Appendix 1

Analysis of the Northern Ireland (NI) market for HFCs and ozone-depleting substances

Final Report

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Abbreviations

A/C	Air conditioning
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DAERA	Department of Agriculture, Environment and Rural Affairs
EEA	European Environment Agency
EPA	Environmental Protection Agency
EU	European Union
F-gas	Fluorinated greenhouse gas
GB	Great Britain
GVA	Gross value added
GWP	Global warming potential
HFC	Hydrofluorocarbon
IPR	Inward processing relief
MAC	Mobile air conditioning
NI	Northern Ireland
ODS	Ozone-depleting substances
OEM	Original equipment manufacturer
PFC	Perfluorinated compound
RACHP	Refrigeration, air conditioning, heat pumps
RoI	Republic of Ireland
RoW	Rest of World
SF_6	Sulphur hexafluoride
SME	Small and medium-sized enterprise
UK	United Kingdom

1 Introduction to This Study

This report details the findings from a market analysis of hydrofluorocarbons (HFCs), an important type of fluorinated greenhouse gases (F-gases), and ozone-depleting substances (ODS) in Northern Ireland (NI). The project aimed to quantify the market trade flows, demands, and end-uses of HFCs and ODS within Northern Ireland, whilst also assessing the potential impact of the separation of the regulatory systems between the European Union (EU) and Great Britain (GB). The uninterrupted trade of these gases is key for the continued operation of commercial refrigeration, industrial refrigeration, air-conditioning systems, heat pump equipment, and for use as blowing agents for foams, fire extinguishants, aerosol propellants, and solvents.

The study was conducted by Aether, at the request of the Department of Agriculture, Environment and Rural Affairs (DAERA), by means of a scoping survey which was distributed amongst all identified organisations and key actors in the supply chain of HFCs and ODS in Northern Ireland, followed by interviews with key stakeholders. This study focussed on the market of HFCs and ODS specifically, as opposed to the F-gas market in its entirety.

The study addressed the following key objectives:

1. To understand better the scale of the markets, trade and use of HFCs and ODS in Northern Ireland.
2. To help ensure a smooth transition for these sectors as Northern Ireland continues to apply EU law on HFCs and ODS.
3. To help understand the impact of potential divergence of laws on HFCs and ODS between Northern Ireland (operating under EU law and systems) and Great Britain (operating under the new GB quota system, retained EU law and the resulting new GB F-gas and ODS systems).
4. To decide upon the scale of resources needed to enforce legislation applying to HFCs and ODS in Northern Ireland.
5. To gain more information to help DAERA and district councils in Northern Ireland carry out their enforcement more effectively.

2 Legal Background

Until the early 1990s, ODS were widely used as coolants in refrigeration, air-conditioning and heat pump equipment, and also as foam blowing agents and aerosol propellants. Since then, the Montreal Protocol has required the phasing out of many of these ODS in favour of gases that have no potential for depleting stratospheric ozone. The main substitute for ODS are HFCs which share similar properties, but which lack either chlorine or bromine which are responsible for the ozone-depleting properties of ODS. HFCs, like ODS, however are extremely potent greenhouse gases – they have very high global warming potentials (GWPs) – and, as such, are commonly subject to national regulations to restrict their release to air. They are also being phased down under the Kigali Amendment to the Montreal Protocol.

2.1 Regulations for ODS

The Montreal Protocol introduced the phase out of ODS which were used coolants in refrigeration, air-conditioning, heat pump equipment, foam blowing agents and aerosol propellants. This also required substitution of ODS, and HFCs were thus gradually established as ozone-friendly alternatives for certain applications.

At EU level, several ODS Regulations have been implementing the Montreal Protocol requirements. The latest Regulation 1005/2009 is controlling the few remaining uses of ODS and setting further measures such as licensing and reporting.

2.2 Regulations for HFCs

EU legislation to control F-gases, including HFCs, perfluorinated compounds (PFCs) and SF_6, has been in place since 2006 with the adoption of the original F-gas Regulation[1]. The current EU F-gas Regulation[2], which has applied since 1 January 2015, replaced and strengthened the original regulation with the aim to cut the EU's F-gas emissions by two thirds by 2030 compared to 2014. The current regulation introduced the following measures[3]:

- **Limiting the total amount** of HFCs that can be placed on the EU market from 2015 onwards and phasing them down in steps to one-fifth of the 2015 baseline in 2030. This will be the main driver of the move towards more climate-friendly technologies as HFCs represent the dominant F-gases in terms of use quantities and emissions within the EU
- **Banning the use** of HFCs in many new types of equipment where less harmful alternatives are widely available, such as fridges in homes or supermarkets, air conditioning and foams and aerosols. Certain bans also relate to PFCs and SF_6.
- **Preventing emissions** of F-gases from existing equipment by requiring leak checks, proper servicing and recovery of the gases during repair and at the end of the equipment's life**.** Containment measures also apply to electrical switchgear containing SF_6.

The HFC phase-down is implemented by allocating annual quotas to producers and importers of HFCs. This system is operated by the European Commission and based on historic placing on the market and declarations of quota needs by companies. Quota is

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006R0842
[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014R0517&qid=1608306002561
[3] Taken from: https://ec.europa.eu/clima/policies/f-gas/legislation_en

required to legally place HFC bulk gases on the EU market for the first time. To account for gases in refrigeration, air conditioning and heat pump equipment pre-charged with HFCs, importers of pre-charged equipment need to hold authorisations for the use of quota equivalent to the amounts of HFCs contained in their equipment. These regulations have directly contributed to reductions in the use of HFCs and greenhouse gas emissions from HFCs in the United Kingdom (UK) since 2014.

Table 1: Phase down of HFCs across the EU relative to the baseline quota[4]

Years	Percentage of the baseline: Maximum quantity to be placed on the market and corresponding quotas
2015	100%
2016 - 2017	93%
2018 - 2020	63%
2021 - 2023	45%
2024 - 2026	31%
2027 - 2029	24%
2030	21%

Source: Annex V, REGULATION (EU) No 517/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006

The F-gas Regulation aims to send a long-term signal to the market that these substances will become progressively more scarce, incentivising companies to substitute with HFCs with lower GWP as well as non-HFC substances where feasible. The available evidence – at EU level – indicates the ease, costs and speed of substitution of HFCs is not uniform. For example, use of HFCs in metered-dose inhalers appears to have seen no reduction to date, (as it is exempted from the phase down schedule according to Art 15(2f) of the EU F-gas Regulation), whilst uses in foam blowing have largely ceased (via prohibition, as stated in Annex III of Regulation 517/2014).

2.3 F-gas Regulations following the end of the transition period and the Northern Ireland Protocol

The withdrawal of the United Kingdom from the European Union took effect on 1 February 2020, meaning that the United Kingdom is now considered as a third country under the existing EU F-gas Regulation. During the transition period, provided for in the Withdrawal Agreement[5], EU law was still applied across the United Kingdom until 31 December 2020. On 1 January 2021, the new GB quota system for the trade of HFCs in Great Britain became operable. The GB system currently operates under the same legislative controls as the EU system but through a separate GB F-gas regulation and as a result, a new GB quota system[6].

At the end of the transition period the Protocol on Ireland/Northern Ireland ("IE/NI Protocol"), which is annexed to the Withdrawal Agreement, came into effect and

[4] The baseline quantity is the annual average of total quantity placed on the market into the Union between 2009 and 2012.
[5] Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community, OJ L 29, 31.1.2020, p. 7 ("Withdrawal Agreement").
[6] https://www.gov.uk/guidance/applying-for-quota-to-produce-or-import-f-gas

stipulates that the EU F-gas and ODS Regulation continues to apply to and in Northern Ireland. Therefore, Northern Ireland is treated under this EU regulation as if it were a Member State and companies must now comply with two regulatory systems when trading between Great Britain and Northern Ireland.

This has the following implications on HFC trade between Northern Ireland, the EU and GB:

- Shipments from Northern Ireland to the EU of gas previously placed on the market are not an import under the EU regulation, neither are exports from the EU to Northern Ireland of gas previously placed on the market. This is instead classified as 'intra trade' and is available between all EU Member States.
- HFCs placed on the market for the first time in Northern Ireland, either as bulk or in pre-charged equipment, requires quota/authorisations as established under the EU regulation. Quota is required for bulk gas whereas authorisations are required for pre-charged equipment.
- The placing on the market of HFCs in Great Britain, both as bulk or in pre-charged equipment, counts towards the quota established under the GB quota system.
- Shipments between Great Britain, or any third country, and the EU, including Northern Ireland, are now considered as an import/export under the EU regulation and require quota allocations on import under both the EU F-gas Regulation and the GB quota system respectively.

2.4 The F-gas Regulation Review and potential for divergence

Under the EU Withdrawal Agreement, the UK retained EU law with only minor changes made to correct operability deficiencies. However, with upcoming independent regulation reviews both in the EU and in Great Britain, there is a potential for policy divergence.

The EU Review of the EU F-gas Regulation launched in July 2020 and continues through public consultation and a stakeholder conference. The proposal for the new regulation is expected by the end of 2021 whereas the proposal for the GB regulation resulting from the GB review of its F-gas regulation is expected in 2022. Therefore, whilst presently legislation is mirrored between Great Britain and the EU, changes in regulations following these reviews have the potential to create policy divergence. In turn, this could mean that the Northern Irish market would operate under different rules and policies to the rest of the UK. Policy divergence could begin to emerge as early as the end of 2022 following legislative changes.

Areas of potential amendments of the EU Regulation include:

- Increasing HFC phase down ambition before and after 2030
- Introducing prohibitions for F-gases in products or equipment where these gases are no longer needed
- Removing some exemptions and thresholds not foreseen by the Montreal Protocol
- Establishing a separate phase down schedule for HFC production. Whilst under the Montreal Protocol the determination of the production of ODS and HFCs is a competence of the Member States and cannot be set by the EU, it would

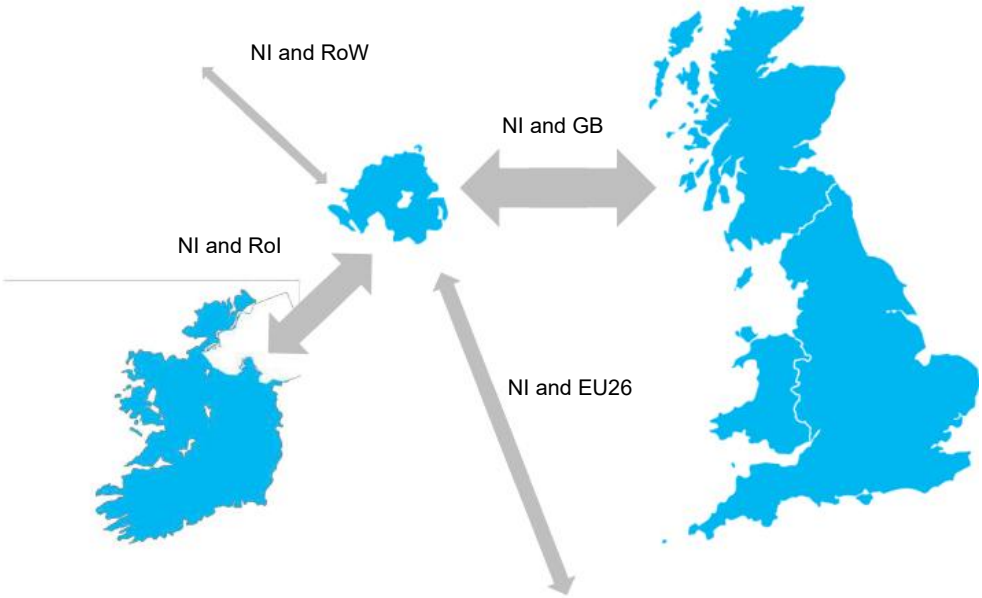
technically be possible that all EU MS agree on a common phase-down schedule.

- Certification of technicians to include skills on the use of low-GWP alternatives
- Improving enforcement and preventing illegal trade
- Establishing more comprehensive monitoring.

3 HFC and ODS Production, Distribution, Consumption and Trade Flows for Northern Ireland

In order to determine the potential impact of policy divergence in F-gas regulations, it is important that the current state of the HFC and ODS markets in Northern Ireland is investigated. This should include obtaining quantitative information on trade flows between Northern Ireland and different countries, specifically between Northern Ireland and Great Britain. This section summarises the findings from the scoping survey distributed to organisations consuming or handling HFCs or ODS in Northern Ireland, or where flows pass through Northern Ireland. It addresses the market size and composition before presenting findings on the current and potential impact of the Northern Ireland Protocol on trade flows (**Figure 1).**

Figure 1: Trade flows



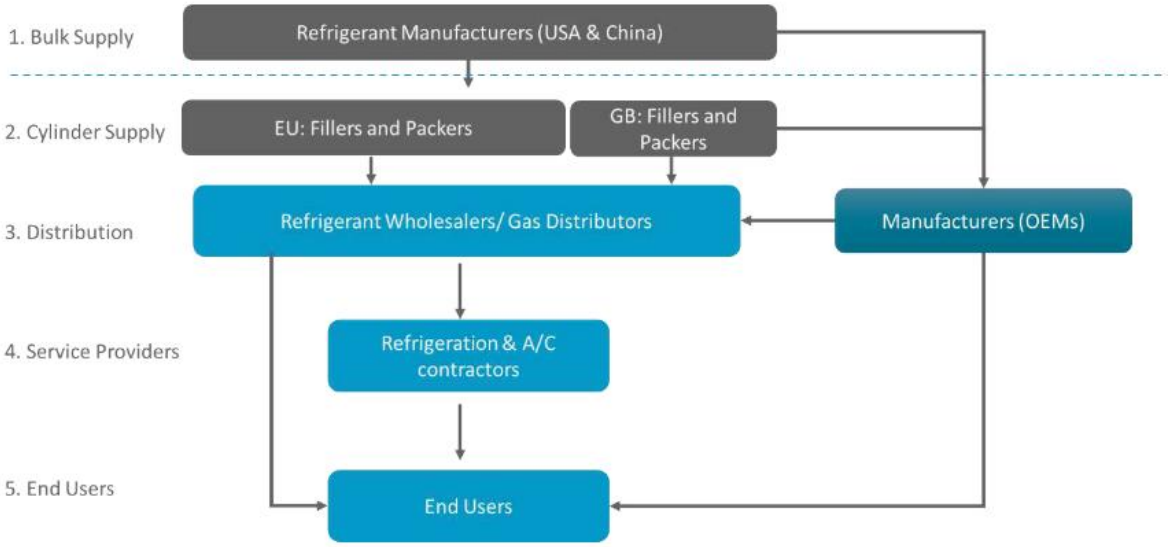
3.1 Market structure and composition

The HFC market in Northern Ireland is supplied by 'packer-fillers'[7] who import, generally from the Far East but in some cases from the USA and to limited extent in the EU, bulk gas within International Standards Organisation (ISO) tanks for distribution. Packer-fillers subsequently supply wholesalers within Northern Ireland who distribute gas and pre-charged equipment to both contractors and end users. Original equipment manufacturers (OEMs) also supply directly to the Northern Irish market for distribution. This supply chain is illustrated in **Figure 2**.

Direct supply of bulk gas to Northern Ireland is limited by the lack of rebottling facility which means that the market is only equipped to deal with the trade of cylinders, as opposed to the ISO tanks which are used in the upstream supply of HFCs from producers to packer-filler.

[7] Packer-fillers are companies that import large quantities of bulk HFCs before blending and re-packaging gases into small cylinders for wholesalers to sell.

Figure 2: Market structure for HFCs in Northern Ireland



Information on the Northern Irish market was collected from multiple sources to estimate the market composition. The market distribution across different actors of the supply chain is illustrated in **Figure 3**. Note that this does not include known suppliers of bulk gas to the Northern Irish market, all of which are based either in GB or in Europe. Of particular interest are the wholesalers of refrigerants and equipment, as these include the major distributors of HFCs. Note that we have not identified any refrigerant manufacturers or packer-fillers operating in Northern Ireland which further supports the assertion that the Northern Irish market imports all supply of HFCs.

Figure 3: Estimated NI HFC and ODS market composition

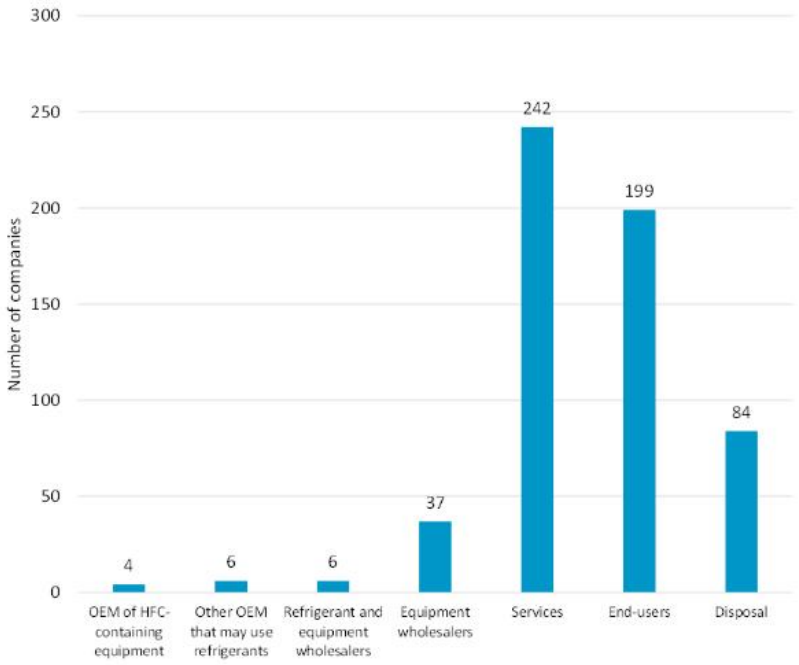


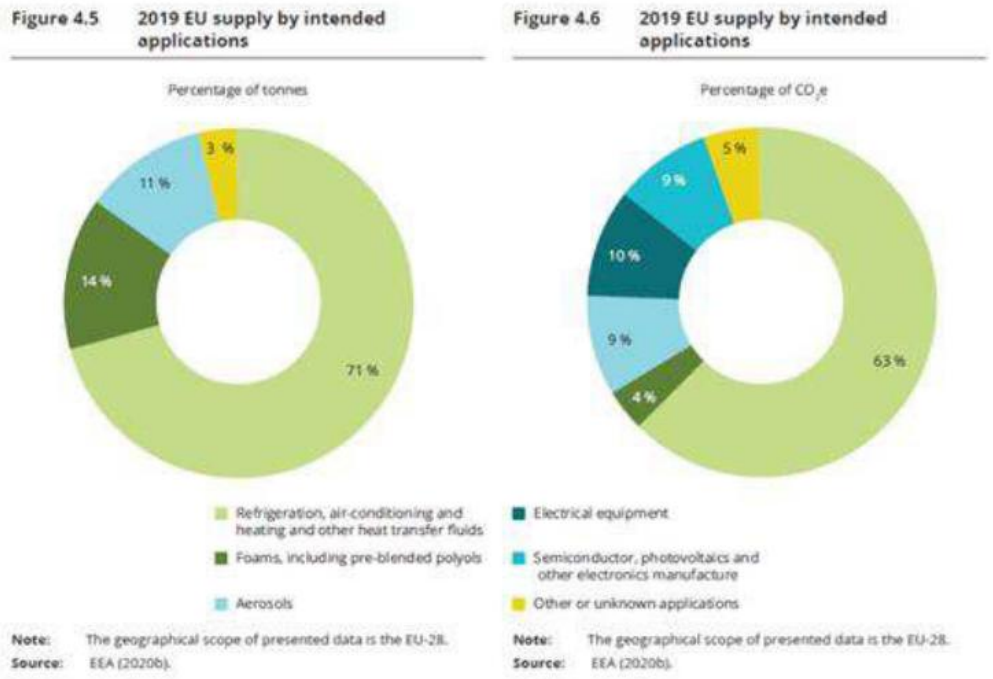
Table 2 provides the further percentage breakdown of service and end-user types presented in Figure 3. This suggests that companies dealing with the servicing of equipment, including the supply, install and servicing of refrigeration systems, HVAC and domestic appliances are significant end users in Northern Ireland along with companies dealing with mobile air conditioning and food supply. This market composition should be interpreted with caution however, as the percentage split is based on the number of companies operating under that sector, rather than being indicative of the size of the operation, the number of staff employed or the amount of HFC consumed. For example, it may be that the service industries are over represented as they have a higher proportion of single-person companies.

Table 2: Service provider and end user breakdown of market composition

Service/ End User Type	
Auto salvagers (disposers)	16.4%
Food supplier (end-users)	15.6%
Services (supply, installation, repair): refrigeration, HVAC	12.7%
Electrical engineers	10.7%
Services (supply, installation, repair): refrigeration	8.8%
Services (supply, installation, repair): domestic appliances	7.4%
Chemical supplier (end-users)	4.9%
Services (supply, installation, repair): refrigerated transport	3.3%
Distillery and cold drinks (end-users)	3.1%
Services (supply, installation, repair): HVAC	2.5%
Dairy products (end-users)	2.3%
Dairy supplies (end-users)	2.3%
Training facility	2.3%
Abattoir (end-user)	1.6%
Services (supply, installation, repair): vehicle air-conditioning	1.4%
Organic Rankine Cycles	1.2%
Research institute	1.2%
Food processing (end-users)	0.6%
Laboratory services	0.6%
Supermarkets (end-users)	0.6%
Fire protection equipment, servicing, and training	0.2%
Other commercial end-users	0.2%
Refrigerated trucks/lorries and trailers (end-users)	0.2%

Whilst information specific to the Northern Irish market was limited by survey responses, no information received during the course of the scoping study gave reason to suggest that the NI market does not reflect typical patterns across the EU. Therefore further insight to the market in NI can be gained through looking at the EU market composition. **Figure 4** below supports the finding that the most relevant sector using F-gas is refrigeration and air conditioning (71%).% of tonnage supplied).

Figure 4: EU F-gas supply by intended applications



Source: EEA report No 20/2019, Fluorinated greenhouse gases 2019, Data reported by companies on the production, import, export, destruction and feedstock use of fluorinated greenhouse gases in the European Union, 2007-2018

3.2 Market size

The Northern Ireland HFC market, including both trade and intra-trade, is estimated to comprise around 2.8% of the overall UK market. This estimate assumes that consumption in Northern Ireland is proportionate to the Northern Ireland share of the UK population. Assuming that the GB market (taking into account trade and intra-trade) is well represented by the total value of the GB quota system (nearly 7.3 MT CO_2e for 2021), that would mean the Northern Irish market is equivalent to 0.2 MT CO_2e in 2021. Assuming an average GWP of 1500[8], this is equivalent to approximately 130 tonnes of gas placed on the NI market.

This top-down estimate was discussed with stakeholders and sense checked against their own (confidential) sales volumes and estimates of their company's market share in Northern Ireland. The overall consensus is that the current market, as of April 2021, is between 80 and 100 tonnes of HFCs; the latter is considered the best estimate (**Table 3**). This means that the two methods of estimating the size of the Northern Irish market are comparable and provide confidence that the estimate for the size of Northern Ireland is within the correct order of magnitude. For comparison, the Republic of Ireland (RoI) market is estimated by stakeholders at between 400 and 500 tonnes.

[8] Table A5.17 Total EU supply of F-gases in https://www.eea.europa.eu/publications/fluorinated-greenhouse-gases-2020

If we consider that the NI market is typical of the EU market, then we can make the following assumptions on the size of different parts of the market[9]:

- Reclamation of gas is 9% of the produced amount and 3% of the EU supply of virgin HFCs.
- Equipment imports made up approx. 10% of the total imported amount.
- In refrigeration & air conditioning as well as the small fire protection sector, the use of HFCs for servicing is much higher than for new installations: approximately 82% vs 18% (French case study[10])

Trends at the EU level suggest a decrease in the supply of total F-gases (97% of which are assumed to be HFCs) with a strong decline observed since 2017: the 2019 supply measured in tonnes was 15% below 2018 and almost 25% below 2017. Expressed in carbon dioxide equivalent (CO_2e), the reduction is even more significant at 20% below 2018 and 42% below 2017.

Table 3: Estimated size of the Northern Ireland HFC market

Tonnes placed on the market	(t/yr) 2021
Low	80
Medium (Best estimate)	100
High	150

Source: Industry survey and stakeholder engagement, Spring 2021

Whilst it has not been possible to quantify the amount of ODS imported into Northern Ireland separately, it is anticipated that ODS are only supplied in minor quantities for exempted uses only such as essential laboratory and analytical uses. As an indication of the size of the market, one laboratory survey response was received which reported 80 ml of the following substances: carbon tetrachloride (CTC), 1,1,1-Trichloroethane (methyl chloroform) (TCA), Methyl bromide (bromomethane) (MB) and Bromochloromethane (BCM) (all within methanol standards).

ODS exempted uses are:

- Analytical Use - any use of ODS for the identification of compounds or the determination of the proportions of components in a mixture, for example the use of ODS as reference material.
- Laboratory Use - any use of ODS in a laboratory that is not an analytical use, for example laboratory feedstock uses or uses of ODS in a toxicological study.
- Laboratory Feedstock Use - the use of ODS in a laboratory in a chemical synthesis process where the ODS is a reagent in the chemical transformation and is chemically converted from its original composition. This is different from cases where an ODS is used as a solvent or catalyst.

Engagement with ODS users in Northern Ireland also reported a use case for ODS based fire extinguishers for civil aircraft. The use of halons represents an exemption from the ODs phase-out in few clearly defined cases in this application[11].

[9] EEA report No 20/2019, Fluorinated greenhouse gases 2019, Data reported by companies on the production, import, export, destruction and feedstock use of fluorinated greenhouse gases in the European Union, 2007-2018.

[10] Agence de la Transition Ecologique, Observatoire des gaz fluores, Rapport annuel, Octobre 2020.

[11] https://www.icao.int/safety/OPS/OPS-Section/Pages/Halon-Replacement.aspx

Minimal interruption to the supply of ODS to Northern Ireland was reported, however companies did report requiring new registration for an import quota as imports were coming from outside of the EU i.e. GB. At the time of the study only one ODS quota holder was registered on the ODS licensing system held by the European Commission. It was also suggested that the cost of purchasing ODS analytical standards will increase as the amount of administration associated with goods transfer will be increasing. It is likely that these costs will be passed onto the customer. It should be noted that an alternative to obtaining quota to supply ODS, companies could buy directly from suppliers in the EU with no need for quota.

3.3 Impact of the Northern Ireland Protocol on actors in the supply chain

3.3.1 Suppliers

Suppliers of bulk gas to the Northern Irish market are predominantly GB-based packer-filler companies. This is expected to contribute to between 80-90% of the Northern Irish market. These are classified as 'suppliers' within the Northern Irish market. Previously, GB-headquartered packer-fillers were importing HFCs to Northern Ireland from Great Britain either using EU quota or through the intra-trade mechanism which does not require quota. Intra- trade is permitted between Member States of the EU following the initial placing on the market of gas.

Under the current regulations, following the Northern Ireland Protocol, these companies would need to obtain quota in both the GB and the EU quota systems to continue this historical mode of operation. As a response to this new quota requirement, this study has found that packer-filler operations have shifted supply chains to supply bulk gas to Northern Ireland through the EU. Respondents cited the driver of this being the avoidance of a 'double count' of quota. The perceived double count of quota is underpinned by the removal of the intra-trade allowances granted to EU Member States which previously did not restrict the flow of gases between Northern Ireland and GB, given that the gas had previously been placed at some point on the EU market.

Qualitative evidence suggests that changes to the operations of packer-fillers supplying Northern Ireland are aimed at seeking the 'path of least resistance' in terms of maintaining existing flows where possible whilst avoiding administrative burden and alterations to logistical arrangements. To this end, it has been reported that for administrative purposes orders of HFCs from Northern Ireland are routed through GB administrative operations, but fulfilment is passed to sister company operations within the EU.

No significant risks to supply from the packer-fillers were identified, however slower fulfilment times were reported due to longer shipping routes (in one case reported as previously taking between 5 and 7 days and now under new operations, 2-3 weeks).

There are several OEMs operating in Northern Ireland that have the potential to use HFCs. The most directly related are small-scale manufacturers of refrigeration and heat pump equipment and are not believed to be significant consumers of HFCs. They are likely to source their bulk gas from the wholesalers operating in NI rather than import directly from elsewhere. It is not expected that the impacts of the Northern Ireland Protocol will have significant impact on these operations.

Survey returns included OEMs who have operations in GB and across the EU who are supplying to Northern Ireland. These companies have reported that trade flows have not altered since the end of the transition period due to the mechanism of inward processing relief (IPR) which allows for product manufactured in the EU to be shipped to Northern Ireland through the existing GB trade routes. IPR applies to goods arriving in Great Britain which are not intended for the GB market. Through this process OEMs have been able to maintain existing trade flows through the establishment of a designated site in which goods are stored or processed on import into Great Britain before immediate export to Northern Ireland.

3.3.2 Distributors/wholesalers

Whilst some packer-fillers have their own retail operations for the further distribution of gases within Northern Ireland, most of the gas once imported is distributed through wholesalers. This operation reportedly remains unchanged as a result of the Northern Ireland Protocol, and in some instances wholesalers were not aware of the operational changes happening upstream.

No significant risks to supply were identified for Northern Irish wholesalers, however all respondents reported stockpiling of gas prior to the end of the Withdrawal Agreement in order to mitigate any previously unknown interruption.

3.3.3 End users

Little is known about the impact on end-users of trade changes as a result of the Northern Ireland Protocol. Whilst the contact database developed to support survey distribution for this study revealed that there are many companies intrinsically tied to servicing of pre-charged equipment, engagement with this portion of the supply chain was notably more challenging. However, it is reasonable to suggest that changes to the supply of bulk HFC into Northern Ireland will have downstream impacts in terms of pricing and possibly supply. It is unclear how the cost of purchasing bulk HFC from Northern Irish wholesalers will change over the short- to medium-term as a result of the Withdrawal Agreement, but any change in price is likely to be passed on to the consumer.

The most significant impact on the end user, or rather the service provider, is the future of the certification and attestations to work with HFCs in refrigeration, air conditioning, heat pumps, mobile air conditioning as well as fire protection and solvents sectors. EU

regulations 2015/2067[12], 304/2008[13], 306/2008[14] and 307/2008[15] detail certification requirements and the conditions for mutual recognition of company and personnel certificates within the EU. Certificates are issued by certification bodies designated by Member States and are required for persons or companies installing, maintaining or servicing stationary refrigeration, air conditioning and heat pump equipment as well as for certain activities in the other sectors. Following the end of the transition period, the Withdrawal of the United Kingdom[16] excluded the possibility for the UK to participate in mutual recognition with the EU, which means that companies in the EU cannot get recognition of certificates issued by a certification programme established by the United Kingdom automatically. However, companies in Northern Ireland certified by a certification programme established by the United Kingdom in respect of Northern Ireland can continue to perform activities under the respective EU regulation. This means that F-gas technicians in Northern Ireland will be able to continue to work in Northern Ireland with their current certificate; however, they will need to qualify for an Irish (EU) certificate if they are to continue working in the Republic of Ireland or other EU countries from January 2021.

To address this issue the Irish Environmental Protection Agency (EPA) established a programme under Irish legislation[17] which provides for holders of UK certified F-gas certificates and attestations, to obtain a new Irish certificate/attestation from the Environmental Protection Agency. These Irish F-gas certifications/attestations will be recognised in Ireland and other EU Member States. At the time of drafting this report the re-certification programme had issued Irish EPA certificates to a number of technicians based in Northern Ireland (summarised in **Table 4**).

Table 4: Certifications/attestations issued by the Irish EPA to Northern Irish technicians

Type of Certification	No.
Refrigeration, Air Conditioning, Heat Pumps (RACHP)	217
Mobile Air Conditioning (MAC – Automotive service technicians)	28
Switchgear (relates to SF_6)	1

Source: Irish EPA, March 2021

[12] Commission Implementing Regulation (EU) 2015/2067 of 17 November 2015 establishing, pursuant to Regulation (EU) No 517/2014 of the European Parliament and of the Council, minimum requirements and the conditions for mutual recognition for the certification of natural persons as regards stationary refrigeration, air conditioning and heat pump equipment, and refrigeration units of refrigerated trucks and trailers, containing fluorinated greenhouse gases and for the certification of companies as regards stationary refrigeration, air conditioning and heat pump equipment, containing fluorinated greenhouse gases.

[13] Commission Regulation (EC) No 304/2008 of 2 April 2008 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, 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.

[14] Commission Regulation (EC) No 306/2008 of 2 April 2008 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, minimum requirements and the conditions for mutual recognition for the certification of personnel recovering certain fluorinated greenhouse gas-based solvents from equipment.

[15] Commission Regulation (EC) No 307/2008 of 2 April 2008 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, 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.

[16] https://ec.europa.eu/clima/sites/default/files/f-gas/docs/brexit_notice_en.pdf

[17] http://www.epa.ie/air/airenforcement/ozone/training/brexitodsfgas/

Whilst this process was largely designed to ensure the continuity of work for Irish technicians who are certified by UK certification bodies, it has also ensured continuity for Northern Irish technicians; however, the end of mutual recognition between the UK and the EU may have implications should policy divergence occur. Firstly, technicians from both the Republic of Ireland and Northern Ireland will need to find training bodies within the EU for future certification or designate their own training bodies Secondly, this temporary recognition given by the European Commission may be sensitive to policy divergence, as it depends on the continued compatibility of certifications between Great Britain and the EU.

3.3.4 Reclamation and disposal

Reclamation of HFCs refers to re-processing of gas to return it to the relevant specification. Direct recycling for immediate reuse differs from reclamation as only basic cleaning processes are performed. Waste HFCs are consigned as hazardous waste to comply with the Hazardous Waste Regulations (NI) 2005 and can only be moved under Transfrontier shipment of waste (TFS) regulations for recovery. Reclamation is currently not possible within Northern Ireland as the required facilities to obtain the high purity are not available. Prior to the Withdrawal Agreement organisations reportedly shipped gas to Great Britain for reclamation. Recycling may well occur in small scale instances across Northern Ireland during on-site maintenance and repair however this will not be recognised in market analysis directly as it is not subject to any reporting obligations. It will instead have low resulting impacts on patterns of demand but is technically possible only to limited extent. It is known that the majority of waste equipment containing HFCs within Northern Ireland is directed to a facility managed by Techrec (Enva) for end-of-life disposal.

Survey responses indicated that in several instances sending gas to Great Britain for reclamation is believed to be no longer viable due to the new quota requirement. GB companies were allocated quota on the basis of their current operations, and therefore it is likely that quota allocation is being reserved by companies for other operations. Some packer/filler operations reported that shipping of gas for reclamation purposes has been shifted away from GB and re-directed to EU facilities. Increased restrictions on the shipping of gas to Great Britain may drive demand for a reclamation facility to be established within the Republic of Ireland. Whilst not currently operational, Harp Refrigerants Limited have a licensed facility for an operation that comprises of reclamation of waste refrigerant gases, and the storage of waste refrigerant gases, waste refrigerant oil and cooling fluids[18]. Stakeholder interviews suggested that storage of gas at this facility has begun.

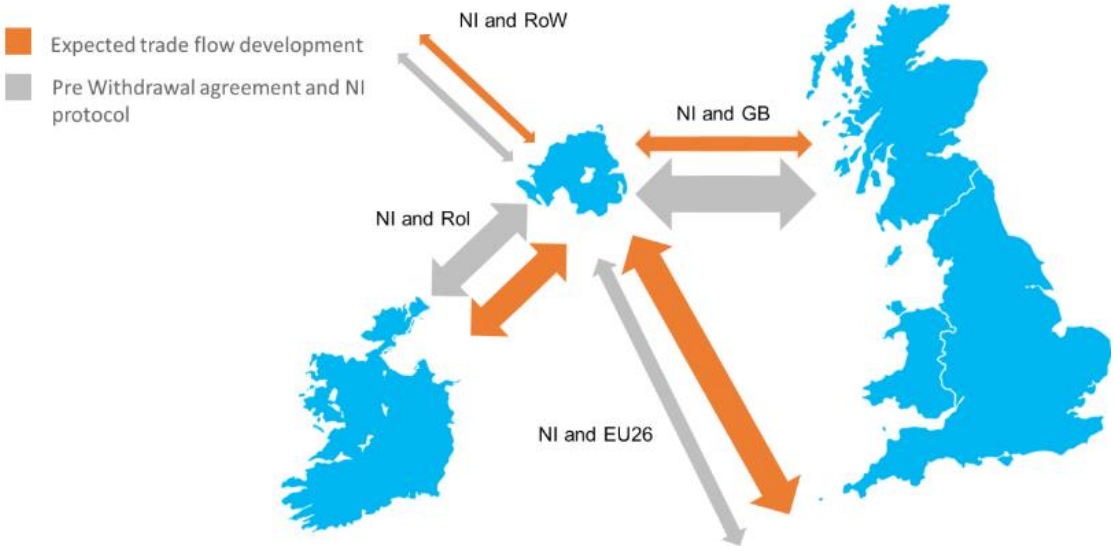
Our survey also found that the new regulatory environment has also impacted on the reclamation of gases between Great Britain and the EU. An OEM reported that their EU factories are no longer supplied by reclaimed product from Great Britain. It requires further consultation to determine if this is due to quota requirement for shipment of this product or due to cross-border waste regulation.

[18] http://www.epa.ie/licences/lic_eDMS/090151b28069dd2b.pdf

3.4 Impact of the Northern Ireland Protocol by trade flow

The implications of the Northern Ireland Protocol and the trade of HFCs on each level of the supply chain, set out in the previous section, collectively have impacts on the trade flows of HFCs (**Figure 5**).

Figure 5: Estimated impact on trade flows



3.4.1 Great Britain to Northern Ireland

Findings of the study have consistently enforced the assertion that trade flows between Northern Ireland and Great Britain have decreased as a result of the introduction of the GB quota system. This is a direct result of the perceived 'double count' of quota, or rather the removal of the intra-trade capability that benefit Member States of the EU. Much of the prior trade from this route has been shifted to come from EU subsidiaries of the same suppliers. Whilst this shift seems to have occurred with relatively minor implications on the supply of HFCs, the study did highlight that GB companies with operations pre-existing in EU have been advantaged in adapting to these circumstances.

3.4.2 Northern Ireland to Great Britain

Whilst this does not currently represent a significant trade flow, there is potential for this to grow should changing market prices drive trade through best price purchasing. However, this will also require the participation in both the EU and GB quota systems and therefore the quota implications outlined above remain relevant.

This flow is important for reclamation of HFC gases, and it has been reported through engagement with packer filler companies that the shipping of gas from Northern Ireland to Great Britain for reclamation has been interrupted since the Northern Ireland Protocol.

The study did identify another existing use case within this trade flow that may be impacted by the introduction of the GB regulatory environment. The fire protection sector is a small part of the market which uses high GWP product (HFC-227ea) within fire suppression cylinders. This is largely restricted to high value or sensitive locations such as data centres, museums etc where alternatives are not yet in place. These

cylinders require pressure testing at defined intervals which has generally occurred within GB where the facilities to extract and test the gas are located. It is not clear what the implications of the GB quota system may be on the operation of this service.

3.4.3 Northern Ireland and Republic of Ireland

Fluid movement between the Republic of Ireland and Northern Ireland is expected to remain constant or increase as fewer imports are received directly in Northern Ireland from Great Britain. This is most relevant at the wholesaler level of the supply chain where gas is distributed to meet demand between branches. However, this fluidity is unlikely to develop for the trade of pre-charged equipment due to differences in product regulation between the EU and UK. For example, heat pumps have different requirements and therefore some EU products cannot be directly shipped to Northern Ireland.

3.4.4 Northern Ireland and EU26

The introduction of the GB quota system has meant that the trade of F-gas, originally dominated by GB/NI flows, has been significantly replaced by imports from the EU26. Whilst the key NI-based stakeholders are likely to remain the same, alternative shipping routes of supply using companies located in EU Member States has already begun.

There is potential that the introduction of the GB quota system opens the Northern Irish market to new EU based packer-fillers that may seek to trade with Northern Ireland.

3.4.5 Northern Ireland and Rest of World

Anecdotal evidence suggests that supply of F-gas to Northern Ireland from countries outside of the EU constitutes less than 10% of the market previously. Direct supply from refrigerant manufacturers is limited as there is no re-bottling facility within the island of Ireland. NI quota holders are therefore likely to use or trade any quota to source supply from within the EU, however NI companies do not hold significant quota and so this will be limited.

4 Economic Analysis of the Implications of the UK's Exit From the EU on the F-gas market

4.1 Introduction

The potential impacts of the Withdrawal Agreement on trade flows of HFCs and ODS in Northern Ireland have been outlined in Section 3. The market response to the Northern Ireland Protocol and resulting alterations to trade flows may have economic implications additional to those expected as a result of the HFC phase down. This section seeks to evaluate the economic risks and opportunities stemming from the above to the sector and the Northern Irish economy. The original intention was to draw on aggregated and anonymised results from an industry survey. However, insufficient responses were obtained for this to be possible due to a low response rate[19]. As such the information in this section draws on stakeholder estimates on market sizes and public data on prices. This has been supplemented by a small number of in-depth interviews with industry representatives. As such the level of granularity possible is limited; uncertainties and limitations on the underlying data are made clear and the discussion focuses on a qualitative analysis of identified risks and potential mitigation.

This section includes the following:

- Quantitative data on the size and characteristics of the NI HFC and ODS market. Given limited survey returns, this is based on stakeholder estimates and data are in ranges.
- Commentary on how companies have responded to the parallel GB and EU27 quota systems to date (after some four months of operation).
- Taking into account the relative size of the Northern Irish market, we summarise the main identified economic risks to Northern Ireland.
- Given the uncertainties, future risk mitigation measures are proposed.

4.2 Overview of the F-gas market in Northern Ireland

4.2.1 Volumes and trade flows

As discussed in Section 3, Low, Medium and High estimates for the current size of the Northern Ireland market for HFCs are 80, 100 and 150 t/yr. In terms of trade flows, stakeholders estimated that pre the Withdrawal Agreement between 80/90% of this mass is imported from Great Britain to Northern Ireland. This suggests in the order of 70 to 90 tonnes (with a maximum of around 130 tonnes). Between 10% and 20% are sourced from the EU27 including the Republic of Ireland. This suggests around 10 to 15 tonnes, with a maximum of around 20 tonnes per year are sourced via this route. However, as outlined above in Section 3.4, these trade flow magnitudes have been altered following the Withdrawal Agreement and so we can expect shipments from the EU27 will become more significant. Flows from Northern Ireland to Great Britain are not considered to be significant, although some stakeholders did note that reclaimed F-gas

[19] The survey instrument sought to obtain further detail on the different stages and roles in the supply chain, end uses, prices, HFC supply contract durations, concerns and issues arising from the new arrangements, the main drivers of any cost increases, the significance of costs, whether these costs were likely to be absorbed or passed on to the next stage in the supply chain etc.

is exported via this route, although the mass is not known. Illegal supplies, whilst a possible source of additional volumes, are considered by stakeholders to be negligible.

4.2.2 An approximate evolution of the NI market (2015 – 2030)

The EU HFC phase-down mechanism noted earlier was introduced in 2015 and progressively decreases the total GWP of the substances placed on the market. The baseline used was the annual average of total quantities placed on the market in the EU28 between 2009-2012. **Table 5** illustrates the progressive reduction in quota. This is expressed in bulk tonnage in the table below, given the current market estimate above is in tonnes, however the quota mechanism is measured in CO_2e, given the focus of the regulation[20]. The largest decrease of some 30% commenced in 2018; a further decrease of 18% was introduced in 2021.

In the absence of a full dataset, using the 2021 NI market estimates described above, the market evolution under the quota scheme has been recreated, between 2015 to 2030. This is an approximate estimate to give a sense of scale only. It assumes the GWP of the total HFCs being used in Northern Ireland does not significantly change over time. Data is available at EU level indicating that on average the GWP of HFCs in the total supply decreased in the order of 17% between 2015-2019, with most of this decrease taking place after 2016/2017[21]. In reality, therefore, the historical tonnage volumes below are likely to be understated somewhat, and future tonnage volumes – assuming the EU pattern applies in Northern Ireland and continues into the future – would likely be overstated somewhat as shifts to lower GWP gases continue. This cannot be quantified accurately at present as we do not have neither NI data for individual gases. Whilst a further uncertainty, this is offset by the use of a conservative high range. Overall, this suggests that the reduction in quota for Northern Ireland over 2020/21 may be in the order of 30 to 60 tonnes. It suggests additional future reductions required over the period 2021 to 2030 in the order of 40 to 80 tonnes.

Table 5: Estimating market evolution (bulk tonnage placed on the market in NI based on quota, 2015-2030)

Implied market trends	% of baseline: Maximum quantity placed on market and corresponding quota	Implied market evolution (Low)	Implied market evolution (Medium)	Implied market evolution (High)	Levels of uncertainty
2015	100%	180	220	330	High
2016-2017	93%	170	210	310	High
2018-2020	63%	110	140	210	Medium
2021-2023	**45%**	**80**	**100**	**150**	**Low**
2024-2026	31%	60	70	100	Medium
2027-2029	24%	40	50	80	High

[20] The initial total allocation in 2015 was 183.1 $MtCO_2e$ (EC, 2018). In 2016 and 2017, the first stage of reduction applied and only 170.3 $MtCO_2e$ was allocated (93% of the 2015 allocation). Following a recalculation of the maximum quantity for 2018, which allowed for the subtraction of exempted gases as stipulated in Annex V of the F-gas Regulation, an HFC quota totalling 101.2 $MtCO_2e$ was allocated for 2018 (EC, 2018). Source: EEA F-gases report 2018, p.27.

[21] Data provided by Öko-Recherche (May 2021), taken from EEA F-gas report data.

Implied market trends	% of baseline: Maximum quantity placed on market and corresponding quota	Implied market evolution (Low)	Implied market evolution (Medium)	Implied market evolution (High)	Levels of uncertainty
2030	21%	40	50	70	High

Source: Estimate based on 2021 market size from industry survey and stakeholder engagement, Spring 2021

Since the bulk tonnage only gives limited insight into the market situation due to the intended shift to low GWP alternatives and not-in-kind solutions, the estimates given in **Table 6** are based on CO_2 equivalent values.

Table 6: Estimating market evolution (expressed as CO_2e placed on the market in NI based on quota phasedown, 2015-2030)

Implied market trends	% of baseline: Maximum quantity placed on market and corresponding quota	EU $MtCO_2eq$ (EEA, 2018)	UK share (assumption 11% of EU)	NI share (assumption 2.5% of UK)
2015	100%	183.1	20.1	0.5
2016-2017	93%	170.3	18.7	0.5
2018-2020	63%	101.2	11.1	0.3
2021-2023	**45%**	**82.4**	9.1	0.2
2024-2026	31%	56.8	6.2	0.2
2027-2029	24%	43.9	4.8	0.1
2030	21%	38.5	4.2	0.1

4.2.3 Price trends

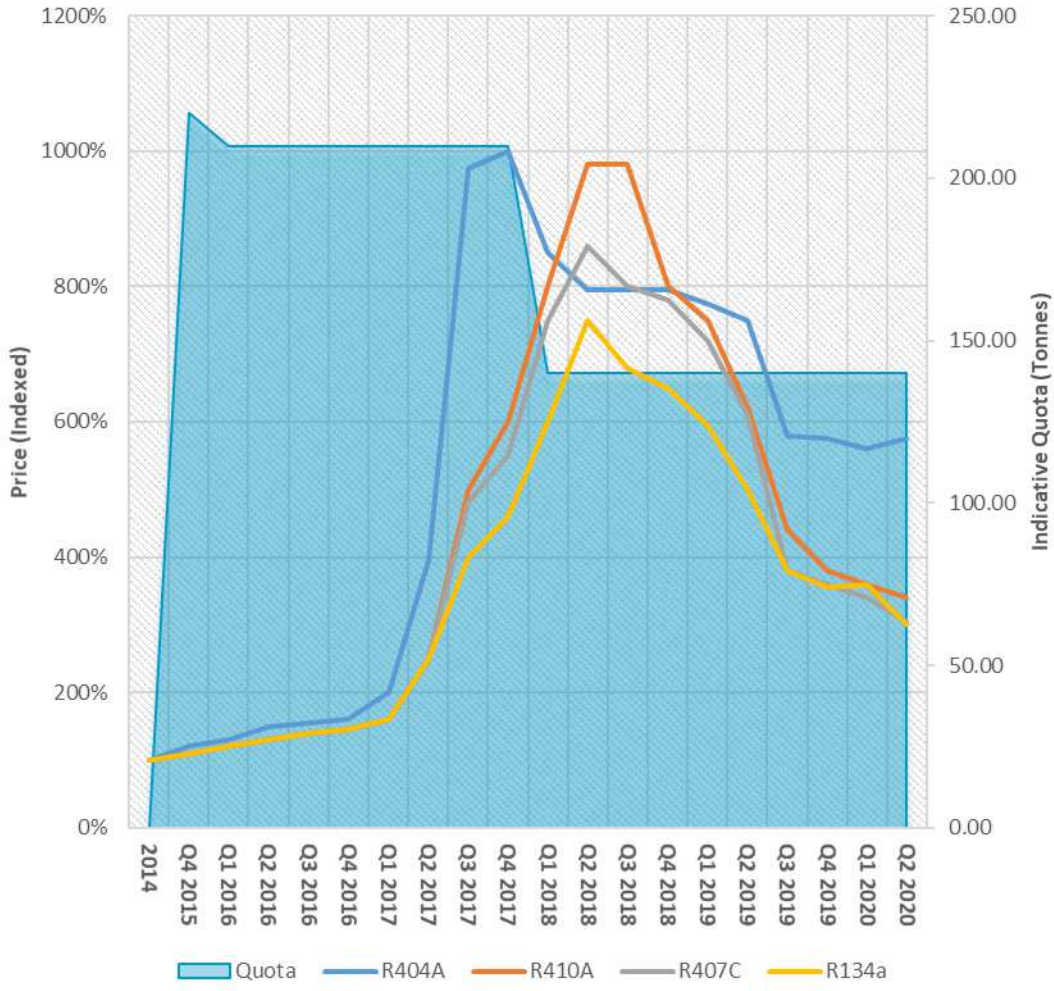
The survey data has provided some limited information on prices paid by entities at different stages in the supply chains. These are commercially confidential and insufficient responses have been provided for that data to be quoted. However under a contract for the European Commission, Öko-Recherche collect longitudinal monitoring data on refrigerant prices[22]. The most recent data relates to Quarter 2 (Q2) 2020 but a longer data series between Q1 2019 and Q2 2020 have been made available.

Figure 6 below overlays the estimated quota reduction between 2014-2020 (taking into account the caveats on tonnage volumes above) with indexed trend of the purchase prices of four most commonly used HFC refrigerants. The prices are those paid at gas distributor level (based on data from three such companies). Note that prices are indexed to the baseline year of 2014 (shown as 100%). Reflecting the basis of the quota,

[22] The data is based on 84 companies from 11 Member States; the most common are France, Germany, Italy and Poland. Data was obtained from all supply chain levels (3 gas producers, 10 gas distributors, 28 OEMs, 36 service companies, 5 end-users and 2 other companies) and are reported purchase and/or selling prices for HFCs.

the relative price increase of each of the four gases rose in line with their GWP. Prices for R404A, with a GWP of 3,922, rose faster than R134a with a GWP of 1,430, and the former has remained elevated for example. This also reflects further restrictions on the use of R404A in refrigeration systems with capacities greater than 40 t CO_2 equivalent and for servicing. It is understood that most distributors stopped selling this gas by the end of 2019. It is now mostly available from reclaimed quantities[23]. Data are also available based on prices paid by OEMs[24] which show similar trends to those below.

Figure 6: Price and quota evolution – 2014 to Q2 2020



Source: Indexed price data Q2 2020, Öko-Recherche "monitoring of refrigerant prices against the background of Regulation (EU) No 517/2014. Note the prices shown are those for gas distributers. Note data for 2014 was only presented for the year, rather than quarters.

These patterns show the introduction of the current F-gas Regulation (which applies since 1 January 2015) resulted in modest but consistent increase in prices over the period leading up to the first quota decrease. This quota decrease amounted to a 7% reduction by GWP and was introduced in January 2016.

[23] Market intelligence provided by Öko-Recherche (May 2021).
[24] A company whose goods are used as components in the products of another company, which then sells the finished item.

A more significant increase in prices were observed throughout 2017. For R404A (GWP 3922), prices peaked in Q4 2017 at ten times 2014 levels. Prices for the three, comparatively lower GWP gases (R410A: GWP 2088; R407C: GWP 1774; R134a: GWP 1430), peaked later in Q2/3 2018 at between 8 and a little under 10 times 2014 prices. These increases reflect the larger decrease in the quota (30% by GWP) which took effect in 2018. Prices thereafter slowly decreased but remain at about 3 to 6 times 2014 prices.

A further quota decrease took effect in January 2021 for which price data is not yet available. This quota decrease was smaller than that in 2017 (18% by GWP). All things being equal, the price increase expected in 2021 would be less than that in 2017. However, this depends on the degree to which companies can and have switched to either lower GWP HFCs or to other alternatives, as well as the relevance of refrigerant reuse/recycling/reclamation alongside potential illegal imports. This in turn reflects the specific downstream uses the extent of substitution of HFCs with alternatives that has taken place already differ between these significantly. The survey data does not provide more detailed information on this. But the EU data referred to above suggests a degree of substitution within the industry to the lower GWP gases over time.

4.2.4 Prices per tonne

Table 7 summarises average prices for the three most common HFC refrigerant gases, based on the most recent publicly available price per kg data (2019). Note the latest available price per kg information is from 2019. The above information suggests prices have further decreased since then in the early stages of 2020. These prices are in Euro and have been converted into Pound Sterling at the September 2019 exchange rate. The Euro/pound exchange rate is therefore another factor which may influence prevailing prices paid by companies in Northern Ireland. Given that R404A is no longer available, this has been removed from the calculation. An average of the remaining three gases suggests a price of just over £26,000 per tonne.

Table 7: Purchase prices (as at Q3, 2019 – latest data)

Purchase prices of the most commonly used HFC refrigerants Q3/2019	R410A	R407C	R134a	Average Price
Average purchase price (Euro per kg)	€ 32	€ 31	€ 24	~
Prevailing exchange rate (Sept 2019)	0.8922			
Costs per tonne (£)	£29,000	£28,000	£21,000	£26,000

Source: Price data Q3 2019, is the average prices from survey respondent companies in Germany, France, Spain, Italy and Poland, prices are from Q3 2019 Öko-Recherche "monitoring of refrigerant prices against the background of Regulation (EU) No 517/2014. Note the prices shown are those for service company level. Note the costs per tonne figures are rounded. Exchange rate data: https://www.ofx.com/en-gb/forex-news/historical-exchange-rates/monthly-average-rates/

Table 8 repeats the same approach but using HFC refrigerant prices at their highest overall average (which was in Q2 2018). Note the highest individual price for any one gas was in Q4 2018 for R404A. This gas has been excluded from the analysis below but gives an indication of the scale of prices at this highest price point, suggesting costs per tonne at just over £41,000 per tonne or up to £65,000 per tonne. These prices have been estimated based on the indexed change since Q3 2019 and are approximate.

Table 8: Purchase prices (at highest points)

Time Period	R410A	R407C	R134a	Average (non-weighted)
Q2 2018 Price (highest average)	£65,000	£63,000	£41,000	£56,333
Q2 2018 price (indexed from 2019 Q3)	224%	225%	195%	

Source: Derived using Price data from Q3 2019, is the average prices from survey respondent companies in Germany, France, Spain, Italy and Poland, prices are from Q3 2019 Öko-Recherche, excerpt for participants "monitoring of refrigerant prices against the background of Regulation (EU) No 517/2014. Note the prices shown are those for service company level.

4.2.5 NI market costs

Table 9 applies this average price to the overall Northern Ireland market size to estimate total HFC costs to Northern Irish businesses as a whole (using the market size information in **Table 3**). We then estimate an order of magnitude cost paid, on average by service companies and by end users in Northern Ireland. The estimate is based on the number of such companies identified in the stakeholder contact database[25]. These numbers too are subject to uncertainty[26].

The average costs per company is estimated based on the number of service companies and end users and assuming all price increases are passed through the different stages of the supply chain, and ultimately paid by the final consumers. This assumption is supported by stakeholder feedback. This approach assumes that all companies use similar amounts of F-gases. In reality, anecdotal information from the survey suggests a small number of larger players, with a larger and diverse number of small users in several different sectors, but it has not been possible to confirm this. The approach below suggests the average company may use less than 1 tonne per year.

Based on Q3 2019 prices of £26,000 per tonne – and assuming a market size of between 80 tonnes (Low), 100 tonnes (Medium), and up to 150 tonnes (High) – costs to the industry as a whole in Northern Ireland would be over £2.5 million (c. £2 million to c. £5 million). On average, this suggests total HFC costs to any one firm of around £10,000 – £15,000 (£10,000 – £20,000). However, given that a further quota decrease has taken place since this 2019 price data, it is possible that prices have increased again in 2021.

Table 9: Market size and average costs (Q3 2019 prices)

Estimated Market Costs	Low	Medium	High
NI Market cost at Q3 2019 Prices	£2,100,000	£2,600,000	£3,900,000
Approximate average cost per company (service companies)	c.£10,000	c.£10,000	c.£15,000
Approximate average cost per company (end users only)	c.£10,000	c.£15,000	£20,000

[25] These were 242 service companies and 199 end users.

[26] The stakeholder database contains a long list of companies that are headquartered in NI, those who operate in NI. Whilst efforts have been made to exclude non-NI companies, the database may contain some companies that do not operate in NI, but only in GB. Similarly, the database may not cover all NI service providers. Therefore, this is an indicative cost only. This is discussed further in the recommendations section.

Source: Own estimate based on market size and latest price data. Note numbers are approximate and have been rounded.

As such, **Table 10** contains the same estimate using the highest average price for the three most common and available HFC refrigerants (just over £56,000 per tonne) that has been observed since 2015. The figure assumes the whole market incurs costs at the highest level and that no one can substitute to alternatives at lower cost, as such it appears a reasonable worst case. This suggests overall NI costs to industry closer to over £5 - £8 million, with average costs per end user company, of around £30,000 (£25,000 to £45,000).

Table 10: Market size and average costs (maximum prices – 2018)

Estimated Market Costs	Low	Medium	High
Costs to industry (highest average)	£4,500,000	£5,600,000	£8,500,000
Approximate average cost per company (service companies)	c.£20,000	c.£25,000	c.£35,000
Approximate average cost per company (end users only)	c.£25,000	c.£30,000	c.£45,000

Source: Own estimate based on market size and price data. Note numbers are approximate and have been rounded.

4.3 Industry response

The stakeholder engagement exercise sought to understand how companies had (or were planning to) respond to the challenges associated with the quota mechanism and to EU exit more generally. As above, the responses do not enable a firm conclusion on trends across the Northern Irish market as a whole. However, discussions were held with several companies providing an overview of their individual company responses:

- Several companies have switched suppliers of HFCs from GB suppliers to EU suppliers. This appears to have been more common amongst those with an EU parent or with other EU entities which form part of a group of companies. This may place smaller companies, likely purchasing smaller volumes, at a disadvantage and may serve to consolidate the market somewhat.
- Given the above, whilst not possible to quantify, stakeholder feedback indicates the overall net effect is likely to be a reduction in GB/NI trade flows, offset by an increase in EU/NI trade (particularly from RoI). NI/GB trade is considered to be small, but could be attractive if significant differences in price arise from future regulatory divergence.
- Stakeholders indicated that in anticipation of potential border issues in the aftermath of the end of the transition period, companies have stockpiled for Brexit. The evidence suggests this has had only a limited – if any – effect on prices as they have continued to fall from a peak in 2018. Stakeholders have indicated decreases in end user demand have been observed associated with the various COVID-19 lockdowns, particularly amongst retailers, restaurants and via a reduction in supermarket refits etc. This would have offset any rise in prices. A comprehensive NI lockdown was instigated on 28th March 2020[27].

[27] https://www.bbc.co.uk/news/uk-northern-ireland-55303928

- The survey indicated mixed awareness of the issues associated with quotas, price effects and in particular the issues around complying with quota requirements for both GB/NI and NI/GB trade.

4.4 Potential economic risks

Table 11 provides a qualitative commentary on the key economic risks identified, drawing on stakeholder feedback. A quantitative assessment of the significance and scale of these risks is limited by the low number of survey responses. However, the economic risks identified should be taken in the context of the wider objectives of the F-gas regulation which is designed to reduce consumption and to use price increases to incentivise substitution with alternatives. Overall, whilst based on anecdotal feedback, the wider economic risks to Northern Ireland appear to be limited.

Table 11: Commentary on potential economic risks

Risk identified	Commentary	Scale	Significance
Price increases driven by quota limits	The main economic risk identified is industry concern of price increases associated with the quota limit decrease. The market is price sensitive, and stakeholders indicated that price increases will be passed on to downstream users, and ultimately to the end users/consumers. So therefore it is possible that for specific sub-sectors, where substitution is technically difficult, and where industry has been comparatively slow to substitute and where there are long lifetime uses for equipment, consumers may experience some price increases and/or losses in profit margin. The affected end-user markets are predominantly retailers, hotels, supermarkets[28]. The anecdotal evidence from stakeholders is that short term risks of price increases are mitigated given stockpiling of refrigerants by companies during late 2020 in advance of the end of	It is not possible to quantify potential price increases to the end users. However, modelling the latest (2019) price data and comparing this to historical highs, suggests the average price increase to end-user companies would be relatively modest (on the order of £10,000 to £15,000 and around £45,000 on average for each company) at most. These additional costs may then be further passed on to the final consumer, further diluting any price increase for food at restaurants/suppliers, hotels etc. The anecdotal evidence suggests that whilst there may be some issues encountered by individual firms (inability to upgrade, replace equipment or substitute specific uses) this is likely to be limited to specific parts of the market, with small and medium-sized enterprises (SMEs) likely to be at higher risk. Other factors, such as exchange rates for food/drink imported from outside of the UK is also likely to affect prices. Higher up the supply chain, losses in market share of F-gas	The anecdotal evidence suggests that effects at the level of the NI economy as a whole would be limited. Effects may be felt in some end uses in increased prices. To give a sense of scale, the NI electricity, gas steam and air conditioning supply sector, for example comprised just over 1% of total NI gross value added (GVA) in 2018 (latest data)[29]. In turn, total estimated costs that might be incurred by the sector, based on the highest historical prices, comprise less than 2% of the GVA of that sector. It should be borne in mind that an increase in prices is evidence of the regulation working as intended, incentivising progressive replacement of higher GWP gases with lower GWP gases or non-HFCs,

[28] Watterson, J (2019) Assessment of the potential to reduce UK F-gas emission beyond the ambition of the F-gas regulation and Kigali Amendment, Report for the Committee on Climate change. Ricardo, Energy and Environment, 12 March 2019.

[29] Source: ONS - https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/regionaleconomicactivitybygrossdomesticproductuk/1998to2018

Risk identified	Commentary	Scale	Significance
	the Brexit transition period. Alongside this, companies noted demand decreases from end users, which reflect closure of hotels/restaurants etc. associated with the COVID-19 lockdowns. However, demand may return quickly in 2021 and historical prices have increased significantly over the period of the last – and largest – quota decrease. There are no reliable data on the price effects from the most recent quota decrease; the latest data is from 2020.	suppliers would be offset by gains from suppliers of lower GWP or non-F-gas alternatives.	reducing leakage and increasing recycling and reclamation.
Supply chain exposure	A more general risk is a recognition that NI market is at the 'end of supply chain', whether importing from GB or the EU. The market is small and as such not considered particularly attractive. Given this there is the potential for further market consolidation, resulting in fewer suppliers. This compounds the risk from price increases driven by quota decreases described above, particularly for those using very small volumes.	This is a general risk which is not possible to quantify. It is likely that those most at risk are smaller volume/value users and SMEs.	The anecdotal evidence indicates no reports of supply interruptions at present. This is a general risk which is not possible to quantify. However stockpiling alongside purchases from EU suppliers appear to have mitigated short term risks.

Risk identified	Commentary	Scale	Significance
Interruptions in supply	Interruptions in supply are not considered to be a genuine risk by consultees at present. However, several have noted that lead in times for supplies are currently greater (having increased for some from a few days to around 1 week, given issues at the border). Increases in administrative burden have also been noted. This has consisted of additional paperwork as well as some logistical changes, for example EU suppliers providing products in marginally different-sized containers.	Potential risks are in theory greater than price rises alone, given the supply challenges would likely be reflected in further prices rises over and above spikes from quota decreases. Risks have been offset by stockpiling, and by those companies who have been able to secure supplies from EU27 suppliers; however demand may recover quickly in 2021 which could lead to supply bottlenecks.	This issue was not considered to be the primary concern or the primary driver of increased prices, at present. Some companies have offset this risk by procuring supplies from EU suppliers (including parent companies).
GB/NI quota divergence	A proposed revision of the F-gas regulation is expected at EU27 level by the end of 2021. Under the terms of the Withdrawal Agreement, Great Britain may adhere to these revisions, or may diverge from them, within the constraints of the Kigali Amendment commitments. As above, the primary concern is price effects from GB/NI quota divergence after 2021. Whilst a potential risk, this is very uncertain. In terms of the quota decrease, the GB may go faster than the EU proposal – see for example analysis provided to the Committee on Climate change for analysis of where further	A faster quota reduction in GB to that in the EU may serve to increase prices for those importing from GB to NI. This would increase attractiveness of EU suppliers. A slower quota decrease in GB – or a decision by GB to use a more flexible mechanism to decrease HFC use, such as a voluntary agreement and/or a tax – would have the opposite effect.	Whilst how precisely GB may diverge from the EU regulation, if at all, is unclear it appears the risks are relatively limited.

Risk identified	Commentary	Scale	Significance
	action may be focussed[30], or it may go slower. It may also seek to change the means by which a decrease in use in achieved, for example via use of a tax or voluntary agreement, supported by quota decreases if progress is not made at sufficient speed. Such a more flexible GB approach may potentially offset risks of price increases to Northern Ireland. Related, some consultees noted a potential concern arising from different products specifications and effects on 4 to 5 year product development cycles if EU and GB approaches diverged significantly.		

[30] Watterson, J (2019) Assessment of the potential to reduce UK F-gas emission beyond the ambition of the F-gas regulation and Kigali Amendment, Report for the Committee on Climate change. Ricardo, Energy and Environment, 12 March 2019.

4.5 Key messages

This section has explored available information on the Northern Ireland HFC market in the context of the UK's exit from the European Union and has qualitatively explored economic risks. The detail possible in this assessment and the certainty associated with the conclusions is limited by a lack of survey data, and a lack of publicly available market data for Northern Ireland, combined with the dynamic nature of the context and the diversity of downstream uses. With more data on specific uses, and data on downstream markets, further analysis could have been undertaken on the significance of the identified price increase on companies (based on typical turnover, profitability etc.).

It is important to place any price rises in the context of the aims of the regulation. The F-gas regulation imposes a progressively smaller decreasing quota, based on the CO_2 equivalent of the total supply. Over time, by reducing supply, prices increase incentivising businesses to substitute higher GWP gases with those of lower GWP as well as to non-HFC alternatives to reduce the global warming contribution of NI businesses. The key messages are:

- EU-level data illustrates a sharp increase in prices for the most commonly used HFC refrigerants, particularly from 2017, peaking in 2018 as the quota decrease to 63% of the 2015 baseline took effect. The latest data (Q2 2020) indicates that in general prices continued to fall after 2018. A further quota decrease took effect in 2021 (to 45% of the 2015 baseline). Whilst price data is not available covering that period, it is reasonable to assume that prices may increase in response to quota reduction, should demand resume following the COVID-19 pandemic.
- Using available price data from 2019 suggests total HFC refrigerant costs to NI businesses as a whole were on the order of £2.5 million (and within a range of £2 million to around £5 million) per year.
- In the period 2014-Q2 2020, prices peaked in Q2 2018. Assuming the entire market paid prices at this level, which appears unlikely, this suggests costs to NI businesses as a whole of a little over £5.5 million (within a range of £4.5 million and £8.5 million) per year.
- Evidence from stakeholders suggests that any increases in HFC refrigerant prices would be passed down the supply chain. Based on approximate numbers of end-user companies in the NI supply chain, average costs to the average end-user company of around £10,000 to £20,000 per year may be expected, based on recent prices. Using the highest historical prices, these costs would be in the region of £20,000 to £45,000 per year; i.e. a cost increase in the order of £10,000 to £25,000 per company, per year.

5 Conclusions and Recommendations

5.1 Conclusions

The study concludes that there is no significant threat to consistent supply of HFCs and ODS to Northern Ireland as a result of the Northern Ireland Protocol. The best available estimate of the NI HFC Northern Ireland HFC market size is between 80 and 100 tonnes per year (2020/2021). A conservative high range of 150 tonnes has been included to test the effects of this on business costs. These market size values represent between 1% to 3% of the UK market.

Through engagement with stakeholders the study has revealed that a number of alterations to trade flows have already occurred in response to the Northern Ireland Protocol following the UK's exit from the European Union. This report has highlighted that the major implication for supply chains has been that of the shift of bulk gas supply shipments from GB to EU subsidiaries to avoid the new quota implications of exporting to Northern Ireland from GB which, if pertained to gas already placed on the market, previously did not require quota due to EU intra- trade. Anecdotally, this process has been easier for those who are members of a wider group and/or have parent or partner EU entities. The overall net effect is expected to be an increase in EU/NI trade, including via the Republic of Ireland, and a decrease in GB/NI trade. This means that the supply of HFCs to Northern Ireland is reliant on companies in mainland Europe continuing to supply to the Republic of Ireland and Northern Ireland.

The economic analysis of the Northern Ireland HFC market revealed that the primary driver of price increases are from the HFC phase down; however, this is by design and is the mechanism that will ensure decreased reliance on high GWP gases. Such price increases can therefore be mitigated by companies substituting HFC refrigerants with alternatives which are not affected by the quota decrease within the HFC phase down. Whilst the data suggests the price increases are likely to be modest, it is possible that specific parts of the supply chain, where substitution has proved economically and/or technically infeasible, could experience some price increases. Any final effects to consumers – via hotels, restaurants etc. – would be further diluted.

The findings of the study have been limited by low levels of survey response across the HFC and ODS supply chain. Therefore, the following recommendations have been formulated to support DAERA in elaborating on this study to further understand and to track the implications of the Northern Ireland Protocol for the HFC market. This will be of relative importance depending on the outcomes of the current F-gas regulation reviews and any emerging divergence between the EU and GB F-gas regulations.

5.2 Recommendations

The below recommendations are intended to support DAERA in their position as the NI Competent Authority for ODS/F-gases and to give suggestions for the next steps which may benefit the Northern Irish market. They also aim to support businesses in Northern Ireland to mitigate the economic risks identified. Whilst the significance and scale of economic risks identified appear limited, there are options for DAERA to help limit these risks if they materialise.

Price Monitoring

Consider monitoring the prices of the most common HFCs and alternatives, possibly in a cooperation with an industry association. An increase on 2017/2018 levels *may* signal a potential problem and will alert DAERA to emergence of the potential market risks identified

Further survey distribution

Obtain comprehensive market data through mandated survey responses. Attempt to improve and update the market data contained in this report via regular outreach and engagement. Aim to repeat the assessment and stakeholder interviews towards the end of this year.

It is likely that a comprehensive understanding of the Northern Irish market will be essential for UK reporting under the Montreal Protocol. It therefore may be a requirement for Northern Irish companies to report to both the EU and to Defra.

It may also be beneficial for DAERA to consider further survey engagement with other F-gas markets, such as electrical equipment and semiconductor, photovoltaics and other electronics manufacturer where SF_6 is widely used.

Guidance and Awareness raising

Engagement with companies throughout this study flagged that there is mixed awareness of the implications of the introduction of the GB quota system and the potential implications of policy divergence. It is therefore recommended that further guidance for companies be established to mitigate risk to companies.

It is suggested that this covers the following:

- Guidance and awareness raising of the dual regulatory systems for Northern Ireland and Great Britain and of key dates, such as the next quota decrease and upcoming product bans.
- Opportunities for using inward processing relief (IPR) to trade between Great Britain and Northern Ireland without quota implications.
- The quota and waste regulation implications for reclamation processes in Great Britain
- Providing assistance and guidance to help companies introduce alternatives to HFCs and to reduce leakage. This would include signposting companies to support for substituting with alternatives where these are technically and economically feasible, well in advance of further quota decreases.

Good models to consider are the “guidance in a nutshell” documents published by the European Chemicals Agency. Another option, depending on budget constraints, are helpdesk hotlines (e-mail and/or phone). These could be jointly financed/resourced across the UK.

Follow up on the market risks identified

Whilst the report has not identified any specific concerns on the continued supply of HFCs and ODS to Northern Ireland, some isolated risks to specific parts of the market have been highlighted. It is therefore recommended that targeted follow up is considered for the following sectors:

- **Fire sector** –the relatively small use case of sending fire protection equipment to Great Britain for safety testing may experience interruption due to the

quota implications of transferring this gas between Northern Ireland and Great Britain. Whilst this is a small use for specialist fire equipment it will be important to ensure that this process is still viable.

- **Reclamation** –the process of sending gas to Great Britain for reclamation has been interrupted by the GB quota system. Therefore, this should be further investigated to ensure that there is still an opportunity for gas placed on the NI market to be sent for reclamation. It is expected that this will become increasingly significant as the phase down continues. Part of this further work should be the engagement with the licenced facility for reclamation within the Republic of Ireland, and investigation into the hazardous waste regulations and the potential impact of the Northern Ireland Protocol on waste regulation.

Track regulatory reviews

This study has been conducted while reviews of the EU and GB F-gas regulations are ongoing. Northern Ireland is in a unique position in that the outcomes of both reviews may have significant impact on the HFC and ODS market. Therefore, it will be important for DAERA to monitor the outcomes of both regulation reviews and actively participate in consultations where possible to ensure that the interests of Northern Ireland are considered, and that potential implications are known of in advance. For example, a key consideration will be the future of certification for NI companies and technicians.

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