

Cost Savings and Environmental Benefits

Environmental benefits of 500 to 1,000 tonnes CO_2 equivalent per year.

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028. This analysis shows:

- A net present value (i.e. a saving to the economy) of between £0.19 million and £0.34 million.
- A net cost of between £5 for each tonne of CO_2 equivalent saved.

7. IMPACTS FOR MOBILE AIR-CONDITIONING

7.1 Background and Industry Structure

The mobile air-conditioning sector (MAC) refers to the use of air-conditioning in cars and small vans. MAC systems have become increasingly popular in cars sold in the GB market during the last 10 years. The current market penetration is 80% of new cars sold during 2007. It is estimated that around 15 million cars registered in the GB are fitted with a MAC. All MACs installed in new cars since 1994 use HFC 134a as the refrigerant. A typical car MAC contains about 0.75 kg of HFC 134a.

The structure of the industry is as follows:

1) **Car Manufacturers.** The main car manufacturers are responsible for the installation of all MAC systems in new cars. They will be subject to certain rules under the MAC Directive 2006/40/EC. These include rules on the maximum leak rates allowable in new cars fitted with HFC 134a systems and also the gradual phase out of HFC 134a for new car types, starting in 2011. The requirements in the MAC Directive have no relevance to this Impact Assessment, which is only reviewing issues related to the F Gas Regulation.

2) **MAC Equipment Suppliers.** A small number of specialist companies provide design support and components for the main car manufacturers.

3) **MAC maintenance companies.** MAC systems are maintained in the car "after market". This includes 5 types of company: (a) main dealerships, that provide a complete service portfolio for their own make of car; (b) MAC specialists who provide sub-contract services to both main dealers and small independent garages; (c) quick repair centres that provide various specialist activities such as exhaust system repair and, in some cases, MAC servicing; (d) small independent garages who sometimes offer MAC servicing and (e) body shops that sometimes service MAC equipment during accident repairs.

4) **End Users.** Whilst there are enormous numbers of MAC end users, the obligations in the F Gas Regulation have no direct impact on them.

Existing Practices Related to Emission Prevention

Historically many companies in the car after market did not make any significant efforts to recover refrigerant or to minimise leaks from MACs. Use of disposable containers was very common in this sector – with inevitable wastage and emission of refrigerant. Garages did not all

have proper recovery equipment, so emissions during maintenance were inevitable.

This situation has improved considerably in recent years. Car manufacturers are producing new cars with much lower leak rates than those built 10 years ago. Many companies in the car after market have recovery equipment, although the use of disposable containers was still widespread before the recent ban.

The degree to which recovery is done properly can be judged by looking at the market penetration of recovery sets. It is estimated by companies selling recovery sets that between 13,000 and 17,000 MAC recovery sets are in use in the GB. This is sufficient for 100% coverage at franchised dealerships and at quick repair centres, 60% coverage in body shops and 30% coverage at independent garages.

7.2 Minimum Qualification Requirements

7.2.1 Introduction to Minimum Qualifications

CR 307/2008 is entitled: “Minimum requirements for training programmes and the conditions for mutual recognition of training attestations for personnel as regards air conditioning systems in certain motor vehicles containing certain fluorinated greenhouse gases”. It sets down requirements for minimum qualifications to be held by personnel carrying out certain activities on MAC equipment.

7.2.2 Impacts related to Certification of Personnel

The Commission Regulation defines minimum qualifications for personnel involved in the following activities with HFC FP systems:

a) Recovery.

All personnel involved in this activity will need to obtain a certificate showing they have passed an examination that meets the minimum requirements specified in the Annex to the Commission Regulation.

Current Industry Qualifications

Under the GB 2008 Fluorinated Gases Regulations there are a number of qualifications specified as suitable for working on MACs with F Gas refrigerants. These include:

a) The SRAC qualifications (City & Guilds 2078 and CITB 206710)

b) An in-house qualification

c) One of 22 further qualifications specifically related to automotive qualifications issued by City & Guilds and the Institute of the Motor Industry (IMI).

None of these current qualifications meets the new requirements of the F Gas Regulation and CR 307/2008.

Future Plans

The industry is well advanced with plans to introduce new training courses that will meet the new requirements in the Annex to CR 307/2008. City & Guilds and IMI are expected to make suitable courses available.

Number of personnel

There is significant uncertainty about the number of service engineers that may wish to obtain the new qualifications.

A high proportion of new vehicles are now fitted with MACs, so it is highly likely that personnel in main dealerships (who service the majority of cars less than 3 years old) would wish to be able to use the recovery equipment and seek certification. The high end marques will probably want all their personnel (8 - 10 per site) to be certified as they recommend that air conditioning be serviced at 24 month intervals. Main dealerships dealing with lower marques will require fewer certificates as there would be a lower proportion of cars with MACs. There are 5,200 main dealerships, which may require about 25,000 to 30,000 personnel to become qualified. In addition there are around 1,000 quick repair centres and 5,000 body shops that would have a further 10,000 to 15,000 personnel needing training. The area with the greatest uncertainty is independent garages. It is not certain how many of these carry out MAC servicing. This sector could require a further 10,000 to 15,000 personnel to be trained.

The industry has stated that a low side estimate is that some 50,000 personnel will need to be certified.

Training Capacity required

Training capacity could be a major issue for the MAC sector. The interim period for MACs only runs until July 2010. Hence there is only 2 years available for the training of 50,000 personnel. This will require a training capacity of about 150 candidates per day.

The training requirements specified in the Annex to CR 307/2008 include some theoretical knowledge and some practical work that must be carried out on a car fitted with a MAC. The theoretical examination could be done quite easily with a computerised system. The practical work is more labour and hardware intensive. One assessor with 2 test cars could evaluate about 8 candidates per day in 2 half day sessions.

To achieve the required capacity there will need to be about 20 assessors working for the 2 year period. It will be essential to get an early start to the training process if this number of personnel are to get trained before the July 2010 deadline.

Costs for training and examination

Many candidates already have sufficient knowledge to obtain the new qualification with little extra training. A half day course including a bit of training to cover the new theoretical knowledge, a theory exam and a practical assessment should be sufficient. Some candidates will need more training before the exam – a one day course including the exam should be sufficient.

The costs, including training, examination, certification, loss of earnings and travel, for those undergoing a half day course are estimated to be around £400. This is based on costs for similar courses already available.

The costs, including training, examination, certification, loss of earnings and travel, for those undergoing a full day course are estimated to be around £700. This is based on costs for similar courses already available.

Assuming that 80% of candidates have a half day course and 20% take a full day course the overall cost to train 50,000 personnel will be in the range of £15 to 20 million, spread over a 2 year period.

Environmental Impact and Benefits

It is expected that standards of refrigerant recovery will rise through better training and awareness. A good training programme will also ensure that personnel carry out good leak repairs and do not let cars back on the road with a leak. The training will also make personnel more aware of the ban on non-refillable containers.

The most recent GB F Gas Emissions Inventory (AEAT, 2004) shows that the F Gas emissions from the MAC sector are around 1.5 million tonnes CO_2 equivalent. This is equivalent to an actual emission of about 1100 tonnes of F Gas per year (all HFC 134a). This is made up of 4 types of release:

- Slow leaks during car use.
- Release of whole charge during certain car accidents.
- Emissions due to poor recovery during plant servicing.
- Emissions due to poor recovery at end of vehicle life.

With around 15 million cars on the road it is calculated[75] that over 90% of emissions come from slow leakage[76] during car use plus accident

75 This is based on average leak rates of 60g per car per year plus 1% of cars having an accidental total loss of charge per year. This gives leakage of 1,000 tonnes of HFC 134a, which is over 90% of the total.

76 It should be noted that the rate of slow leakage is being addressed by other legislation (The MAC Directive). New cars will need to have leak rates below 40 g per year (and, after 2011, the use of HFC 134a in new cars will be gradually phased out). The F Gas Regulation only addresses the refrigerant recovery issue for MACs.

damage. The remainder represents losses through poor recovery. This amounts to 150 ktonnes CO_2 equivalent. As the majority of companies already use recovery equipment the potential for reduced emissions via better training is relatively small. A saving in the range of 10% to 20% is reasonable, which is equivalent to 15 to 30 ktonnes CO_2 equivalent.

Cost Savings

There are no direct cost savings linked to these environmental benefits. Although there will be some reduced consumption of new refrigerant this saving is offset by the increased generation of recovered refrigerant that will need to be sent for reprocessing or destruction. These costs are approximately equal, so there is no net saving.

7.2.3 Summary of Impact for Minimum Qualifications in MACs

Total costs for all activities discussed in 7.2 are estimated at a one off initial cost of £15 to 20 million spread across 2 years. The environmental benefit is estimated to be between 15 to 30 ktonnes CO_2 equivalent per year.

7.3 Summary of Costs and Benefits for MACs

The costs for MAC have been discussed in section 7.2. These are identified in terms of initial one-off costs plus on-going annual costs. Table 7.1 summarises the costs.

As discussed above, the environmental benefits are mainly in terms of reduced direct HFC emissions.

Table 7.1 Costs Related to MAC

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	n/a	n/a	n/a	n/a
Labelling	n/a	n/a	n/a	n/a
Leak checking	n/a	n/a	n/a	n/a
Personnel certification	15,000	20,000	0	0
Company certification	n/a	n/a	n/a	n/a
Total	15,000	20,000	0	0

Cost Savings and Environmental Benefits

The cost savings and environmental benefits for SRAC were discussed in Section 7.2 above. These were calculated as follows:

- Environmental benefits of 15 to 30 ktonnes CO_2 equivalent per year.

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028. This analysis shows:

- A net present value (i.e. a cost to the economy) of between -£6.5 million and -£8 million.
- A net cost of £34 for each tonne of CO_2 saved.

8. IMPACTS FOR FLUID SUPPLIERS

8.1 Background and Industry Structure

The section addresses the impacts on companies that manufacture and sell F Gas fluids. The key obligations for these companies relate to labelling of containers and reporting of quantities manufactured, imported and exported.

The structure of the industry is as follows:

1) **Fluid Manufacturers.** There are only 2 GB companies that manufacture F Gases, Ineos Fluor and F2 Chemicals.

2) **Primary Distributors.** These are specialist gas supply companies that purchase bulk supplies (either from GB manufacturers or via imports) and package the F Gases into smaller containers. Some of their sales are direct to end users and some are to gas wholesalers. Most primary distributors have facilities for blending and recovered fluid reprocessing. There are around 10 primary distributors in the GB.

3) **Secondary Distributors.** These are companies such as refrigeration component wholesalers that sell a variety of products including refrigerants. They obtain most of their supplies from primary distributors, although could import packaged products directly from overseas suppliers.

8.2 Fluid Reporting Requirements

8.2.1 Assessment of Reporting Impacts

CR 1493/2007 sets down requirements for reporting of F Gases produced in the EU, imported into the EU (from a country outside the EU) and exported from the EU.

The two manufacturers plus Air Products (who export recovered SF_6 to America for recycling) will definitely need to report annually under the CR 1493/2007 requirements. In addition, other distributors may choose to import from outside of the EU dependent on market conditions.

The reporting is reasonably simple in format. Each affected company will only require a few days of extra administrative work per year to keep the necessary records. It has been estimated that the total cost of annual reporting will be £15,000 to £25,000.

Environmental Impact and Benefits: The reporting requirement will have no direct environmental impact on the fluid supply sector.

8.2.2 Summary of Impact for Reporting in Fluid Supply

Costs: £15,000 to £25,000per year.

Benefits: none

8.3 Labelling Requirements

8.3.1 Assessment of Labelling Impacts

CR 1494/2007sets down requirements for labelling of new equipment and products placed on the market after April 1st 2008. The labelling requirements in Article 7 of the F Gas Regulation specifically apply to F Gas containers.

The label specified in CR 1494/2007 must show some basic information including the name of the F Gas, the quantity in the equipment and also the text “Contains fluorinated greenhouse gases covered by the Kyoto Protocol”.

The label needs to be affixed to each pressure cylinder containing F Gases before it is placed on the market. It is already normal practice for each cylinder to be labelled. The new obligations can be met by either:

- Redesigning the existing label to ensure that the new information is clearly shown.
- Affixing a second “F Gas” label with the relevant information.

The majority of filling of F Gas cylinders is carried out by the 10 primary distribution companies in the GB. The costs of redesigning the current labels are estimated at below £2,000 per company. Once the label is redesigned there is no additional revenue cost associated with affixing the labels.

Environmental Impact and Benefits: European F Gas containers are already well labelled and the additional material is not likely to reduce the rate of leakage from the current levels. Hence, the labelling requirement will have no direct environmental impact on the FP sector. However, the requirement for labelling may help in policing imports and this remains to be seen.

8.3.2 Summary of Impact for Product Labelling in Fluid Suppliers

The distributors are following the format of the labels used by the manufacturers. There is small cost impact for the redesign of labels used by 10 companies. This is estimated as a one-off cost of between £10,000 and £20,000. On-going costs will be negligible.

There is no measurable environmental benefit for these labels.

8.4 Summary of Costs and Benefits for Fluid Suppliers

The costs for each aspect of fluid supply have been discussed in sections 8.2 to 8.3 above. These are identified in terms of initial one-off costs plus on-going annual costs. Table 8.1 summarises the costs.

Table 8.1 Costs Related to Fluid Suppliers

Item	One-Off Costs £ 000		On-going Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fluid reporting	0	0	15	25
Labelling	10	20	0	0
Leak checking	n/a	n/a	n/a	n/a
Personnel certification	n/a	n/a	n/a	n/a
Company certification	n/a	n/a	n/a	n/a
Total	10	20	15	25

Cost Savings and Environmental Benefits

There are no cost savings related to the fluid supply sector.

There are no measurable environmental benefits related to the fluid supply sector.

Discounted Cash Flow Analysis

The cost figures have been analysed using discounted cash flow methods, using a discount rate of 3.5%. Costs and savings have been assessed over a 20 year period up to 2028. This analysis shows:

- A net present value (i.e. a cost to the economy) of between -£0.4 million and -£0.2 million.

9. CONCLUSIONS

This Impact Assessment has reviewed the costs and benefits in the GB of implementing 10 Commission Regulations that specify various requirements in relation to the F Gas Regulation (EC 842/2006). The Commission Regulations cover:

- Annual reporting of F Gas manufacture, import and export.
- Leak checking requirements (for fire protection and stationary refrigeration and air-conditioning).
- Equipment labelling.
- Minimum qualifications (for fire protection, stationary refrigeration and air-conditioning, HV switchgear, solvents and MACs.

The impact of each Regulation has been assessed by market sector. Chapters 3 to 8 of this report provide details for fire protection, stationary refrigeration and air-conditioning, HV switchgear, solvents, MACs and fluid suppliers.

In most cases there are few implementation options – the Regulations specify a clear requirement that must be adopted in the GB. In a few situations options were identified for different ways of implementing the Regulations. In particular this refers to:

a) Options for the SRAC sector to implement a mandatory personnel registration scheme (including a scheme with one-off registration and an alternative scheme that requires re-registration every few years.

b) Options for the FP and SRAC sectors to adopt a company registration scheme that requires re-registration every few years.

The overall costs and benefits of the Commission Regulations analysed in this Impact Assessment are summarised in Tables 9.1, 9.2 and 9.3.

Overall Costs and Benefits

The financial value of the total benefits of the proposed measures outweighs the costs. Using a discounted cash flow analysis over a 20 year period, with a 3.5% discount rate there is:

- A net present value of between £534.8 million and £675.6 million (i.e. a net benefit to the GB economy)
- CO_2 emission reductions of between 1.6 and 2.8 million tonnes CO_2 equivalent per year.

Table 9.1 Summary of Costs

Sector	One-Off Costs £ 000		On-going Annual Costs £ 000	
	Minimum	Maximum	Minimum	Maximum
Fire Protection	2,400	8,600	700	2,800
SRAC	79,000	136,000	76,000	161,000
HV Switchgear	400	600	0	0
Solvents	30	100	0	0
MACs	15,000	20,000	0	0
Fluid Supply	10	20	15	25
Total (rounded)77	97,000	165,000	77,000	164,000

Table 9.2 Summary of Discounted Cash Flow

Sector	Net Present value[78] £ 000		Net cost per tonne CO_2 saved[79], £	
	Minimum	Maximum	Minimum	Maximum
Fire Protection	-43,000	-10,000	152	305
SRAC	540,000	700,000	-2.3	-6.1
HV Switchgear	10,000	21,000	0.65	16.4
Solvents	190	340	5	5
MACs	-8,000	-6,500	34	34
Fluid Supply	-400	-200	n/a	

77 Note, total costs are rounded so that they do not imply a degree of accuracy greater than those possible in the SRAC figures, which dominate the total value

78 Net present value based on 3.5% discount rate, 20 year period to 2028. A positive value is a cost saving. The figures include an allowance for the value of CO2 not emitted, at £26.50 per tonne.

79 Net cost per tonne based on discounted costs and benefits over 20 year period with 3.5% discount rate.

Total (rounded)	530,000	670,000	-	-

Sectoral Variation

The analysis shows enormous variations in impact between end user sectors.

The overall figures are dominated by the costs and benefits in the stationary refrigeration and air-conditioning sector. In this sector there are very high costs, but these are offset by high levels of benefit in terms of reduced electricity consumption (lower leakage levels will lead to higher refrigeration plant efficiency).

The fire protection sector has the highest level of net cost. The savings (in terms of reduced fluid consumption and the value of CO_2 not emitted) are only in the range of £110,000 to £220,000 per year, whilst there are on-going costs for improved leak prevention of £0.7 million to £2.8 million. The discounted cash flow analysis shows a net present value of -£43 million to -£10 million.

The MAC sector also has a significant level of cost – the discounted cash flow analysis shows a net present cost of £6.5 million to £8 million.

The solvents and HV switchgear sectors both show small amounts of net benefit and the fluid supply sector has a small net cost.

Impact of Optional Measures

Company Certification

Optional measures for more robust company certification have been assessed for both fire protection and stationary refrigeration and air-conditioning. In both cases the optional regime includes regular re-registration (every 3 to 5 years) and an on-going audit programme that will ensure better compliance. The extra costs are tiny in comparison to the other costs in both these sectors (less than 1%) and can be justified in financial terms if they lead to savings to savings that are higher within the predicted range. A number of non-financial benefits are summarised in Sections 3.5.4 and 4.5.5.

Personnel Registration

An optional measure for mandatory registration of qualified personnel has been assessed for stationary refrigeration and air-conditioning. The optional regime includes mandatory registration of all personnel plus a sub-option for regular re-registration (every 3 to 5 years). The

extra costs are tiny in comparison to the other costs in the SRAC sector (less than 0.5%) and can be justified in financial terms if they lead to savings to savings that are higher within the predicted range. A number of non-financial benefits are summarised in Section 4.5.4.

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APPENDICES

BAFE	Fire safety organisation, providing training
BEAMA	British Electrotechnical and Allied Manufacturers' Association
BERR	Department for Business, Enterprise & Regulatory Reform
BFPSA	British Fire Protection Systems Association (now part of FIA)
CFC	Chlorofluorocarbon. Family of chemicals that was historically used in various applications such as refrigeration, foam blowing, aerosols. Now completely banned under Ozone Regulation.
CITB	Construction Industry Training Board
CR	Commission Regulation
DASA	Domestic Appliance Service Association
Defra	Department of Environment, Food and Rural Affairs
DME	Di-methyl ether. A fluid that can be used as an aerosols propellant.
F-Gas	Fluorinated gases in the Kyoto Protocol i.e. HFCs, PFCs and SF_6 (ibid.)
FIA	Fire Industry Association
FP	Fire Protection
GHG	Greenhouse gas
GIS	Gas insulated switchgear – used in very high voltage electricity circuit breakers.
GWP	Global warming potential. This represents the "strength" of a gas in terms of impact on global warming – compared to CO_2 which has a GWP = 1.
Halons	Bromochlorofluorocarbons. Fire protection fluids with very high ODP, phased out under Ozone Regulations.

HC	Hydrocarbon. Family of chemicals including propane, butane etc. These have been adopted

	as alternatives to ODS and F-Gases in some applications.
HCFC	Hydrochlorofluorocarbon. Family of chemicals used in various applications such as refrigeration, foam blowing, aerosols. Already phased out in many applications under Ozone Regulation. All applications will be banned in EU by 2015.
HFC	Hydrofluorocarbon. Family of chemicals used in various applications such as refrigeration, foam blowing, aerosols.
HFE	Hydrofluoroether. Family of chemicals that can be considered as HFC alternatives in some applications e.g. fire protection systems.
HV	High Voltage
IMI	Institute of the Motor Industry
IPPC	Integrated Pollution Prevention and Control. Regulation of certain industrial processes in respect of emissions to a variety of media. GB implementation as a result of an EU Directive
MAC	Mobile air-conditioning. Air-conditioning in vehicles, especially in cars.
MDI	Metered dose inhaler. Medical aerosol used to dispense certain drugs (e.g. inhalers for asthma treatment).
OCF	One Component Foam. A specialised aerosol that is used in the construction industry.
ODS	Ozone depleting substance. Various chemicals, including CFCs and HCFCs that damage the ozone layer. Many are already completely phased out.
ODP	Ozone depletion potential, compared to CFC 11 which has an ODP equal to 1.
OEM	Original Equipment Manufacturer
REFCOM	Organisation operating register of companies competent to handle refrigerants
SRAC	Stationary Refrigeration, Air-conditioning and Heat Pumps
PFC	Perfluorocarbon. Family of chemicals used in a few unusual applications such as electronic chip manufacture and certain refrigerants.

PU	Polyurethane – a type of rigid foam used for insulation.
RAC	Refrigeration, air-conditioning and heat pump equipment.
SF_6	Sulphur hexafluoride. An F-Gas. Used in a few unusual applications such as magnesium smelting and HV switchgear.
100 year GWP	GWP (ibid) can be measured against different time horizons. The 100 year timescale is commonly used for GWP figures quoted in Kyoto Protocol documentation.