MILTCON SERVICES LIMITED

SWECO

Determining Historic and Current PFAS Levels in AFFF in the Republic of Ireland

SPCP-2018-02-1 (Lot #5)

December 2020

Status / Revisions

Rev.	Date	Reason for issue	Prepared		Reviewed		Approved	
[1]	[00.00.00]	Draft for Discussion	ME/ DM	14.11.20	NT	19.11.20	ME	20.11.20
[2]	30.11.20	Final to Client	ME/ DM	08.11.20	NT	10.12.20	ME	11.12.20

Reg. Office Address:
Sweco UK Limited
Grove House
Mansion Gate Drive
Leeds, LS7 4DN
+44 113 262 0000

Reg. No.: 2888385
Reg. Office: Leeds

www.sweco.co.uk

Sweco UK Limited
Glandore
3rd Floor City Quarter Lapps Quay
Cork, T12 Y3ET
+353 21 206 3920

Maeve English
+353 21 206 3960
maeve.english@sweco.ie

Table of contents

List of figures

List of tables

Appendices

Table of abbreviations

Per- and polyfluorinated alkyl substances	PFAS
Perfluorobutanoic acid	PFBA
Perfluoropentanoic acid	PFPeA
Perfluorohexanoic acid	PFHxA
Perfluoroheptanoic acid	PFHpA
Perfluorooctanoic acid	PFOA
Perfluorononanoic acid	PFNA
Perfluorodecanoic acid	PFDA
Perfluoroundecanoic acid	PFUnDA
Perfluorododecanoic acid	PFDoDA
Perfluorotridecanoic acid	PFTrDA
Perfluorotetradecanoic acid	PFTDA
Perfluorobutane sulfonic acid	PFBuS
Perfluorohexane sulfonic acid	PFHxS
Perfluorooctane sulfonic acid	PFOS
Perfluorodecane sulfonic acid	PFDS
6:2 Fluorotelomer Sulfonate	6:2 FTS
Perfluorooctane sulfonamide	PFOSA
N-Methylheptadecafluorooctane sulfonamide	N-MeFOSA
N-Ethylheptadecafluorooctane sulfonamide	N-EtFOSA
N-Methylheptadecafluorooctane sulfonamidoethanol	N-MeFOSE
N-Ethylheptadecafluorooctane sulfonamidoethanol	N-EtFOSE
Fluorotelomer alcohol	FTOH
1H,1H,2H,2H-perfluoro-1-octanol	6:2 FTOH
1H,1H,2H,2H-perfluoro-1-decanol	8:2 FTOH
1H,1H,2H,2H-perfluoro-1-dodecanol	10:2 FTOH
Fluorotelomer unsaturated carboxylic acid	FTUCA
Fluorotelomer carboxylic acid	FTCA
Fluorotelomermercaptoalkylamido sulfonate	6:2 FTSAS
Fluorotelomer sulfonamide alkylbetaine	6:2 FTAB

1 Introduction

1.1 This report

Sweco has been contracted by the Environmental Protection Agency (EPA) to deliver a study on determining both current and historic levels of poly- and perfluoroalkylated substances (PFAS) in aqueous film-forming foams (AFFF)[1] used in fire fighting in the Republic of Ireland.

Sweco are working in partnership with Miltcon Services Ltd. to deliver this contract.

1.2 Scope of work

The specific objectives of this study are to:

1. Estimate quantities of AFFF installed in systems and kept as feedstock in the Republic of Ireland
2. Identify historic users in a number of key sectors on a site-by-site basis
3. Identify historic and current suppliers of AFFF within the country
4. Identify areas potentially impacted by PFAS from current and historic AFFF use/application using the project specific database
5. Develop a database of 'users' to assist with future operator reporting requirements.

The delivery of the study is broken down into the following tasks:

Task 1 Generation of a Project Plan - Details the proposed methodology for identifying target sectors for surveying along with the specific information required from each survey type.

Task 2 Generation of list(s) of intended stakeholders to be contacted/surveyed - Stakeholders were grouped into six sectors covering marine users, COMAH/EPA licensed and VOC permitted sites, Local Authority Fire Services, Utilities and construction sector and aviation users.

Task 3 Generation of project surveys and fact sheet - Different information was sought depending on the sector and type of entity. To account for this and the multiple objectives of the engagement, four different online surveys were developed and follow-up consultation with the respondents was conducted.

Task 4 Generation of database of key users of PFAS containing AFFF – Using Microsoft Access to develop a database directly populated with data collected from the online surveys.

Task 5 Generation and submission of Project Report.

This report comprises the output of Task 5.

1.3 Naming of PFAS and properties

PFAS is the abbreviation for per- and polyfluoroalkylated substances which are organic chemicals containing carbon-fluorine bonds. PFAS chemistry was discovered in the late 1930s and these substances have been widely manufactured and used around the world since the 1950s[2]. The range of PFAS substances includes some 4,700 chemicals.

[1] The terms AFFF and fire fighting foams are used interchangeably in this report
[2] Technical and Regulatory Guidance: Per- and Polyfluoroalkyl Substances (PFAS). The Interstate Technology and Regulatory Council, September 2020. https://pfas-1.itrcweb.org/wp-content/uploads/2020/10/itrc_pfas_techreg_sept_2020_508-1.pdf

The highly stable chemical bonds between carbon and fluorine atoms in PFAS means that they are highly resistant to degradation and in turn highly persistent within the environment. Consequently, as long as PFAS continue to be released to the environment, humans and other ecosystems will be exposed to higher concentrations of PFAS as they will accumulate in the environment. Even if all releases of PFAS would cease immediately, they would continue to be present in the environment, and humans, for generations to come[3].

PFAS are divided into polymeric and non-polymeric substances. PFAS found in AFFF are typically non-polymeric, of which there are four groups:

1. Perfluoroalkyl acids (PFAAs)
2. Compounds derived from perfluoroalkane sulfonyl fluoride (PASF)
3. Fluorotelomer (FT) - based compounds; and
4. Per- and polyfluoroalkyl ether (PFPE)-based compounds.

Most PFAS found in fire fighting foams (FFF) are PFAAs of which two important groups are perfluoroalkyl carboxylic acids (PFCAs) and perfluoroalkane sulfonic acids (PFSAs). These can be further broken down into 'long chain' and 'short chain' substances.

The terminology 'long-chain' and 'short-chain' is used to distinguish different types of PFAS substances based on the length of the fluorinated carbon chain as detailed in Table 1. This is important given that long chain PFAS (such as C8), have been replaced in FFF by what have been perceived as safer alternatives, such as short-chains substances like C6 fluorotelomer (FT) based fluorosurfactants[4,5].

Table 1 Examples of long-chain and short-chain PFAS substances[5]

Long Chain PFAS	Perfluorocaboxylic acids (PFCAs) with carbon lengths C8 and higher and include perfluorooctanoic acid (PFOA)
	Perfluoroalkane sulfonic acid (PFSAs) with carbon chain lengths C6 and higher include perfluorohexane sulfonic acid (PFHxS) and perfluorooctane sulfonate (PFOS) (Refer to Figure 1)
	Precursors of these substances that may be produced or present in products
Short Chain PFAS	PFAS with carbon lengths of C5 and lower including perfluorobutane sulfonic acid (PFBS)
	PFCAs with carbon lengths of C7 and lower e.g. perfluorohexanoic acid (PFHxA)
	Precursors of these substances may be produced or present in products. Examples are short-chain perfluoroalkyl sulfonyl fluoride-based raw materials and short chain fluorotelomer-based raw materials

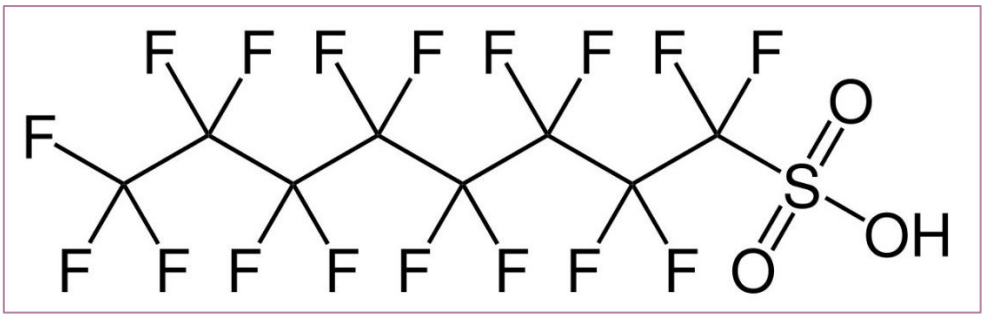
[3] https://echa.europa.eu/hot-topics/perfluoroalkyl-chemicals-pfas

[4] Fluorosurfactants are synthetic organofluorine compounds with multiple fluorine atoms. They can be fluorocarbon-based or polyfluorinated (Lehmler, 2005)

[5] European Commission DG Environment/European Chemicals Agency (ECHA), June 2020. The use of PFAS and fluorine- free alternatives in fire fighting foams – Final Report, June 2020

Figure 1 shows the molecular structure of perfluorooctane sulfonic acid (PFOS), a perflourinated PFAS that was very common in AFFF. PFOS along with perfluorooctanoic acid (PFOA) have been the most extensively studied of the PFAS chemicals[6].

Figure 1 Molecular structure of PerFluoroOctaneSulfonic acid (PFOS)



It is important to note that from the available analytical methodologies, fewer than 50 PFAS can be commonly identified using laboratory techniques.

1.4 Background to the study

PFAS have been used in industrial and consumer applications since the 1950s owing to their physical and chemical properties which impart friction reduction, surfactant abilities, repellence against oil and water as well as chemical and thermal stability in products to which they are added. The result is that PFAS are used in many sectors including the semiconductor, aerospace, automotive, medical, construction, and electronics industries. PFAS are common in everyday consumer products such as outdoor equipment, food packaging, carpets, clothing, furniture, cleaning products, paints, cosmetics and fire retardants.

The Stockholm Convention on Persistent Organic Pollutants (POPs)[7] was adopted in 2001 and came into force in 2004. This global treaty requires its parties to take measures to eliminate or reduce the release of POPs into the environment, of which two substance groups are included as set out in Table 2. The POPs and resulting actions for the Parties are categorised under three annexes:

- Annex A: Parties required to take measures to eliminate the production and use. The specific exemptions for use or production as listed only apply to Parties that register for them
- Annex B: Parties required to take measures to restrict the production and use of the listed chemicals, unless for acceptable purposes/ specific exemptions detailed in the Annex; and
- Annex C: Parties required to take measures to reduce the unintentional release of chemicals, with the goal of continuous minimisation and where feasible, ultimate elimination.

The Stockholm Convention is implemented in the European Union (EU) through the POPs Regulation (Regulation (EU) 2019/1021). Further information on the Stockholm Convention and POPs Regulation can be found in Section 2.2.2.

[6] https://www.epa.gov/pfas/basic-information-pfas
[7] http://www.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx

Table 2 When and why PFOS, PFOA and related substances were listed under the Stockholm Convention

	PFOS, its salts and perfluorooctane sulfonyl fluoride (PFOSF)	PFOA, its salts and PFOA-related compounds
Date added	COP-4 (May 2009)	COP-9 (May 2019)
Classification	Annex B	Annex A
Reasons for restriction/ prohibition	• Extremely persistent • Can undergo long-range transport • Substantial bioaccumulation and biomagnifying properties • Fulfils the toxicity criteria of the Stockholm Convention. • Unlike other POPs, PFOS does not follow the classic pattern by partitioning into fatty tissues. Instead, it binds to proteins in the blood and liver. It is both intentionally produced and is an unintended degradation product of related chemicals	• Substance of very high concern • Persistent, bioaccumulative and toxic • Highly stable • Can undergo long-range transport • Exhibits adverse effects on living organisms and humans, including kidney cancer, thyroid disease, pregnancy-induced hyper-tension, high cholesterol

As identified, PFOS was very commonly used in FFF. While it is still permitted for certain uses under the EU POPs Regulation, Ireland does not avail of any of the exemptions for use of these substances.

The PFAS substance PFHxS and related substances have also been proposed for restriction under the Stockholm Convention, as discussed in Section 2.2.2.

Most significantly, the European Chemicals Agency (ECHA) registered an intention under the REACH Regulation (Regulation (EC) 1907/2006) for restricting the use of all PFAS in FFFs in October 2020[8].

1.5 Use of PFAS in fire fighting foams

PFAS are used in Class B FFF which are surfactant solutions used to combat Class B flammable fuel fires[9] and in fire prevention i.e. solvent chemical spills. The main function and advantage of PFAS in FFF products is their *spreading* and *sealability* properties.

Spreading relates to the surface-tension lowering properties of PFAS which facilitates the rapid spreading on burning liquids while sealability relates to the ability of the film to display resistance to the diffusion of flammable vapours. PFAS are also very chemically stable so that the film persists in fire conditions.

The 2020 report commissioned by the European Commission DG Environment and ECHA[10] estimates that at least 14,000 tonnes, but probably as much as 20,000 tonnes of PFAS based FFF are sold in the EU annually. The main applications were identified in the chemical and petrochemical industry which uses some 59% of these foams. This was followed by the municipal fire brigade, marine application, airport and the military.

[8] https://echa.europa.eu/nl/registry-of-restriction-intentions/-/dislist/details/0b0236e1856e8ce6
[9] Fire in flammable liquids or flammable gases, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, or alcohols
[10] The use of PFAS and fluorine- free alternatives in fire fighting foams – Final Report, June 2020

There are many FFF brands containing PFAS in different formulations. For example, the following types of PFAS containing Class B foams have been or are currently used:

- Aqueous film-forming foams (AFFF) are the most common formulations and have been in use within all sectors of fire fighting
- Alcohol-resistant aqueous film-forming foam (AR-AFFF) is a universal foam product where the PFAS also imparts foam stabilisation[11]
- Film forming fluoroprotein foam (FFFP) has been used for airplane related fire suppression at airports[9]
- Alcohol Resistant Film Forming Foam film-forming fluoroprotein foam (AR-FFFP)
- Fluoroprotein foams (FP) have been used for fire protection within the petroleum industry and onboard ships (KEMI 2015).
- Alcohol resistant fluoroprotein foam (FPAR).

Tables 3 and 4 list examples of long-chain and short-chain PFAS identified in FFF brands as part of the EC DG Environment/European Chemicals Agency 2020 study[5]. The brands identified as part of this study were cross checked against the EC study and are marked in bold within Tables 3 and 4. These are discussed in more detail in Section 4 of this report.

Table 3 Examples of long-chain PFAS compounds in foam brands

PFSAs with ≥C6	
PFHxS (C6)	**Angus Fire, 2000; Niagara 1-3** **Ansul AFF Ansulite** 3M Lightwater Angus Fire Forexpan
PFHpS (C7)	3M 1992 3M1993 3M 1998
PFOS (C8)	**Angus Fire, 2000; Niagara 1-3** Angus Fire, 2007, Hi Combat A™ Dr. Sthamer STHMES-AFFF 3% **Ansul Ansulite ® AFFF**
PFNS (C9)	3M Lightwater
PFDS (C10) and	Ansul AFF Angus Fire, N/a Fomtec MB 5
PFUnDS (C11)	None identified
PFCAs with ≥C8	
PFOA (C8)	**Ansul AFFF Ansulite®** Angus Fire, N/a **Angus Fire, 2000; Niagara 1-3** Sthamex AFFF-P 3% **Towalex 3x3**
PFNA (C9)	**Ansul AFFF Ansulite®** Angus Fire, N/a **Angus Fire, 2000; Niagara 1-3** **Towalex 3x3** Towalex 3% master

[11] Swedish Chemicals Agency (2015) Förekomst och användning av högfluorerade ämnen och alternativ. Report 6/15.

PFDA (C10)	**Ansul AFFF Ansulite®** 3M Lightwater Fomtex Arc 3x3* **Towalex 3x3*** Towalex 3% Master
PFUnDA (C11)	Ansul Ansulite® ANSUL Ansulite 6% AFFF
PFD0DA (C12)	**Ansul AFFF Ansulite®** 3M Lightwater Fomtex Arc 3x3 **Towalex 3x3** Towalex 3% master
PFTrDA (C13)	3M AFFFs from 1965 up to 1986
PFTeDA (C14)	3M AFFFs from 1965 up to 1987
PFOcDA (C18)	These are old products from 2007 and earlier

Table 4 Examples of short-chain PFAS compounds in foam brands

PFSAs with ≤C6	
PFEtS (C2)	3M AFFFs A(C2-C3) used from 1998 to 2001
PFPrS (C3)	3M AFFFs A(C2-C3) used from 1998 to 2001
PFBS (C4)	**Ansul AFFF Ansulite** **Angus Fire, 2000; Niagara 1-3**
PFPeS (C5)	None identified
PFCAs with <C8	
PFBA (C4)	**Angus Fire, 2000; Niagara 1-3** **Ansul AFFF Ansulite** 3M Lightwater Angus Fire, 1997 Forexpan **Towalex 3x3**
PFPeA (C5)	3M 1992 3M1993 3M 1998 **Angus Fire, 2000; Niagara 1-3**
PFHxA (C6)	**Ansul AFFF Ansulite** 3M Lightwater **Angus Fire, 2000; Niagara 1-3** Towalex 3x3 Sthamex AFFF-P 3%
PFHpA (C7)	**Ansul AFFF Ansulite** **Towalex 3x3** Sthamex AFFF-P 3%

1.6 Alternatives

Fluorine-free FFF alternatives occupy a smaller share of the market with some 7,000 – 9,000 tonnes[4] sold annually across the EU and are marketed for use on class B hydrocarbon fuel fires such as oil, diesel and aviation fuels and class A fires such as wood, paper, textiles. According to the recent EC report [12], the most common PFAS alternatives can be grouped into four classes; hydrocarbons, detergents, siloxanes and proteins as shown in Table 5. In the case of siloxanes, it was found that their use in FFFs is still under development, whereas numerous hydrocarbons and detergent based foams were available. While the study found that fluorine-free FFFs are generally available, technically feasible and have been successfully used in a number of sectors including airports and the petrochemical industry, it was noted that:

- PFAS-based surfactants were effective at low concentrations within the fire fighting concentrate (≤3% w/w based on data) while the hydrocarbon/detergent alternatives are potentially less effective, meaning greater concentrations are needed with the concentrate product (typically 10-20% w/w)
- A combination of non-fluorinated substances was needed to ensure effectiveness in fire fighting, resulting in increased emissions of hydrocarbons and detergents for example.

Table 5 lists some of the available fluorine free foam brands, some of which were found to be in use by Irish sites. The brands identified as part of this study were cross checked against the EC study and are marked in bold.

Table 5 Fluorine free alternative foam brands[12]

Substance Group	Examples of Supplier and Product Name
Hydrocarbons	• Respondol ATF 3-6% • **Angus Fire: Expandol (aka Expandol 1-3)** • STHAMEX ® 2% F6 Multi -purpose detergent foam: Dr Sthamer • **Dr Sthamer: Moussol-FF®3/6** • Dafo Fomtec AB: Fomtec AFFF1%
Detergents	• **Dr Sthamer: Moussol-FF®3/6** • **Chemguard: 3% AFFF foam concentrate** • vs FOCUM: Silvara APC 3x3 • **Angus Fire: Expandol**
Siloxanes	• 1% AFFF Denko • 6% AFFF Denko Alcohol AFFF 3%

[12] The use of PFAS and Flourine Free Alternatives in fire fighting foams prepared on behalf of EC DG Environment/European Chemicals Agency. June 2020

2 PFAS at EU Level

2.1 PFAS toxicology and the EFSA review

The toxicity and health effects of PFAS is a complex issue which affects regulations and regulatory strategies within the EU. The main issue is that the PFAS group encompasses thousands of compounds and the toxicity endpoints have only been investigated in some detail for a few of these (European Commission 2020)[13].

In 2008 the European Food and Safety Authority (EFSA) published a risk evaluation for PFOS and PFOA (EFSA Contam Panel 2008)[14]. Based on animal studies, the risk assessment established a tolerable daily intake (TDI) of 150 ng/kg body weight per day for PFOS and 1,500 ng/kg body weight per day for PFOA. The TDI corresponds to the amount that a person can ingest every day throughout their life without risking any impact on health. The TDI was based on increased cholesterol levels as the main critical effect of exposure to the PFAS under investigation.

In recent years, EFSA has been working on an updated risk assessment of PFAS as part of a scientific opinion on the risks to human health arising from the presence of these substances in food. The final 2020 version sets out a common Tolerable Weekly Intake (TWI) for the sum of four different PFAS; PFOA, PFNA, PFHxS and PFOS[12]. The evaluation provides a total TWI of these four PFAS of 4.4 ng/kg body weight per week which corresponds to a TDI of 0.63 ng/kg body weight per day. This TWI is based on epidemiological studies which showed a decreased response of the immune system to vaccination as the most critical human health effect when determining the TWI. The same report assesses that the European population are exposed to between 3 and 22 ng PFAS/kg body weight per week.

Toxicity endpoints including TDI are used in various EU Regulations. For instance, PFOS which is designated as a priority hazardous substance within the Water Framework Directive (Directive 2013/39/EU), has set Environmental Quality Standards (EQS) for surface waters in Europe. The EQS value for PFOS is based on a calculation that includes the earlier EFSA TDI value. If the new EFSA TDI value was to be used *as is* for future revisions of the EQS value, the EQS would be lowered by a factor of ca. 240. Toxicity endpoints are also used in the various phases of substance evaluation and risk assessment in EU chemical legislation, and any lowering of the toxicity endpoints will likely have implications for how PFAS are regulated within these also.

2.2 Regulation within the EU relating to PFAS

2.2.1 Restrictions on the marketing and use of PFOS

Directive 2006/122/EC[15] placed restrictions on the marketing and use of PFOS within EU. This included FFF which were not allowed in such products after the Directive took effect. The Directive also stated that FFFs that had been placed on the market before 27 December 2006 could be used until 27 June 2011. Finally, by 2008, Member States had to establish and communicate to the Commission an inventory that covered the amounts of PFOS used in and released from foams and the existing stocks of FFFs containing PFOS.

2.2.2 POPs Regulation

The Stockholm Convention on Persistent Organic Pollutants is used to regulate POPs globally and was brought about by a growing awareness in the early nineties that POPs were posing a major and increasing

[13] EFSA CONTAM Panel (2020) Risk to human health related to the presence of perfluoroalkyl substances in food. EFSA Journal, 18(9). 6223.

[14] until EFSA CONTAM Panel (2008) Opinion of the Scientific Panel on Contaminants in the Food chain on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and their salts. EFSA Journal, 1 - 131.

[15] Directive 2006/122/EC of the European Parliament and of the Council of 12 December 2006 amending for the 30th time Council Directive 76/769/EEC on the approximation of the laws, Regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (perfluorooctane sulfonates

threat to global human health and the environment. In May 1995, the Governing Council of UNEP requested an international assessment process of an initial list of 12 POPs and that the Intergovernmental Forum on Chemical Safety (IFCS) develop recommendations. In 1996, IFCS concluded that available information was sufficient to demonstrate that a global legally binding instrument was required to minimise the risks from POPs. In early 1997, the UNEP prepared an intergovernmental negotiating committee (INC) to establish an international legally binding instrument, initially for the 12 POPs (this list currently stands at 30 substances). This was developed by the INC across six meetings held between June 1998 and March 2000 in various countries. At the first meeting, a Criteria Expert Group was also established to develop criteria and a procedure for identifying additional POPs as candidates for future action. This was developed over two meetings held in October 1998 and June 1999.

The Stockholm Convention has been implemented in one the EU through the EU POPs Regulation (Regulation (EU) 2019/1021) that prohibits or restricts the use of POPs on their own, in mixtures and articles. The POPs Regulation compliments earlier EU legislation on POPs and brings into line with provisions of international agreements on POPs.

Annex I of the POPs Regulation lists substances that are subject to prohibition on manufacturing, placing on the market and use while Annex IV lists substances that are subject to waste management rules according to Annex V.

Since the 4th July 2020, PFOA, its salts and PFOA-related substances[16] were included in an amendment to Annex I of the POPs Regulation (Regulation (EU) 2020/784) with a number of use and concentration based specific exemptions for intermediate use or other specifications.

Perfluorooctane sulfonic acid (PFOS) and its derivatives[17] are included in *both* Annex I and IV, also with several use and concentration-based specific exemptions on intermediate use or other specification.

Another long-chain PFAS, PFHxS, commonly found in many foam formulations and subsequently in the environment and human biomonitoring, is being assessed for restriction. Norway has submitted a proposal to list PFHxS, its salts and PFHxS-related compounds in Annexes A, B and/or C to the Stockholm Convention.

It is also worth noting that the PFAS substances regulated under the POPs Regulations are far more extensive than those listed. i.e. PFOS, PFOA and possibly (in the future) PFHxS. This is because the POPs Regulation also includes a number of related substances that can potentially degrade to PFOS and PFOA[17,18].

Apart from the POPs Regulation, the agreements reached under the Stockholm Convention in relation to POP substances have been integrated into a number of other Regulations including:

- Regulation (EC) No. 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) that includes provisions for assessment of and controls on substances with POP characteristics
- Regulation (EC) No. 689/2008 that concerns the export and import of dangerous chemicals and which prohibits the export of 10 out of the 12 original POP substances listed in the Stockholm Convention, including PFOS.

2.2.3 Water Framework Directive

The Water Framework Directive, (WFD) (Directive 2000/60/EC), commits EU Member States to achieve good qualitative and quantitative status of all designated water bodies according to a set time schedule.

---

[16] Any related substance (including its salts and polymers) having a linear or branched perfluoroheptyl group with the formula C7F15- directly attached to another carbon atom, as one of the structural elements. Any related substance (including its salts and polymers) having a linear or branched perfluorooctyl group with the formula C8F17- as one of the structural elements

[17] C8F17SO2X, (X = OH, Metal salt (O-M+), halide, amide, and other derivatives including polymers)

One part of the WFD covers the chemical quality of the water bodies. This is achieved by identifying and regulating substances of highest concern to the water environment across the EU. These priority substances are listed in Annex I to Directive 2013/39/EC. The same Directive includes Environmental Quality Standards (EQS) which specify maximum concentrations for the priority substances. If one such concentration is exceeded, the water body will not be classed as having a "good chemical status". Member States are obliged to reduce the emissions and discharges of the priority substances and to phase out those that are considered most harmful, i.e. the priority hazardous substances. There are also several other obligations under the WFD for Members States relating to inventories of emissions and discharges as well as environmental monitoring.

Perfluorooctane sulfonic acid (PFOS) is the only PFAS in the WFD and it is designated as a *priority hazardous* substance with EQS values set for water and biota (fish) that are based on risks to human health from consuming fish products. Member States are obliged to ensure that all EQS are met in order to achieve good chemical status in accordance with the WFD.

Member States must also identify substances of national or local concern via River Basin Management Plans and set quality criteria for these. Sweden for example has identified additional PFAS as substances of national or local concern.

2.2.4 Ground Water Directive

Groundwater is partly covered by the WFD, with the Ground Water Directive (GWD) (Directive 2006/118/EEC) expanding on the WFD in certain areas. The GWD focuses on the assessment of the chemical status of groundwater and how to identify increasing trends in specific pollutant concentrations. There are provisions in the Directive to set local/national EQS for substances of concern, and several countries have done this. Sweden for instance has done this for the sum of 11 PFAS.[18][19]

The Directive does not however include PFAS at a transnational level. An initiative was started in 2015 with the aim of attaining information on substances posing a potential risk to groundwater in Europe. These substances are to be included in a voluntary Ground Water Watch List (GWWL) and potentially in future versions of Annex I and/or II to the WFD. PFAS has been monitored by 11 Member States[20] and consequently 10 PFAS were identified as fulfilling the criteria for inclusion in the "List facilitating Annex I/II review process".

2.2.5 Drinking Water Directive

The Drinking Water Directive (Directive 98/83/EC) concerns the quality of water intended for human consumption. Its objective is to protect human health from adverse effects of any contamination of water intended for human consumption. Of note however, is that this Directive does not apply to household single well water supplies.

It sets out minimum requirements for drinking water quality and EU Member States can choose to impose more stringent requirements.

A major revision of the 1998 Drinking Water Directive has been under way since 2014. A final version of the revised Directive has been developed and a provisional agreement was reached by the EU Parliament and

[19] PFBS, PFHxS, PFOS 6:2 FTS, PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA

[20] European Commission (2020) COMMISSION STAFF WORKING DOCUMENT. Poly- and perfluoroalkyl substances (PFAS). SWD (2020) 249 final

the EU Council of Ministers in late 2019. The provisional agreement is expected to be formally approved during 2020 with Member States required to transpose the new requirements into national law *before* 2023.

In the new Directive, limit values for PFAS have been added to Annex I as follows:

- A limit value of 100 ng/l for 20 PFAS[21]
- A limit value of 500 ng/l for all PFAS, e.g. “Total PFAS”. The EU Commission will ensure a method for measuring all PFAS is developed before 2022.

Some drinking water supplies in the vicinity (1 – 20 km) of airports and fire fighting training areas have been closed due to PFAS migration from FFF usage to surface water and groundwater in e.g. Sweden, Norway, UK, USA, Germany, Holland. When the new Drinking Water Directive is transposed into Irish Law, these substances will be required to be measured in drinking water supplies, therefore highlighting potential water supply quality issues, particularly in areas around Irish airports and fire fighting training areas.

2.2.6 Chemical legislation

The PFAS substances covered by the harmonised classification and labelling system according to Annex VI of the Classification, Labelling and Packaging (CLP) Regulation (Regulation (EC) 1272/2008) are set out in Table 6. Apart from the substances listed in Table 6, there is ongoing work to also include PFHpA. Ten PFAS are identified as *Substances of Very High Concern* (SVHC substances) and are included in the Candidate List of the REACH Regulation (see Table 1). As of yet there are still no PFAS subject to authorisation requirements, listed in Annex XIV of REACH.

The public activities coordination tool (PACT) list contains information on substances that are under some form of evaluation under the REACH or CLP Regulation. Work is currently underway to develop restrictions on perfluorohexane sulfonic acid (PFHxS) and perfluorohexanoic acid (PFHxA). There are also discussions on introducing a group restriction for perfluorinated carboxylic acids (C9-C14 PFCs) and substances whose degradation products include these PFAS.

Table 6 PFAS included in EU chemical legislation

PFAS	Cas-number	Restrictions in REACH Annex XVII	Candidate SVHC* substances in REACH	Harmonized Classification and Labelling, Annex VI, CLP
PFOA, any related substances including its salts	335-67-1, etc.	X	X (only CAS 335-67-1)	X
PFOS and its derivatives	1763-23-1, etc.			X
APFO	3825-26-1	X	X	
PFHxS, and its salts	355-46-4, etc.		X	
PFNA and its ammonium and sodium salts	375-95-1, etc		X	
PFDA, and its ammonium and sodium salts	335-76-2, etc		X	X

[21] PFBA, PFPA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFDoDA, PFTrDA, PFBS, PFPS, PFHxS, PFHpS, PFOS, PFNS, PFDS, Perfluoroundecane sulfonic acid, Perfluorododecane sulfonic acid, Perfluorotridecane sulfonic acid

PFAS	Cas-number	Restrictions in REACH Annex XVII	Candidate SVHC* substances in REACH	Harmonized Classification and Labelling, Annex VI, CLP
PFUnDA	2058-94-8		X	
PFTeDA	376-06-7		X	
PFTrDA	72629-94-8		X	
PFDoDA	307-55-1		X	
HFPO-DA (GenX)	13252-13-6, etc.		X	
PFBS	375-73-5, etc.		X	

** Substances of Very High Concern (for Authorisation)*

The continuous work to include various PFAS in different parts of the European chemical and product legislation, will affect the importation and transport of FFF into Ireland containing these PFAS. As there is little known at present in relation to the type and concentrations of these PFAS in FFF in Ireland, implementation of these Regulations may prove difficult.

2.3 Industrial Emissions Directive

Under the Industrial Emissions Directive (IED) (Directive 2010/75/EC), relevant sites are required to prepare a baseline report which establishes the status of soils and groundwater at a site in accordance with the requirements of Article 22 of the Directive.

If a substance used at an industrial site is listed in Annex VI of the CLP Regulation, i.e. has a harmonised classification, it must be included in the baseline IED report as a relevant hazardous substance.

Several PFAS have a harmonised classification (refer to Section 2.2.6 of this report) and therefore consideration may be required on the usage of FFF in Ireland at IED sites for inclusion in the IED reporting cycle. This approach has been adopted in some EU Member States.

2.4 Other EU Regulations

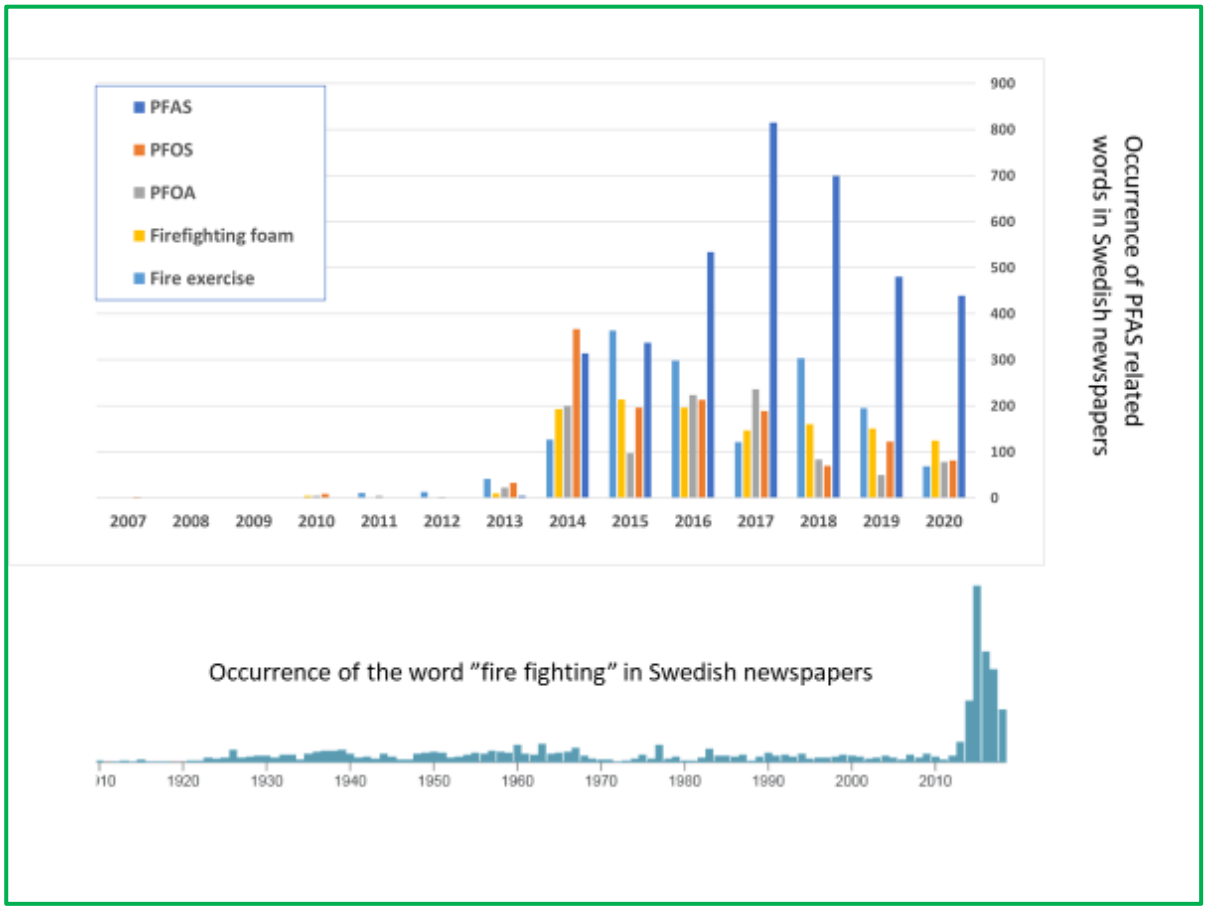
There are several EU Regulations that include reference to PFAS which while not pertinent to this study are listed hereunder for completeness. This includes food contact materials and associated Regulations (Regulation (EC) 1935/2004, Regulation (EC) 10/2011), the Cosmetics Regulation (Regulation (EC) 1223/2009), the Biocidal Products Regulation (Regulation (EU) 528/2012) and maximum levels for contaminants in food (EC 1881/2006) where levels are set by EFSA based on the toxicity review described in Section 2.1.

3 Approach in Other Countries

3.1 Sweden

PFAS has been an issue of focus in Sweden since ca 2010 (refer to Figure 2) when there were several instances of contamination of drinking water by PFAS uncovered as well as cases where fishing was restricted in inland lakes due to the presence of PFAS. From 2010 onwards several drinking water supplies were closed due to PFAS contamination.

Figure 2 Mentions of words associated with PFAS in FFF in Swedish daily press over time



3.1.1 National cooperation and networking

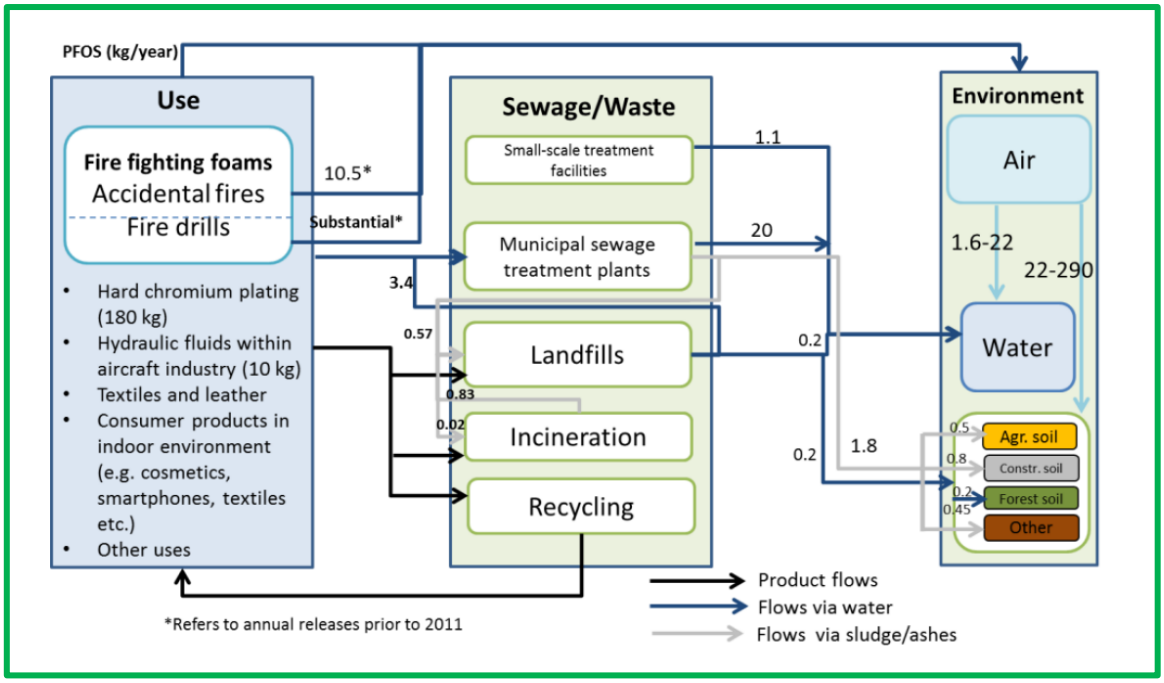
In 2014, a network for national authorities was established with the main aim to coordinate responsibilities on a national level. This network included a number of authorities and agencies, including the Swedish Chemicals Agency, the Swedish Transport Administration, the Swedish Civil Contingencies Agency and the Swedish EPA.

At the same time, the Swedish Chemical Agency (KEMI) and the Swedish Food Agency initiated a national PFAS-network that included national authorities, research institutions, municipalities, water producers and other relevant stakeholders. The aim of the network is to increase and share knowledge on a national level. The network has meetings and seminars twice a year that are open to all interested parties. These events are popular and usually fully booked with attendances from local and regional authorities as well as researchers and representatives from the private sector.

3.1.2 Monitoring, sources and mass balance

In 2016, the Swedish Environmental Protection Agency (SEPA) procured a screening investigation[22] to determine the presence of PFAS in the environment along with the compilation of all previous PFAS investigations in Sweden. A national mass balance of sources to the environment was developed as shown in Figure 3. At the time of this mass balance (2016) there was a lack of data in PFAS in other sources/products. It is likely that the wastewater treatment plant (WWTP) source would be higher if this mass balance was done today.

Figure 3 Tentative mass balance for PFAS in Sweden (2016)



Approximately 6,000 measurements from 2000 - 2016 were assessed with the study showing that PFAS was detectable in 98% of surface water samples. In all samples where PFOS was detected (40%), the (WFD) AA-EQS was exceeded. The EQS for biota was also exceeded, mainly close to fire fighting training sites but also in areas where there were no known point sources of PFAS. Measurements from close to 500 sites showed that up to 80% of all groundwater samples collected close to a fire fighting training site were contaminated (average concentration PFAS-7[23] was ca 44,000 ng/L). In areas with no known point source, ca 40% of the groundwater samples contained PFAS.

In the same report, 2,000 potential point sources were identified, including fire fighting training sites, WWTPs and waste facilities. One of the report's main conclusions was that PFAS are common in the Swedish environment and that human exposure is prevalent which may cause adverse effects. It is also clear there are environmental risks associated with PFAS. *Note* that these conclusions were based on older data on toxicology and environmental risk levels (refer to Section 2.1 of this report).

In 2017, the Swedish government commissioned the SEPA to continue the work on inventory, risk assessment and analysis of all sites where FFFs with PFAS content has been handled. A final report is expected in 2020.

[22] Broad investigation of contaminants in various matrices to provide a rough estimate of typical background and source concentrations within a geographical area
[23] PFBS, PFHxS, PFOS, PFPeA, PFHxA, PFHpA and PFOA

Continuous monitoring of PFOS in surface water is carried out by county administrative boards (in a non-systematic manner) and several water bodies status have been downgraded based on the presence of PFOS. Increased national monitoring is planned by the SEPA.

A 2018 screening study of PFAS in surface soils from Swedish background sites demonstrated that PFAS were ubiquitously detected in Swedish background soil samples with different geographical distributions. In 30% of the background soil samples, the guideline value for sensitive land use was exceeded (refer to section 3.1.6).

Sweden is also regularly monitoring PFAS in marine mammals and birds in addition to marine sediments. This has shown that PFAS levels in marine mammals and birds have been increasing for the last 20 years, and the PFAS congener composition is changing as well. PFAS levels in marine sediments are also increasing.

3.1.3 Regulation

Most Regulations relating to PFAS in Sweden are the result of either direct application of EU law that applies to PFAS (i.e. REACH and CLP) and/or through the transposition of EU Directives into Swedish domestic law. In some instances, Sweden has chosen to add further limits when transposing EU legislation into domestic law.

For example, Sweden has added a limit value for 11 PFAS substances into the Swedish adoption of the WFD. The 11 PFAS are used in the classification of the *ecological* status of surface water (PFOS on the other hand is used for classification of *chemical* status EU wide, refer to Section 2.2.3). Sweden has also chosen to set national limit values for 11 PFAS substances[26] in the Swedish Adoption of the GWD. These are 90 ng/l as an EQS value and 18 ng/l as a trigger value for reversing increasing trends.

3.1.4 Reduction of usage

KEMI is developing a strategy to firstly minimise and reduce the use of PFAS and ultimately eliminate PFAS usage in sources/uses that can cause environmental pollution. KEMI has also proposed national regulation on the collection and destruction of PFAS containing foams associated with fire fighting training activities which are required to operate under an environmental permit. This ensures that facilities of this nature include dedicated collection and retention facilities.

Sweden's largest airport operator (Swedavia) has fully phased out the usage of PFAS in FFF products at all their airports. To ensure that the foams are truly PFAS free, only products that are "fluorine-free" are used. As part of this, all fire fighting equipment that was in contact with PFAS containing foam products is thoroughly cleaned multiple times (e.g. tanks) or replaced (hoses) since the equipment will continue to pollute water and replacement fluorine free foam with PFAS if this is not undertaken.

While municipal fire brigades are still using PFAS containing (but PFOS free) FFFs, there is ongoing work to phase out PFAS containing foams and to clean contaminated equipment. This work is usually initiated by the local regulatory authorities.

3.1.5 Information

The Swedish Civil Contingencies Agency (MSB) is responsible for the education of fire and rescue services. They are working on information campaigns with the aim of both minimising the use of PFAS containing firefighting foams to those occasions when there is no alternative option and to reduce the usage of PFAS in foams. KEMI, SEPA and MSB have produced a brochure with recommendations to only use PFAS containing foams when no other extinguishing methods are applicable, and to collect and send fire overspill water and residues of FFF for destruction via incineration.

3.1.6 Site surveys and contaminated soil

Regulatory agencies (municipalities and county administrative boards) are increasingly focusing on regulatory oversight at both historical and active use sites where PFAS is prevalent, present in soil, groundwater and surface waters. The first stage of this process has been to add all sites with present or historical usage of all FFF to the national registry of contaminated sites.

This has been followed by site investigations both at orphan sites (where the Swedish Government pays for investigations and remediation) and at active sites (where the site operator is mostly financially responsible). Some 30-50 sites are being investigated at present, although this is only a small fraction of the thousands of sites with possible PFAS contamination.

To support the assessment of these sites, guideline values have been established by the Swedish Geotechnical Institute, (SGI) for sensitive soils (e.g. at sites used for building houses) and less sensitive soil (e.g. industrial land) of 0.003 and 0.020 mg PFOS or PFAS 11[24]/kg dry weight, respectively[25]. The guideline values are designed to facilitate risk assessments, to provide a basis for decisions on actions and prioritise different contaminated sites. The guideline values are developed using a quantitative risk model that calculates human exposure through different exposure pathways as well as transport from soil to groundwater and surface water[26]. The calculations result in the production of several guideline values for the protection of human health, ecosystems, and off-site groundwater and surface water. The lowest of these is chosen as the generic guideline value. Site specific risk assessments which include the development of site specific guideline values are frequently conducted in Sweden as the generic values described above are conservative.

3.1.7 Site remediation

There has been a few PFAS-contaminated site remediations in Sweden mostly involving excavation and transport to sites with permits for receiving PFAS contaminated soil. Finding suitable treatment sites however is a key issue since most facilities will not accept PFAS contaminated soils as their leachate treatment facilities will not reduce PFAS. This in turn gives rise to compliance issues for the waste facilities.

The waste facilities that can receive PFAS contaminated soil are using specialised technical solutions e.g. immobilisation of PFAS in the soil-waste in addition to the treatment of PFAS in leachate discharges from these facilities. Soil washing is also being used as a waste solution at one particular site. Consequently, the cost of leaving the treatment of PFAS contaminants as an end of pipe solution results in very high gate fees (typically 100 – 200 euros per tonne). The capacity of these facilities will also not be sufficient to treat all PFAS contaminated soils if a stringent[27] approach is applied in Sweden. This problem of limited capacity and high costs of handling PFAS contaminated soil is prevalent in several European countries.

There is some consensus in Sweden that other remedial strategies/technologies are needed and several large governmental organisations together with universities and consultants are field testing alternative remedial methods. This is mostly being done at airport sites. For instance, Sweco is currently undertaking pilot field testing of PFAS immobilisation in soil and groundwater (two-year study) which involves management techniques such as soil washing and thermal desorption as well as phyto-uptake[28] at Sweden's largest airport (Arlanda).

---

[24] PFBS, PFHxS, PFOS 6:2 FTS, PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA
[25] The guideline values were developed for PFOS. It was however recommended that it be compared to the sum of 7 PFAS (see footnote 24). 2019 – 2020 has been compared to PFAS 11 instead (see footnote 24).
[26] Naturvårdsverket (2009) Riktvärden för förorenad mark. Modellbeskrivning och vägledning. RAPPORT 5976. In Swedish with English summary: https://www.naturvardsverket.se/Documents/publikationer/978-91-620-5976-7.pdf?pid=3574
[27] Applying conservative generic guideline values as a basis for decisions on remediation
[28] phyto-uptake is the uptake of contaminants by plant roots

SEPA and SGI are also working on a guidance document regarding management of PFAS contaminated sites.

Pump and treat methods (e.g. active carbon filter) have been successfully used to treat contaminated groundwater and drinking water although these should be viewed as a protective measure rather than remedial since such pump and treat activities will be ongoing for hundreds of years without decreasing the total mass of PFAS to any significant degree.

3.1.8 Groundwater and drinking water

A preliminary threshold value for PFOS of 45 ng/L has been established for the protection of groundwater as a natural resource and a potential resource for drinking water.

The Swedish Food Agency (SFA) has recommendations on risk-management measures for drinking water contaminated with PFAS[29]. These recommendations are directed at drinking water producers, local authorities and consumers who have private wells or are consumers of locally caught fish. The aim of these measures is to reduce the exposure of consumers to PFAS from contaminated drinking water and fish and to minimise the long-term intake of PFAS. Water producers are responsible for controlling the quality of their drinking water.

There are no legal limits of PFAS concentrations in drinking water. The SFA has established an action level for the sum of 11 PFAS to 90 ng/L in drinking water, i.e. the level at which the water producer needs to take immediate action to reduce the concentrations. At concentrations above 900 ng/L the water is not be consumed.

In Sweden, 35% of all drinking water sources have been analysed for PFAS. It is estimated that ca. 300,000 persons have been exposed to PFAS-levels above 90 ng/L[30] in their drinking water. Analyses of private drinking water wells in a number of site investigations has also highlighted wells with concentrations exceeding 90 ng/l.

Note that this limit level is based on the old TDI value. The new limit level developed by EFSA is > 200 times lower (refer to Section 2.1).

3.2 Denmark

3.2.1 Knowledge gathering

During the last 5 – 8 years, the Danish EPA has launched several initiatives to increase the knowledge on PFAS. This includes reports on health and environmental effects of short-chained PFAS, an inventory of industry sectors where PFAS are used and a review on PFAS contamination in groundwater. There has also been a study on alternatives to PFAS in textiles. In 2018, a report was published by the Danish Environmental Protection Agency on Risk Assessment of Fluorinated Substances in Cosmetic Products.

3.2.2 Monitoring

Denmark performed screening of contaminated soil and groundwater associated with point sources in 2016. It was concluded that there is a risk for PFAS contamination of groundwater at fire fighting sites and that PFAS was found at all sites where there was a known point source in concentrations ranging from a few to several thousand ng/l.

[29] https://www.livsmedelsverket.se/en/food-and-content/oonskade-amnen/miljogifter/pfas-in-drinking-water-fish-risk-management
[30] Swedish EPA (2016) Högfluorerade ämnen (PFAS) och bekämpningsmedel. En sammantagen bild av förekomsten i miljön. Redovisning av ett regeringsuppdrag. Report 6709.

Six PFAS[31] were monitored in surface water, sediment and marine biota from 2009 to 2020. The same substances were also monitored from 2017 - 2020 in aquatic biota as well as incoming and outgoing effluent streams from WWTPs. 11 PFAS[26] are also included in regular national monitoring of groundwater. Furthermore, PFOS and PFOA have been monitored in foods of animal and plant origin since 2011.

3.2.3 Legal and regulatory

As for other EU Member States, PFAS is regulated through the EU Regulations outlined earlier in this report. PFOA and PFOS, however are also included in the Danish EPA List of Undesirable Substances (LOUS). PFAS have undergone a LOUS-review to provide a basis for an assessment of whether there is a need for further regulation and/or other risk reduction measures. An action plan for the reduction of PFOS in Denmark has been developed and is included in the Danish 2013 National Implementation Plan for the Stockholm Convention (NIP). The NIP includes:

1. Clarifying requirements for the disposal of PFOS-containing household waste
2. Assessment of the presence of PFOS in household waste
3. Communication to users of PFOS for acceptable uses in Denmark
4. Notification of acceptable uses
5. Study on the use of PFOS in Denmark
6. Examination of PFOS / PFOA as soil and groundwater contamination.

3.2.4 Reduction of usage

The Danish Emergency Management Agency (DEMA) has acknowledged the environmental issues connected with the use of FFF with PFAS. While in 2016 it was reported that AFFF were not used by DEMA's national fire and rescue centres, there has been no studies undertaken to support this. Nonetheless, the inclusion of PFOA and PFOS compounds in LOUS means that the industry will be encouraged to phase out these substances.

3.2.5 Site surveys and risk assessment

Systematic mapping of PFAS contaminated soil has been required since 2015 and the regional administrations are responsible for preparing and maintaining inventories as well as any remediation works.

A threshold value for soil of 0.4 mg/kg was established for the sum of 12 PFAS[32]. Danish regions have also developed guidelines on how to conduct investigations of PFAS contaminated soil.

The Danish Environmental Protection Agency has performed an evaluation of health hazards by exposure to PFOA, PFOS and PFOSA. This work has also resulted in additional PFAS having been selected for a preliminary screening in relation to toxicity in order to assess the possibilities for derivation of specific quality criteria for the substances.

[31] PFOS, PFOA, PFNA, PFOSA, PFDA, PFHxS
[32] PFBS, PFHxS, PFOS, PFOSA, 6:2 FTS, PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA

3.2.6 Groundwater and drinking water

The Danish EPA has established an administrative quality criterion for groundwater and drinking water of 100 ng/L for the sum of 12 PFAS (see footnote 33). Since 2018, PFAS are included in a list of substances that should be regularly monitored in drinking water.

3.3 Germany

In 2006 a major incident occurred whereby PFAS containing sludge was mixed into a soil conditioner that was subsequently spread onto a number of agricultural sites. The source of the PFAS was thought to be sludge from the paper industry that had been mixed with compost and applied to agricultural fields. Since then, authorities have become more aware of PFAS-issues.

German regulatory authorities are engaging with key stakeholders to exchange information and clarify their concerns regarding industrial PFAS uses. This dialogue includes the feasibility of alternatives, with fire fighting associations compiling information leaflets on PFAS in FFFs.

3.3.1 Monitoring

Since 2018, PFOS is monitored nationally in biota (fish) and surface water, in transitional and coastal waters. PFOS and other PFAS has also been monitored by several Federal States in surface waters in previous years. Retrospective testing for PFOS and other PFAS in archived biological material in the Environmental Specimen Bank is also ongoing. During 2017-2019 wastewater from 49 WWTPs was sampled monthly for several substances including PFOS.

3.3.2 Legal and regulatory

As with most Member States, Germany addresses chemical risk management mainly through EU Regulations. Within the EU context, Germany plans to identify short-chain PFAS as substances of very high concern.

3.3.3 Site surveys and remediation

Many cases are known where the use of AFFF has caused contamination of soil, groundwater and surface water. This includes airports, where FFFs have been used for training purposes and in actual fires after plane crashes (for instance at Düsseldorf airport). The North Rhine-Westphalia State Agency for Nature has estimated that approximately 50% of the known PFAS-polluted sites in North-Rhine Westphalia originate from the use of FFFs.

Under the Contaminated Sites Remediation Program, the Federal Ministry of Defence (MOD) has investigated defence sites to identify potential PFAS risks. 74 sites have been identified as potentially posing possible PFAS-related risks. Consequently, the use of AFFF during training at Federal Defence fire brigades is only allowed when using closed systems.

On a national level, Germany has inventoried PFAS-contaminated soils to some degree but there is currently no co-ordinated approach. Guideline reports are available focusing on identification of contaminated sites.

3.3.4 Limit values

Germany has developed threshold and guideline values to limit the amount of PFCAs and PFSAs in drinking water. Limit values for PFOS and PFOA in sewage sludge used on agricultural fields are set to 100µg/kg. The German Human Biomonitoring Commission has decided to set acceptable blood plasma levels at 2 ng PFOA/ml and 5 ng PFOS/ml. These values represent the concentration below which adverse health effects are not expected and therefore these values have not been revised after the new EFSA review on human toxicology.

3.3.5 Fire fighting foams

A guideline for environmentally responsible use of PFAS containing foams has been published by the German Environment Agency (Umweltbundesamt – UBA). Some Federal States have requirements that fire extinguishing water must be collected (if possible), analysed regarding the PFAS content and properly disposed of thereafter.

4 Survey Methodology

4.1 Introduction

In accordance with the project brief, a survey was developed for dissemination to a broad range of economic operators in identified sectors across the State where the storage and use of FFF is necessitated.

In total, 254 entities were identified as part of the initial 'long list', and 200 were issued with an electronic survey developed by the project team. The sectors and sub-sectors identified, and the relevant number of entities surveyed per sub-sectors are shown in Table 7.

Table 7 Sector and sub-sector of surveyees

Sector	Sub sector	No. of entities identified
Public Sector Users	Local Authority Fire Services	25
	OPW	1
	HSE	1
	Third-Level Institutions	1
Utilities	Gas Networks Ireland	1
	ESB Networks	1
	Ervia	1
	Irish Water	1
Aviation User	Airport/Airfield Operators	24
	Air Corps	1
Marine Users	Naval Services	1
	Irish Offshore Operators Association	2
	Port Facilities	11
	Irish Shipping Operators	6
Users operating under a licence or permit	Waste Management Operators	14
	Seveso (COMAH) sites (with an IE/IPC licence)	27
	Seveso Site (COMAH sites) (without an IE/IPC licence)	20
	VOC Sites	7
	IE/IPC sites	55

Surveys were developed using ESRI ArcGIS Survey 123[33], with outputs from the surveys entered in an MS Access database, to accompany this project report. Surveys were issued to relevant entities using a project specific email (PFAS@sweco.ie) through which all project communication and further queries were managed.

In advance of issuing surveys, contact was made with each relevant organisation, by phone or email, in order to identify the appropriate person within each organisation to whom the survey should be directed. In doing so, a PFAS FFF fact sheet was provided to each entity, a copy of which is included in Appendix A. In addition, the EPA EDEN reporting system was utilised as a means of contacting the relevant EPA licenced facilities to which the surveys were directed.

[33] https://survey123.arcgis.com/

4.1.1 Survey Classification

Given the wide variety of entities within each of the sectors and sub-sectors identified, four different types of surveys were prepared, each focussing on different aspects or nature of FFF use by the different entities. The four types of survey developed, and the classification used in determining the different types, are outlined in Table 8.

Table 8 Survey Types

Survey Type	Description	Types of Fire fighting foam users
Type 1	Individual sites - where the use of FFF is restricted to one site	• Individual facilities operating under relevant licence/permit i.e. COMAH, IPC/IED, VOC, waste • Aviation locations (i.e. airport or aerodrome operators, aircraft maintenance facilities) • Port facilities • Fire fighting training location (one specific site) • Third Level institutes
Type 2	Organisational use - where the use of FFF is distributed across different sites within one organisation	• HSE • OPW • Defence Forces • Utilities
Type 3	Marine use - where the use of FFF is related to the operations in the marine environment	• Offshore locations • Shipping operators and/or individual vessels
Type 4	Local authority fire services - where the use of FFF is related to local fire authorities	• Local Authority Fire Services only

Survey respondents were directed to the appropriate survey (Type 1 - Type 4), according to the category which best described their organisation or operation. Copies of each survey type are provided in Appendix B.

4.1.2 Survey Objectives

The primary objective of the surveys was to attempt to quantify the current amount of PFAS containing FFF stocked by the user, either as part of existing fire suppression systems or being held in stock for future use in the event of incident arising. Where available, quantification of the historical use of FFF by each individual entity was also a central objective.

Other areas of focus for which information was sought in the surveys relate to foam type (brand), supplier, specific use of foam and containment measures employed in the event of release of FFF to the environment. Further detail on the content of the surveys is provided in the following section.

4.1.3 Survey Timelines

The following timeline was followed in the development and issuance of the project surveys:

- Survey development June/July 2020
- Introductory communications issued on 17 June 2020
- Surveys issued end of July 2020, with a deadline of completion before August 28 2020
- Reminder email sent to survey recipients 1 week before the closing date
- Deadline for submissions extended to 9 September 2020 (at which point the surveys were closed to submission of further information)
- After review and validation of information submitted, further information was requested of a number of respondents, with a response timeline of mid-October 2020.

The following sections of the report address:

- Identification of entities surveyed and respondents
- Outline of the information requested in surveys
- Approach taken to validation of information received
- Summary of separate consultation undertaken
- Findings of surveys.

4.2 Survey Requirements

As identified, surveys were structured in four different types, focussed to different respondents.

4.2.1 Common Information

Each of the four survey types required the provision of the same ‘general’ information identifying the type of survey the respondent had selected as being applicable, requesting the respondent’s contact details, as well as information about the site location.

Each survey also offered the ability to attach and submit supporting documentation, such as SDS sheets, list of relevant sites, site layouts, pictures etc.

4.2.2 Type 1, 2 and 3 surveys

Type 1, 2 and 3 surveys contained similar question topics but with slightly different focus - Type 1 presented questions focusing on site specific use of foams, Type 2 presented questions focusing on the organisational use of foams (across multiple sites), while Type 3 presented questions focusing on the use of foams in marine environments e.g. on sea-going vessels.

Questions were presented in relation to the use of FFF onsite i.e. specific use (e.g. automated fire suppression systems, handheld extinguishers, specific training etc.), location(s) of use, details of systems and foam brands, timelines associated with use (periods of use, frequency of use), quantities used annually (historical and current), current stocks maintained onsite and other relevant details.

As there may be multiple uses of FFF on the same site, or across sites within the same organisation e.g. handheld fire extinguishers and automated fire suppression systems, different ‘uses’ could be added to the same survey submission, as well as detail on multiple foam types/brands.

Respondents were also asked to provide details (location, date, foam brands, quantities, and details of containment/disposal) of any releases of foam to the environment other than those identified as a ‘use’ i.e. fire incident, leak, spillage or other accidental release. Where such a release to the environment was confirmed,

respondents were requested to provide detail of whether the FFF released were captured/contained, the ultimate point of discharge of the foam/firewater, and details of the waste management company typically employed for FFF disposal (as applicable).

4.2.3 Type 4 surveys

Initial discussions with local authorities informed the approach to developing the Type 4 surveys focussed on fire fighting services. It was identified that the fire fighting services typically do not keep records of the quantities of foam used at locations and that purchasing records are the only reliable source of information as to how much foam is used by a particular fire fighting service. To this end, questions were focussed on purchasing records and details of foams procured (brands, dates, volumes etc.), as well as establishing details of foam use associated with training locations (locations, types, quantities in stock). In addition, detail was requested in relation to major fire incidents (location, date, quantity and brand of foam used, and firewater management) in order to identify potential sources of large scale 'one off' release.

4.3 Entities surveyed and responses received

An initial 'working list' of 254 entities were identified, with 200 entities issued with surveys, due to the fact that there were a number of entities whereby no points of contact could be made – difficulties arose in establishing communication channels with some organisations due to disruptions caused by COVID-19.

A 'complete response' was when a recipient has responded adequately to the initial survey and to any follow-up queries that had been posed to them (identifying foam brands and quantities) and post validation of their initial response that allowed for determination as to the PFAS containing nature of foams used.

A response was deemed incomplete when either no response was provided to the initial survey issued and/or to any follow up queries posed and where there was inadequate information generally provided.

4.3.1 Validation of the responses

Upon submission of surveys by the respondents, the surveys were reviewed for completeness, the safety data sheets (SDS) and any attachments submitted with the survey were examined, and pertinent information related to the foam types, brands, uses, releases etc., were noted for each site.

Where any 'gaps' in the surveys were present, or any aspects of the survey required further clarification, follow-up emails were issued to the respondents.

4.3.2 Response Rate

Of the 200 entities issued with surveys, there were 86 survey respondents, 77 of which were deemed 'complete' responses – a (complete) response rate of **38.5%.**

Where entities were deemed to have answered sufficiently, the quality of the information provided tended to be high and allowed for a detailed assessment of the relevant survey topics.

As above, of the 86 survey respondents, 9 entities did not respond to further queries posed to them, with a number of these potentially using (or having used) significant quantities of FFF.

There were a number of notable survey respondents which did not provide any survey response, in particular a number of the Type 2 organisations. This is despite first person conversations with representatives of these organisations indicating that responses would be provided.

In addition, no responses were received from Type 3 organisations (marine), while approximately a third of the Type 4 surveyees responded.

The lack of a complete response from these entities may reflect concerns about liability in disclosing the use of foams.

The following table provide a summary of responses received by survey type.

Table 9 Summary of responses received by survey type

Survey Type	Description	Entities surveys	Responses received to survey	Complete responses received	Complete response rate %
Type 1	Individual sites - where the use of FFF is restricted to one site	160	73	65	40.6%
Type 2	Organisational use - where the use of FFF is distributed across different sites within one organisation	7	2	2	28.5%
Type 3	Marine use - where the use of FFF is related to the operations in the marine environment	8 *	0	0	0%
Type 4	Local authority fire services - where the use of FFF is related to local fire authorities	25	10	9	36%

** a response was provided by P&O Ferries which provided information on their North Quay terminal (as a Type 1 survey) but not on their ocean-going vessels*

4.3.3 Determination of PFAS containing nature of FFF identified

Upon receipt of all survey responses and clarification points, and prior to any further analysis of data provided, it was first necessary to identify, insofar as possible, whether FFF identified contain PFAS compounds.

A preliminary task in this regard was also to review each foam identified to assign the correct naming convention – some variation was observed in different surveys when referring to the same foam product.

As an example, the 'broad' term 'Alcoseal' was used in a number of survey responses. For each such foam reference in a survey, the name of the foam used for interrogation was the 'full' name as shown on SDSs or technical data sheets (TDSs) (if provided) and the manufacturers website. Furthermore, as the SDSs can present the same brand name in different layouts, a complete list of the foams under the term 'Alcoseal' was then populated and consolidated, with the correct foam being assigned to relevant surveys e.g. all of the

Alcoseal 3/3, Alcoseal 3:3, and Alcoseal 3-3 grouped together under the same product name, and all of the Alcoseal 3/6, Alcoseal 3:6, and Alcoseal 3-6 grouped together under the same product name.

The primary source of information used in confirming naming convention and in ascertaining the presence of PFAS containing compounds was the SDSs and TDSs provided by survey respondents. This was supplemented by web searches and assessment of product manufacturers websites.

Searches of SDSs, TDSs and other available online information focussed on the presence of or reference to the term 'fluor' within the relevant documentation, either as reference to a product being 'fluorine free' or in reference to the presence of fluorinated substances in the product. This approach mirrors that taken in the methodology applied in the Task 1 'Substance identification' activity, as outlined in the report entitled "The use of PFAS and Fluorine Free Alternatives in fire fighting foams [34] " prepared on behalf of EC DG Environment/European Chemicals Agency.

The same report states that "*the analysis suggests that fluorinated non-PFAS alternatives in the area of fire fighting foams do not exist"* and therefore validates the approach to identification of PFAS containing FFF on the basis of identification of fluorinated compounds.

If an SDS, TDS or other product information source explicitly stated that the foam was 'fluorine free', these foams were noted as being free of fluorine and hence PFAS free.

If the SDS or TDS did not explicitly state that the foam was 'fluorine free', the manufacturer or supplier's website was reviewed in order to aid in the determination. Where it was apparent that fluorine compounds are present in the foam, typically identified in the 'Chemical Composition/Information on Ingredients' section of the SDS or TDS sheet, these foams were noted as being 'PFAS containing'.

There were instances encountered where foam was marketed as being 'non-persistent' but did not specifically state that the product was 'fluorine free' nor indicate the presence of fluorinated compounds. These foams were noted as being 'potentially' PFAS containing. There was also a number of instances whereby a foam's SDS sheet did not suggest the presence of fluorine, but an accompanying product composition breakdown identified multiple fluorine containing constituents. Similarly, a number of SDS sheets or related product information identified some products as 'not containing PFOS or PFOA' while also being indicated as fluorosurfactants.

A summary of FFF encountered in surveys with identification as to their PFAS content is provided in Table 10.

4.4 Separate Consultation & Engagement

In addition to engagement with FFF users, it was identified with the Agency that benefit may accrue from engagement with other stakeholders who, while not directly using foams, could provide useful insight to the use of foams by industry or provide a central point of engagement with foam users. Engagement with the following stakeholders was had during the survey phase.

4.4.1 Construction Industry Federation (CIF)

Initial discussion was had with the CIF, where the purpose and objectives of the project were explained, with a copy of the EPA fact sheet being provided. It was agreed that the project would be discussed internally with relevant individuals and that feedback would be provided, with a view to scheduling a more detailed conference call. However, no further feedback was received, despite follow up requests.

[34] available at: https://echa.europa.eu/documents/10162/28801697/pfas_flourine-free_alternatives_fire_fighting_en.pdf/d5b24e2a-d027-0168-cdd8-f723c675fa98

4.4.2 Engineers Ireland

Contact was made with Engineers Ireland to ascertain whether the project was of interest to their Fire and Safety Division and to elicit any feedback. It was suggested by Engineers Ireland that the writing of a technical article may be the best approach for engagement with their members, which remains open as a future option.

4.4.3 National Directorate of Fire and Emergency Management

The National Directorate of Fire and Emergency Management (NDFEM) provides a support role to local authority fire fighting services through development of fire related policy and the development of guidance documents and codes of practice in relation to fire safety and training. A video conference call was held with a representative of NDFEM and project team members (including EPA personnel) on the 1st September 2020.

While the topic of PFAS in foams was new to the NDFEM representative, the discussion provided an opportunity to outline the future restrictions in relation to PFAS compounds and to understand the general approach taken by local authority fire fighting services to foam procurement and management. The NDFEM representative confirmed that local authority fire services do carry significant stocks of foams.

Additionally, the potential for future engagement in relation to attendance at relevant events/webinars was agreed, as was the possibility to provide specific guidance, through revision/addition to NDFEM guidance documents, in relation to management of PFAS containing foams.

4.4.4 Institution of Fire Engineers (Ireland Branch)

The Institution of Fire Engineers (Ireland Branch) (IFE) is a professional body for fire engineers, with the objectives of advancing education and promoting, encouraging and improving the science and practice of fire prevention, extinction and engineering among its members and the wider community. Engagement between the IFE, project team members and EPA personnel was conducted on the 16th October 2020 via video conference.

The discussion proved very useful and informative, with some of the points discussed summarised as follows:

- The national standard IS291:2015 “Selection, commissioning, installation, inspection and maintenance of portable fire extinguishers” is currently being revised and may represent an opportunity for consideration of PFAS related issues, particularly in the specific appendix relating to environmental impact related to the use of foams
- Given the requirement of IS291:2015 that 25% of an extinguisher is released as part of annual servicing, it is considered that the vast majority of the material is released to the environment e.g. to sewer
- It is estimated that a minimum of 20,000 handheld fire extinguishers are placed on the Irish market annually
- Understanding of the environmental impacts of foams is typically limited across the sector, with the ‘biodegradability’ of certain forms being generally taken as an indicator of acceptable environmental performance.

4.4.5 Apex Fire Ltd.

Contact was made with a representative of Apex Fire who is responsible for handheld fire extinguishers. Apex Fire Ltd had been identified in several surveys as the contracted organisation responsible for the maintenance and testing of units on various sites. The Apex Fire representative was very engaging and knowledgeable on the topic of PFAS with the following noted from the discussion:

- Apex offer a maintenance and testing service which includes the replacement of handheld units in accordance with the requirements of IS291:2015. This involves the removal of units and replacement with new units. The old units are taken to their headquarters in Cavan for refurbishment where possible
- The average life span of the foam is 3-5 years with the spent foam being sent for incineration in the Netherlands
- There is a growing demand from their customer base for fluorine free alternatives, however information from their suppliers on which PFAS substances are within a particular foam is difficult to attain. Similarly, the sourcing of laboratories capable of determining PFAS concentrations to a sufficiently low Limit of Detections (LoD) is also proving difficult
- Their experience to-date is that fluorine-free foams do not match the technical performance of PFAS containing foams.

5 Results of Surveys

Based on the information received from survey respondents, this section presents the findings of the surveys, focussing on a number of headline aspects. A survey database has been prepared presenting survey responses focussing on a variety of aspects, and this section supplements this database by pulling out key aspects of the survey findings. Graphs and tables in the following section outline:

- Foams identified by respondents and determination of PFAS content
- Quantification of foams currently in stock/use:
    - by respondent type
    - by specific use
- Identification of foam type/brand:
    - by volume
    - by specific use
- Identification/quantification of release of PFAS containing foams to the environment.

It should be noted at this juncture that, while information was requested in surveys as to the historical use and quantification of FFF, very little useful information was provided in this regard, with the vast majority of respondents not providing any response to this query. In this regard, quantification of foams in stock or by use relates to volumes as of the time of reporting or in the very recent past i.e. last 12 months prior to the survey being carried out.

5.1 Identification of fire fighting foams and their PFAS content

Table 10 identifies all AFFF brands/types reported by survey respondents, with identification of their PFAS content shown. The source and basis of determining PFAS presence is identified for each product, with the methodology for PFAS identification having been outlined previously.

28 foam manufacturers have been identified, with 72 different foam products listed. Of these:

- 52 products have been determined to be PFAS containing (72%)
- 8 products identified as ‘possibly’ containing PFAS (11%)
- 12 products are identified as not containing PFAS (17%)

Table 10 Fire fighting foams encountered

LEGEND	
Foam product clearly indicated as containing no PFAS	No
Unable to determine content (or otherwise) of PFAS	Possibly
Foam product clearly indicated as containing PFAS	Yes

Manufacturer	Foam	PFAS Containing	Source	Comment (extract/reference from source)
Angus Fire	Alcoseal 3/3	Yes	From information provided in survey	Presence of fluorosurfactant in SDS
	Alcoseal 3/6	Yes	External sources (manufacturers website, product datasheets, other)	Analysis undertaken as part of study entitled “Chemical Analysis of Selected FFFs on the Swedish Market 2014” (KEMI, Swedish Chemical Agency) indicated presence of PFAS compounds: 6:2 FTSAS (fluorotelomermercaptoalkylamido sulfonate) - 3765 µg/kg PFPeA (Perfluoropentanoic acid) – 32 µg/kg PFHxA (Perfluorohexanoic acid) – 796 µg/kg PFHpA (Perfluoroheptanoic acid) – 51 µg/kg PFOA (Perfluorooctanoic acid) – 124 µg/kg PFDA (Perfluorodecanoic acid) – 17 µg/kg
	Alcoseal C6 3/6	Yes	From information provided in survey & External sources (manufacturers website, product datasheets, other)	Listed as C6 technology on website and Hydrogen fluoride listed as a hazardous decomposition product in SDS
	Expandol	No	External sources (manufacturers website, product datasheets, other) https://angusfire.co.uk/products/foam-concentrates/guidance-documents/material-safety-data-sheets/	Listed as 'Fluorine Free' on website
	Expandol LT	No	External sources (manufacturers website, product datasheets, other) https://angusfire.co.uk/products/foam-concentrates/guidance-documents/material-safety-data-sheets/	Listed as 'Fluorine Free' on website
	Forexpan	Possibly	External sources (manufacturers website, product datasheets, other) https://angusfire.co.uk/wp-content/uploads/5130-Forexpan.pdf	Listed under ‘Fluorine Free’ on manufacturers website and stated “Our fluorine free foams are designed not to contain any fluorosurfactants, fluoropolymers, organohalogens, PFCAs, PFOA and no PFOS”

Manufacturer	Foam	PFAS Containing	Source	Comment (extract/reference from source)
				However, 'Forexpan' listed in Tables 3,4. 3.5, 3.6, 3.7 & 3.9 of DG Environment/ECHA report as containing various PFAS compounds including: PFHxS; PFOS; PFOA; PFNA; PFBS; PFBA; PFPeA; PFHxA; PFHpA; 6:2FTS.
	FP70	Yes	From information provided in survey & External sources (manufacturers website, product datasheets, other)	Listed as C8 technology on manufacturer website Hydrolysed protein solution containing fluorosurfactants and glycol solvent.
	C6 FP70	Yes	From information provided in survey	SDS states that “Hydrogen fluoride listed as a hazardous decomposition product”. Also listed as C6 technology on manufacturer website.
	Niagara C6 1:3	Yes	External sources (manufacturers website, product datasheets, other)	Listed as Alcohol Resistant Film-Forming FluroProtein (AR-FFFP) on website; Listed in Tables 3.4, 3.5, 3.7, 3.9 of DG Environment/ECHA report as containing various PFAS compounds including; PFHxS; PFOS; PFOA; PFNA; PFBS; PFBA; PFPeA; PFHxA; PFHpA; 6:2 FTAB; 6:2 FTS; 6:2 FtTAoS; 8:2 FTS; 8:2 FtTAoS
	Niagara 3:3	Possibly	From information provided in survey & external sources (manufacturers website, product datasheets, other)	No clear indication in SDS or websites
	Niagara C6 3:3	Yes	From information provided in survey	Alcohol Resistant Film-Forming FluoroProtein (AR-FFFP) Foam Concentrate
	Nicerol	Possibly	From information provided in survey and internal project team	Hydrogen fluoride listed as a hazardous decomposition product in SDS - No other clear indication
	Petroseal 3	Yes	From information provided in survey	Hydrolysed protein solution containing fluorocarbon surfactants and glycol solvents.
	Petroseal 6	Yes	External sources (manufacturers website, product datasheets, other) http://mscfire.ie/wp-content/uploads/2014/12/Petroseal-6-Data-Sheet.pdf	Petroseal 6 is a superior quality Film Forming Fluoro Protein (FFFP) fire fighting foam concentrate-
	Trainol	No	External sources (manufacturers website, product datasheets, other) https://angusfire.co.uk/products/foam-concentrates/guidance-documents/material-safety-data-sheets/	Trainol 3 and 6 are fluorine free foam concentrates for 3% and 6% usage, which has been specially formulated to provide a unique training foam with a synthetic base material but no fluorosurfactants" -

Manufacturer	Foam	PFAS Containing	Source	Comment (extract/reference from source)
	Tridol S1	Yes	From information provided in survey and external sources (manufacturers website, product datasheets, other) https://angusfire.co.uk/wp-content/uploads/Tridol-S1.pdf	One SDS received mentions "Hydrocarbon surfactants, fluorosurfactants and glycol solvents" and the SDS on the Angus Fire website only mentions 'Hydrogen fluoride' as a degradation component. All 'Tridol' products listed as C6 or C8 technologies of website.
	Tridol 'S' 3%	Yes	From information provided in survey and external sources (manufacturers website, product datasheets, other) https://angusfire.co.uk/wp-content/uploads/5236-Tridol-ATF-3-3.pdf	SDS states "combination of hydrocarbon and flurorocarbon surface active agents" and "Our C6 foams contain no PFOA and no PFOS". All 'Tridol' products listed as C6 or C8 technologies of website. Hydrogen fluoride listed as a hazardous decomposition product in SDS 'Tridol S 3%' listed in Table 3.7 and 3.9 of DG Environment/ECHA report as containing Perfluoroheptanoic acid and fluorotelomer sulfonates
	Tridol C6 ATF C 3:3	Yes	External sources (manufacturers website, product datasheets, other)	All 'Tridol' products listed as C6 or C8 technologies of website. TridolC6 ATF C contains a combination of hydrocarbon and fluorocarbon surface active agents.
	Tridol C6 Ultra 1:3	Yes	External sources (manufacturers website, product datasheets, other)	All 'Tridol' products listed as C6 or C8 technologies of website. TridolC6 Ultra 1-3 contains a unique combination of hydrocarbon and flurorocarbon surface active agents.
Ansul	Ansulite 3% (AFC-3A)	Yes	From information provided in survey and external sources (manufacturers website, product datasheets, other)	Composition certificate lists 3 fluoro compounds and the SDS lists 'Fluorinated oxides' as degradation components. 'Ansul AFFF Ansulite' listed in Tables 3.4, 3.5, 3.6, 3.7, 3.9 of DG Environment/ECHA report as containing various PFAS compounds inlcuding PFHxS; PFOS; PFOA; PFNA; PFDA; PFUnDA; PFDoDA; PFBS; PFBA;PFPeA; PFHxA; PFHpA; 4:2 FTS; 4:2 FtTAoS; 5:1:2 FTB; 6:2 FTS; 6:2 FtTAoS; 7:3 FTB; 8:2 FTS; 8:2 FtTAoS; 9:3 FTB
	Ansulite 3x3	Yes	From information provided in survey and external sources (manufacturers website, product datasheets, other)	SDS and product information sheet list fluoro compounds. "Concentrate is formulated from special fluorochemical and hydrocarbon surfactants, a high molecular weight polymer, and solvents" Ansul AFFF Ansulite listed in Tables 3.4, 3.7, 3.9 of DG Environment/ECHA report as containing various PFAS compounds (as per entry above).

Manufacturer	Foam	PFAS Containing	Source	Comment (extract/reference from source)
Auxquimia	Aquafilm AF-3U	Yes	From information provided in survey	SDS declares "Mixture of fluorosurfactants" composition
Badger Fire	Universal Ultra AR-AFFF Foam	Possibly	External sources (manufacturers website, product datasheets, other) http://www.badgerfire.com/Documents/SDS_ENG_Apr_2015/SDS_Badger_Univ.%20Ultra%20AR-AFFF%20Conc.pdf	SDS doesn't reference 'fluoro' compounds; no clear indication of PFAS presence
Bioex	Ecopol	No	External sources (manufacturers website, product datasheets, other) https://www.bio-ex.com/en/our-products/product/ecopol-a/	"ECOPOL A is a superior quality synthetic Fluorine-Free Foam (F3) concentrate formulated for aircraft fire protection"
CheckFire	Commander	Yes	From information provided in survey	SDS declares "Fluoroalkyl Surfactant" composition
Chemguard	Chemguard 3%	Yes	From information provided in survey	SDS lists "Fluoroprotein foam. Perfluorooctanoic acid" 'Chemguard' listed in Table 3.9 of DG Environment/ECHA report as containing 4:2 fluorotelomer thioamindo sulfonates.
Chubb/Angus Fire	Extra-Eco	Yes	From information provided in survey	SDS states "Perfluoroalkyl amine oxide"
Dafo	Fomtec 3% S	Yes	External sources (manufacturers website, product datasheets, other) https://www.fomtec.com/getfile.php/1316945-1486131557/Bilder/FOAM%20-%20productcatalogue/AFFF/TDS%20-%20Fomtec%20AFFF%203%25%20S%20C6%2007-03-16%281%29.pdf	SDS doesn't reference 'fluoro' compounds, but the product info sheets on the manufacturers website states "Fomtec AFFF 3% S is an aqueous film forming foam concentrate (AFFF) consisting of fluorocarbon and hydrocarbon surfactants blended with various solvents, preservatives and stabilizers."
	Fomtec ARC 3/6%	Yes	External sources (manufacturers website, product datasheets, other) https://www.fomtec.com/getfile.php/1316749-1481554157/Bilder/FOAM%20-%20productcatalogue/AFFF%20ARC/TDS-Fomtec-ARC-3x6%283%29.pdf	Website info doesn't reference 'fluoro' compounds for the product, but the ARC series is not in the 'fluorine free' category of products - https://www.fomtec.com/aqueous-film-forming-foam-alcohol-resistant-concentrate/category36.html
	Fomtec ARC 3X3	Yes	External sources (manufacturers website, product datasheets, other) https://www.fomtec.com/getfile.php/1317080-1491811367/Bilder/FOAM%20-%20productcatalogue/AFFF%20ARC/TDS%20-%20Fomtec%20ARC%203x3.pdf	Website info doesn't reference 'fluoro' compounds for the product, but the ARC series is not in the 'fluorine free' category of products - https://www.fomtec.com/aqueous-film-forming-foam-alcohol-resistant-concentrate/category36.html

Manufacturer	Foam	PFAS Containing	Source	Comment (extract/reference from source)
	Fomtec ARC 3x3 S	Yes	External sources (manufacturers website, product datasheets, other) https://www.fomtec.com/aqueous-film-forming-foam-alcohol-resistant-concentrate/arc-3x3-s-article437-36.html	SDS doesn't reference 'fluoro' compounds, but the product info sheets on the manufacturer's website states "It contains only C6 fluorotelomers" and "that is PFOS free".
	Fomtec FFFP 3%/6%	Yes	From information provided in survey	SDS lists "Fluorosurfactants"
	Fomtec FFFP 6% A	Yes	External sources (manufacturers website, product datasheets, other) https://www.fomtec.com/aqueous-film-forming-foam/afff-6-a-article44-35.html#:~:text=Fomtec%20AFFF%206%25%20A%20is,and%20knocks%20down%20the%20fire	Website describes the foam as "an aqueous film forming foam concentrate (AFFF) consisting of fluorocarbon and hydrocarbon surfactants blended with various solvents, preservatives and stabilisers".
Dr Sthamer	Moussol FF 3/6 F-15	No	From information provided in survey https://www.sthamer.com/download/en/fly/Flyer_MOUSSOL-FF_engl.pdf	Listed as 'Fluorine Free' in product info and on website; 'Moussol FF 3x6' listed in Table 7.1 of DG Environment/ECHA report as a fluorine free product.
	Moussol FF 3:6 F5	No	From information provided in survey https://www.sthamer.com/download/en/fly/Flyer_MOUSSOL-FF_engl.pdf	Listed as 'Fluorine Free' on SDS and website
	Sthamex Class A 0.5% F-15	No	External sources (manufacturers website, product datasheets, other) https://www.sthamer.com/en/pdf/Produktdatenblatt/PD-9071-V09-STHAMEX-class_A_05_F-15_9071-EN.pdf	Listed as 'Fluorine Free' on website, can be used on Class B fires also
	Sthamex 3%	Yes	From information provided in survey	Provided datasheet indicates the foam will comply with the 'significant new use rule (SNUR)' for longchain perfluoroalkyl carboxylate, so contains 'perfluoro' compounds.
	Foamousse FFFP 6% F-15	Yes	From information provided in survey	SDS states "The product contains non-biodegradable fluorosurfactants."
	Moussol APS 3%	Yes	From information provided in survey	SDS states "Fluorinated surfactants"
	Moussol APS Marine 3:6	Yes	From information provided in survey	SDS states "The product contains non-biodegradable fluorosurfactants."
	Training Foam U 3%	No	External sources (manufacturers website, product datasheets, other)	Training and test foams are fluorine-free and 100% biodegradable. Nonetheless, entry into the environment must be avoided.

Manufacturer	Foam	PFAS Containing	Source	Comment (extract/reference from source)
			https://www.sthamer.com/en/training_foam.php	
Firemain Engineering	Profilm Extra 3:6	Yes	From information provided in survey	SDS states "Fluoroprotein foam"
FirePro Systems Ltd.	FPC	Possibly	External sources (manufacturers website, product datasheets, other) https://www.firepro.com/en/environmentally-friendly-fire-suppression	SDS doesn't reference 'fluoro' compounds; no clear indication of PFAS presence
Kerr Fire Fighting	Filmfoam 216	Possibly	From information provided in survey	Hydrogen fluoride listed as a hazardous decomposition product in SDS
	Centrifoam		External sources (manufacturers website, product datasheets, other) https://kerrfire.co.uk/foam-concentrates/	All Centrifoams products on manufacturers website indicate fluoroprotein/fluorochemical composition.
Minimax	Extensid F-6	Possibly	External sources (manufacturers website, product datasheets, other) https://www.minimax.ch/de/perfluorierte-tenside-pft-schaummitteln	SDS doesn't reference 'fluoro' compounds. However, Minimax website states 'Extensid-6 until 12/2002 contained PFOS'
	Extensid F-15	Yes	External sources (manufacturers website, product datasheets, other) http://www.upvcpipe.net/files/Foam%20System%20Application.pdf	3rd party website product info "On a synthetic base, with fluorine components and antifreeze"
Moyne Roberts	1% AFFF Product Code 10010608	Yes	From information provided in survey	SDS lists "Fire extinguishing foam concentrate based on fluorinated and non-fluorinated surfactants. The product contains non-biodegradable fluorosurfactants."
National Foam	Aer-O-Lite 3%	Yes	From information provided in survey	SDS lists "Fluoroalkyl Surfactant" 'National Foam' listed in Tables 3.8, 3.9 of DG Environment/ECHA report as containing various PFAS compounds inluding: PFOSaAm; 10:2 FTAB; 4:2FTS; 6:2 FTAB; 6:2 FTS; 6:2 FtSaAm; 8:2 FTAB; 8:2 FTS
	Universal Gold C6 1/3	Yes	From information provided in survey	Datasheet lists the product is a "C6 Fluorosurfactants" 'National Foam' listed in Tables 3.8, 3.9 of DG Environment/ECHA report as containing various PFAS compounds (as per entry above)..
Orchidee	SC - 1	Yes	From information provided in survey	SDS states "Amphoteric Fluorinated Polymer"
Powers Fire	Power Foam	Yes	From information provided in survey	SDS states "Difluoroethane"
Presto	AFFF	Yes	From information provided in survey	SDS states "Fluorosurfactant composition"

Manufacturer	Foam	PFAS Containing	Source	Comment (extract/reference from source)
Sabo	Hydral AR 3:3 M	Yes	From information provided in survey	"Fluorinated oxides" listed in SDS as degradation product and "AR-AFFF combines fluoro- and hydrocarbon-surfactant technologies" in product information.
Tyco	Towalex ARC 3X3 Plus	Yes	From information provided in survey	SDS lists "Perfluorinated Amphoteric Surfactant" Towelex 3x3 listed in Table 3.5, 3.7 of DG Environment/ECHA report as containing various PFAS compounds. Analysis of Towalex 3x3 undertaken as part of study entitled “Chemical Analysis of Selected FFFs on the Swedish Market 2014” (KEMI, Swedish Chemical Agency) indicated presence of PFAS compounds: PFBA (Perfluorobutanoic acid) – 1008 µg/kg PFPeA (Perfluoropentanoic acid) – 551 µg/kg PFHxA (Perfluorohexanoic acid) - 9770 µg/kg PFHpA (Perfluoroheptanoic acid) -134 µg/kg PFOA (Perfluorooctanoic acid) – 239 µg/kg PFNA (Perfluorononanoic acid) – 20 µg/kg PFDA (Perfluorodecanoic acid) - 63 µg/kg 6:2 FTSAS (fluorotelomermercaptoalkylamido sulfonate) - 8130 µg/kg
	Towalex AFFF 3%	Yes	From information provided in survey	SDS states “based on fluorosurfactants”
Solberg	Arctic 203A AFFF 3%	Yes	From information provided in survey	SDS states"Contains persistent organic fluorochemical(s)"
	Arctic 3x6% ATC AR-AFFF	Yes	External sources (manufacturers website, product datasheets, other) https://www.solbergfoam.com/Technical-Documentation/Foam-Concentrate-Data-Sheets/Arctic-Foam/UL-AR-AFFF/ARCTIC-3x6-ATC-F-2015001-2.aspx	SDS doesn’t reference 'fluoro' compounds while the website states "ARCTIC foam concentrates from SOLBERG are PFOS-free", but the technical datasheets also state "Arctic 3x6 ATC foam concentrate is formulated with C6 fluorosurfactants"
Unite Q	BSX233	Yes	External sources (manufacturers website, product datasheets, other) https://www.traconed.com/files/pub/322.09.RF_PDS.pdf	SDS doesn’t reference 'fluoro' compounds, but is descried on a 3rd party website as a blend of non-Fluorinated and Fluorinated surface tension agents. Fluorinated agents are only “short-chain”.
Viking	3% AFFF	Yes	From information provided in survey	SDS states'Fluoroalkyl' composition
	3% M C6	Yes	External sources (manufacturers website, product datasheets, other) https://www.vikinggroupinc.com/sites/default/files/documents/080917.pdf	SDS declares “based on fluorosurfactants”

Manufacturer	Foam	PFAS Containing	Source	Comment (extract/reference from source)
	ARC 3X3S C6	Yes	From information provided in survey & from external sources (manufacturers website, product datasheets, other) https://www.vikinggroupinc.com/products/foam-concentrates/viking-arc-3x3s-c6-foam-concentrate	SDS doesn't reference 'fluoro', but website identifies that the product contains "fluorocarbon and hydrocarbon surfactants" Website also contains a 'PFAS Warning' identifying that Viking equipment discharges foam containing C6 PFAS; https://www.vikinggroupinc.com/sites/default/files/documents/Viking_PFAS_Warning_051220.pdf
VS Focum	Silvara APC 3	No	From information provided in survey	SDS declares 'Fluorine-free'
	Silvara T3 Class 3%	No	From information provided in survey	SDS declares PFOS and PFOA presence are not expected in the mixture, as a fluorine-free foam.
Williams	Thunderstorm FC601A 1:3 ATC	Yes	From information provided in survey	Product information sheets states "fluorochemical and hydrochemical surfactants in composition"
Shanghai Waysmos Fire Suppression Co., Ltd.	FireFilm-premix 3%Fire Fighting Foam Concentrate	Yes	From information provided in survey and External sources (manufacturers website, product datasheets, other) https://www.gdgroup.ie/wp-content/uploads/2020/09/MSDS-Powerx-Foam-June-16-onwards.pdf	SDS lists "fluoroalkyl surfactant" Website identifies this as a "C6 fluorocarbon surfactant" & "does not contain any PFOS"
3F	Ecofoam 6	Possibly	From information provided in survey	SDS - ECOFOAM 6 is free of persistent components; no clear indication of PFAS presence
	Fluoex 3	Yes	From information provided in survey	SDS Composition: FluoroSurfactant, PerFluoroCoumpounds are persistent in the environment
	Fluoex 6	Yes	From information provided in survey	SDS Composition: FluoroSurfactant, PerFluoroCoumpounds are persistent in the environment
	FP397	Yes	From information provided in survey	SDS Composition: FluoroSurfactant, PerFluoroCoumpounds are persistent in the environment
	Freedol	No	External sources (manufacturers website, product datasheets, other) http://www.3fffuk.com/images/Documentation/Chimie/FREEDOL_SF_FT_UK.pdf	Synthetic Foam Concentrate FFF AR Fluorine Free Solvent Free
	Hyfex 3	No	External sources (manufacturers website, product datasheets, other) http://www.3fffuk.com/images/Documentation/Chimie/HYFEX_FT_UK.pdf	Listed as being fluorine free on manufacturers website

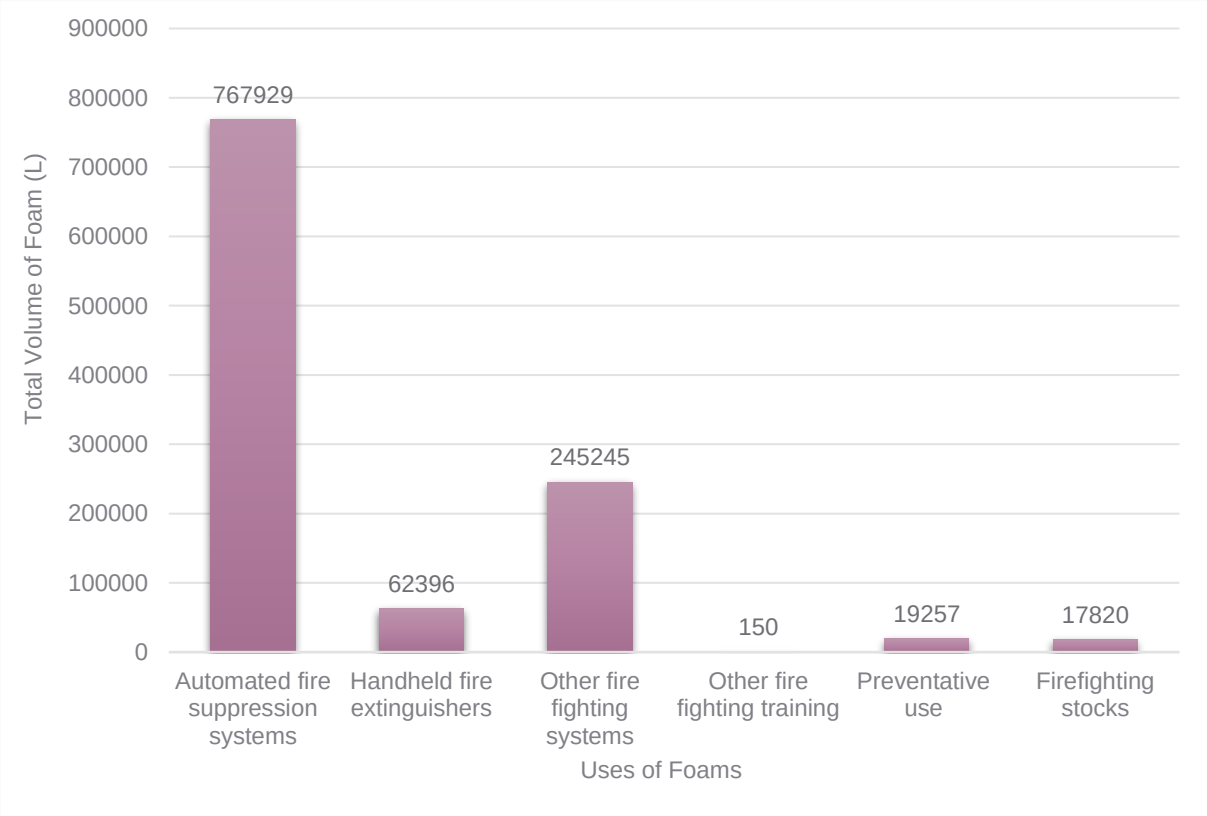
In addition to identifying the PFAS composition of the identified foams in the manner outlined previously, results of chemical analysis of certain foams have been included, where such information is available, albeit this information is presented for only two of the products that have been identified, reflecting the lack of publicly available information on the PFAS composition of AFFF.

5.2 Quantification of fire fighting foams currently in stock

Based on survey responses, volumes of PFAS containing foams currently in stock at respondents' facilities (or related locations) are presented in the following figures on the basis of specific use and are further sub-divided by use per respondent type.

For the purposes of quantification of foams in this section and hereafter, foams identified as possibly containing PFAS will be considered as containing PFAS, in taking a precautionary approach to their PFAS content. In addition, all volumes are presented in litres (L) and quantified in the reported volume of the foam concentrate, irrespective of concentration use. Furthermore, all values relate to the quantity of foam concentrate in an 'unused' state i.e. before having been used in any specific application, including foam concentrates installed in firefighting systems.

Figure 4 Total volume of PFAS containing foams in stock – by use



Commentary:

The total volume of PFAS containing foams currently in stock i.e. having been purchased and contained in fire fighting systems and/or held in stock/storage across Type 1, 2 & 4 survey respondents has been quantified as **1,112,797L.** Of this, **1,075,265L** is held by Type 1 sites.

'Automated fire suppression systems' comprises a significant proportion of this quantity (**767,929L**), where such systems are employed at fuel and solvent storage tank farms at 'Type 1' power plants, fuel terminals and other storage facilities and pharmaceutical facilities.

'Other fire fighting systems' also comprises a large proportion of the total volume (**245,245L**) and typically consisted of standalone fire tenders and response vehicles, mobile foam trolleys, 'cannon' suppression systems at ports, airports, pharmaceutical facilities, fuel storage facilities and power plants.

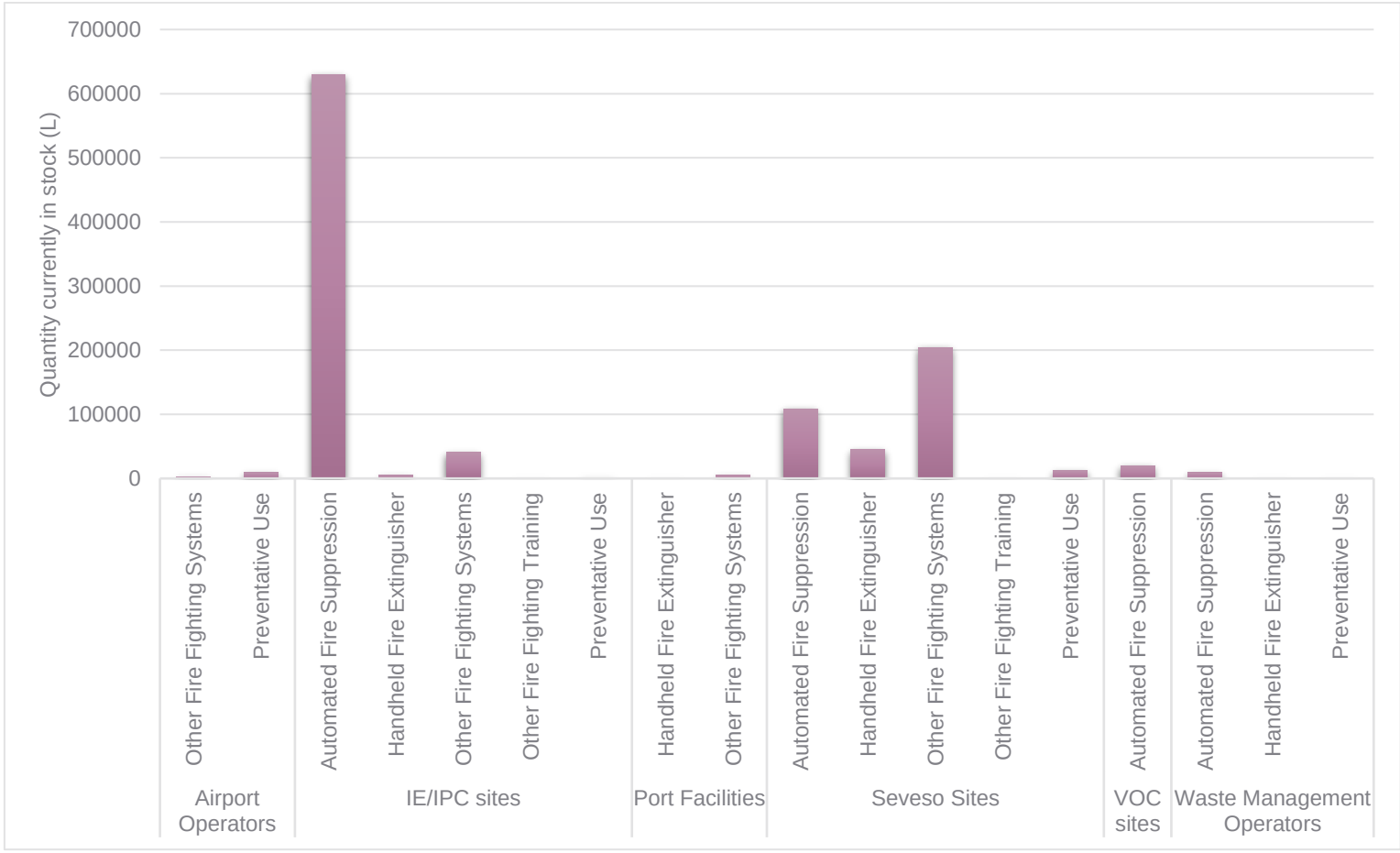
'Handheld extinguishers' form a smaller proportion of foam use (**62,396L**) at survey respondent locations and use is roughly split 2:1 between Type 1 and Type 2 respondents respectively and represent quantities of foam held in extinguishers at these locations (Note, the only foam quantity information provided in relation to Type 2 facilities was in relation to handheld extinguishers). As a representation of volumes of AFFF associated with handheld fire extinguishers, it is considered that this volume is likely to be an under-representation of the 'national' picture, given the expected number of hand-held units in locations not covered by the survey e.g. schools, small firms, offices etc or for those locations where no response was provided.

'Preventative use' (**19,257L**) is identified at a small number of Type 1 facilities and relates to foams specifically stored at locations on these sites to be used in the event of a fuel/oil spillage.

'Fire fighting stocks' relates to the volumes of PFAS foams currently held in stock by the fire fighting services who provided information in this regard (**17,820L**)[35].

[35] Some assumptions made in quantification of this volume on basis of quality of information provided.

Figure 5 Fire fighting applications using PFAS containing foams across different Type 1 installations



***** Seveso sites include sites with and without IE/IPC licences. Seveso sites without IE/IPC licences reported only 16,062L of foam concentrate (of those who responded).

Commentary:

Given that foam quantification information was provided only in relation to handheld extinguishers for Type 2 facilities, Figure 5 provides the variation of uses of PFAS foams across the different types of Type 1 survey respondents only.

Fire fighting systems in the form of 'automated fire suppression systems' and 'other fire fighting systems' comprise the primary use of PFAS containing foams at Type 1 facilities, particularly Seveso/IE/IPC facilities where large quantities of fuel/solvents may be stored.

5.1 Identification of foam type/brand

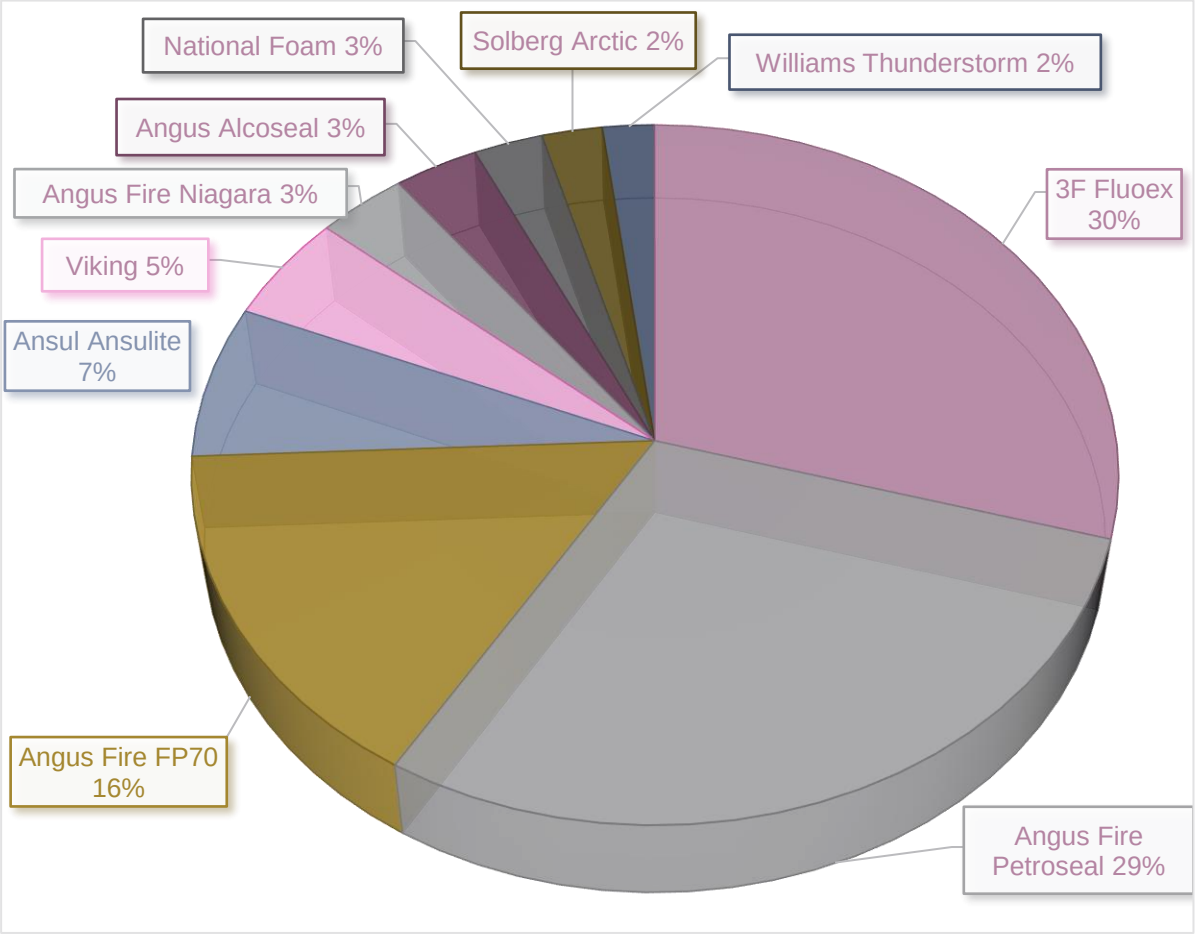
Table 11 outlines the 'top 10' PFAS containing foams currently in stock at Type 1, 2 & 4 survey respondent locations, while their percentage share is illustrated in Figure 6. For ease of presentation, some foams are grouped, where a number of products come within the same brand/sub-brand (as identified in Figure 5 previously).

Table 11 'Top 10' PFAS- containing foams in stock by volume

#	Brand/Type	Product	Volume of Brand (L)
1	3F Fluoex	3F Fluoex 3	295,397
		3F Fluoex 6	
2	Angus Petroseal	Angus Petroseal 6	292,560
		Angus Petroseal 3	
3	Angus Fire FP70	Angus Fire FP70	157,135
		Angus Fire FP70 C6	
4	Ansul Ansulite	Ansul Ansulite 3% (AFC-3A)	70,684
		Ansul Ansulite 3x3	
5	Viking	Viking 3% AFFF	49,900
		Viking ARC 3X3S C6	
6	Angus Fire Niagara	Angus Fire Niagara	34,500
		Angus Fire Niagara 1:3 C6	
		Angus Fire Niagara 3:3	
		Angus Fire Niagara C6 3:3	
7	Angus Fire Alcoseal	Angus Fire Alcoseal 3/6	32,756
		Angus Fire Alcoseal C6 3/6	
8	National Foam	National Foam Universal Gold C6 1/3	26,667
		National Foam Aer-O-Lite 3%	
9	Solberg Arctic	Solberg Arctic 203A AFFF 3%	23,333
		Solberg Arctic 3x6 ATC	
10	Williams Thunderstorm	Williams Thunderstorm FC601A 1:3 ATC	20,000

Note: products highlighted have been identified in Table 10 previously as being likely to contain PFOA

Figure 6 'Top 10' PFAS containing foams in stock



Commentary:

A summary of the use of each of the 'top 10' PFAS containing products is outlined in the following:

3F Fluoex – a significant quantity (279,850 L) stored within an automated fire suppression system at a single facility.

Angus Petroseal – similarly, a significant (279,850 L) quantity of Petroseal is stored within the automated fire suppression system at a single facility.

Angus Fire FP70 – almost all of the reported volume is used at a single facility in County Cork within the automated suppression and 'other fire fighting systems'.

Ansul Ansulite – the Ansulite products are used at a number of Energy Generating and Industrial facilities as part of their automated and 'other fire suppression systems'.

Viking – almost all of the Viking brand foams are used at two facilities in Cork and Dublin as part of automated fire suppression systems.

Angus Fire Niagara – the Niagara brands are primarily used at three facilities (oil refineries and pharmaceutical) as part of their automated fire suppression systems.

Angus Fire Alcoseal – the Alcoseal products are reported to be used at three pharmaceutical facilities as part of their 'other fire fighting systems'.

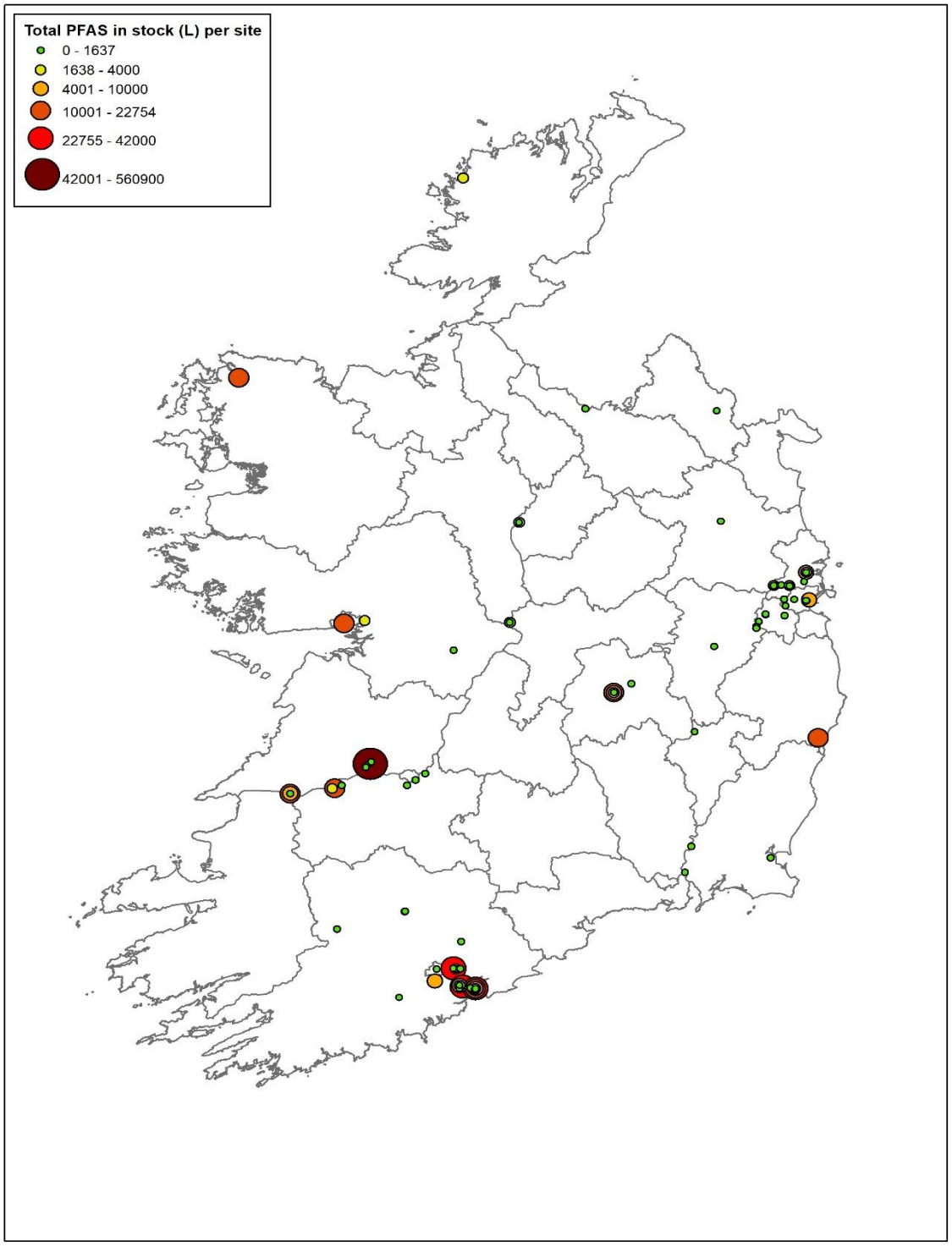
National Foam – two pharmaceutical companies are the largest users of this foam, as part of their 'other fire fighting systems'.

Solberg Arctic – used primarily at two pharmaceutical sites to supply their fire suppression systems.

Williams Thunderstorm – used only at one facility to feed the site's automated fire suppression system.

Figure 7 presents a visual representation of the locations nationally where PFAS containing foams have been identified, noting that this reflects only those locations for which survey responses were received.

Figure 7 Spatial distribution of PFAS foam locations, based on survey responses



5.2 Quantification/Identification of release of PFAS containing foams

Tables 12 and 13 present the data provided in relation to instances where FFF have been released and where the potential to have been directly released to the environment is present.

Tables 12 and 13 relate to Type 4 activities i.e. specific fire fighting incidents and fire fighting training undertaken by fire fighting services, while Table 14 summarises information provided by Type 1 and Type 2 respondents in relation to instances of accidental release of foams at related locations/site.

Table 12 Fire fighting incidents (in last 10 years) where foam released (Type 4)

Fire Service	Description of event:	Foam brand/ Product used:	Quantity of FFF released during this incident (L)	Firewater management during event
1	Aircraft Crash	Petroseal (assumed)	Not reported	Not reported
2	Disused factory https://www.thejournal.ie/blaze-carlow-fire-disused-factory-1853933-Dec2014	Unknown	Unknown	Unknown
3	Large pile of old tyres on fire	Angus Alcoseal AR/FFFP 3/6% used	375	No firewater contained
	Truck carrying plastics went on fire on M7.	Angus Fire alcoseal AR/FFP 3/6%	500	No fire water contained
	Tyres on fire over plastic covering on silage pit.	Angus Fire Alcoseal AR/FFP 3/6	725	Not contained
4	Major landfill fire extending from 11 Jan to 18 Feb 2011. Multiple purchases of foam to deal with this incident as part of fire fighting strategy.	Alcoseal 3-3 AFFP	4,150	All firewater runoff was collected in the leachate ponds at the bottom of the site. Post fire, leachate was removed from site by road tankers and treated at a WWTP.
		Alcoseal 3-6 FFFP		
		Niagara 3-3		
		Fomtec 3-6 FFFP		
		Tridol 3-3.		

Fire Service	Description of event:	Foam brand/ Product used:	Quantity of FFF released during this incident (L)	Firewater management during event
5	Fire Industrial, underground cables on fire	Angus Niagara 3/3	1,000	Not Known
	Truck on fire	Angus Niagara 3/3	400	Not Known
	Multiple vehicles on fire in scrap yard	Angus Niagara 3/3	10,000	Not Known
	Truck on fire	Angus Niagara 3/3	400	Not Known
	Fire Industrial	Angus Niagara 3/3	500	Not Known
	Sheds on fire	Angus Niagara 3/3	Not reported	Not Known
	Fire Industrial	Angus Niagara 3/3	400	Not Known
	Fire in underground car park	Angus Niagara 3/3	400	Not Known
	Large Shed on Fire	Angus Niagara 3/3	400	Not Known
	Car Recycling Centre Fire	Angus Niagara 3/3	3,000	Contained on site, but no further detail provided

Fire Service	Description of event:	Foam brand/ Product used:	Quantity of FFF released during this incident (L)	Firewater management during event
	Fire Industrial	Dr.Stahmer Moussol FF 3/6 F-15	500	Not Known
	Truck on fire	Dr.Stahmer Moussol FF 3/6 F-15	400	Not Known
	ESB Sub Station fire	Angus Niagara 3/3	600	Not Known
	Industrial fire	Dr.Stahmer Moussol FF 3/6 F-15	8,000	Not Known
	Cars on fire in garage	Dr.Stahmer Moussol FF 3/6 F-15	400	Not Known
6	HGV fire carrying rolls of asphalt roofing felt - 100% destroyed by fire - used 120ltrs of Ecopol Foam concentrate at 3% induction with medium expansion foam branch	Ecopol	120	Drains were sealed prior to use and specialist contractor brought in by Local Authori to remove contaminated fire water
	Fire in ESB Transformer after tree damaged during a storm.	Moussol	40	Diluted down the drainage system
	Machinery fire inside the transfer building (Grab Machine)	Moussol	40	Site operates under an EPA licence and has on site receptors - firewater was contained to these.
	Waste tyre fire at farmyard	Moussol	40	Absorbed into ground - no open water sources in location

Fire Service	Description of event:	Foam brand/ Product used:	Quantity of FFF released during this incident (L)	Firewater management during event
	Track machine Fire in Union Wood County Sligo	Moussol	60	Large booms were sent to the site in liaison with Sligo County Council Environment section which contained some and some was absorbed into the ground.
Total quantity of PFAS containing (and possibly PFAS containing foams) released during these reported incidents (Fluorine free foams not included)			**22,850**	

LEGEND	
Foam product clearly indicated as containing no PFAS	No
Unable to determine content (or otherwise) of PFAS	Possibly
Foam product clearly indicated as containing PFAS	Yes

Commentary

The above table presents useful information in relation to the nature and type of fires fought using AFFF over the past 10 years by the six fire fighting services that provided information. What is clearly evident is that in a number of incidents, large volumes of AFFF concentrate have been used to fight the specific fires, with containment of resultant firewater not typical. A trend possibly indicated in the above table, is the use of fluorine free foam concentrate in fire fighting events in more recent years.

On the basis of the information provided by those Fire Service Authorities who responded to the survey, a reasonable estimate of quantities for non-reported fire fighting services over the same period may be 20,000 – 25,000L.

Therefore, a reasonable estimate of volumes of PFAS containing (and possibly PFAS containing foam concentrates) used in fire fighting events over the past 10 years by local authority fire fighting services nationwide can be estimated to be approximately **45,000L**, with the majority of the resultant foam expected to be uncontained.

Table 13 Fire fighting Training where foam released to environment (Type 4)

Fire Service	Training undertaken from:	Training undertaken to:	Foam brand/ Product used:	Frequency of training	Quantities per training event (L):	Current annual use (all sites) (L):	Management of foams
1	2000	Present	Angus Trainol	2 - 4 events per annum	20	120	No capture/containment
2	Not reported	Present	Alcoseal 3/6 AR-FFFP	1 event per annum	25	50	No capture/containment
			Sthamex - Class A 0.5% F-15				
3	Not reported	Not reported	Angus Fire Alcoseal AR/FFFP 3/6	Twice yearly	50	400	No capture/containment
			Dr. Sthamer Foamousse FFFP/AR 3-6 F15%				
			Expandol				
4	Not reported	Not reported	Moussol APS Marine 3/6 F10	Not reported	20 - 40	200	"*Left on yard to decay naturally*"
			Alcoseal -AR-FFFP 3/6				
			Alcoseal -AR-FFFP 3/3				

Fire Service	Training undertaken from:	Training undertaken to:	Foam brand/ Product used:	Frequency of training	Quantities per training event (L):	Current annual use (all sites) (L):	Management of foams
5	2013	2020	Angus Forexpan	20 events per annum	25	500	Foam training conducted in designated area. Foam dispersed using water jets post training event.
	2013	2020	Angus Niagara 3/3	20 events per annum	25	500	
	1985	2020	Moussol FF3/6 F -15	20 events per annum	25	500	
	1985	2020	Silvara APC 3	20 events per annum	25	500	
	1985	2020	Dr Sthamer Training Foam U 3%	20 events per annum	25	500	
6	1985	2020	Petrosea	4-6 events per annum	20	100	All drainage from the site goes into surface water drains and into the network. *("For the past 10 years only environmentally friendly foams have been used in training. If possible, we substitute with washing up liquid)*
			Expandol				
			Ecopol				
			Moussol-FF 3/6				
7	2010	2020	Expandol	10 events per annum	25	250	Normally diluted and dispersed to ground using water.
			Niagara 3-3				
			Alcoseal 3-6				
8	Not reported	Present	Sthamex Class A 0.5% F15	1-2 events per annum	100	250	Dedicated training area, fire water and foams run from training area into foul water sewers
			Angus Alcoseal				
Estimate Annual quantity of PFAS containing (and possibly PFAS containing foams) released during training at these sites						**2,300**	

LEGEND	
Foam product clearly indicated as containing no PFAS	No
Unable to determine content (or otherwise) of PFAS	Possibly
Foam product clearly indicated as containing PFAS	Yes

Commentary

The obvious conclusion from the above table is the general absence of containment and appropriate treatment of foams/foamwater used in training at the locations identified. Management of foams is either through direct discharge to foul sewer or run-off to ground infiltration. In most instances, use of PFAS containing and fluorine free foam concentrates have both been reported as being used in training at these locations. Frequency of training varies between the different services, albeit the amount of foam concentrate used per training event is generally consistent at 20-25L i.e. one ‘drum’ of foam concentrate.

Of the estimated annual quantity of PFAS containing (and possibly PFAS containing foams) released during training events, one Fire Authority Service accounts for approximately 65% of the foam concentrate released.

On this basis, it can be estimated, on the assumption that fire fighting training practices are similar across the country, that approximately **4,000 to 5,000L** of FFF concentrate are used in training events by fire fighting services annually, with this assumed to be, in the majority of instances, manged through infiltration to ground with potential environmental contamination implications.

Table 14 Accidental foam releases (Type 1 & 2)

Brief description of the release to the environment:	Type/Brand of FFF released:	Estimated Quantity of FFF concentrate released (L)	Provide detail as to how captured/contained FFFs were disposed of:
Accidental fire foam release into diesel tank and some into surrounding bund. This was caused when testing fire system and accidentally activating the diesel tank foam discharge system.	Tridol S 3% Afff	20	Discharge to surface water drainage
There was a false activation of the fire suppression system in 2006. An amount of material was released from site through a drain that went into the main Dublin port drainage system.	Viking 3% aqueous film forming foam	20	Some captured in SW storage, some released to wider port SW drainage network
Site tank farm deluge false activation. The linear heat foam deluge system in the tank farm activated and AAAF Fire foam was released.	Tridol 1x3% AFFF AR C6 Ultra 13	20	Onsite wastewater treatment plant
Warehouse Drum store, foam activation/spillage during project work.	Tridol C6-ATF-C-33	20	Onsite wastewater treatment plant
Routine maintenance check resulted in blockage with backflow to foam tank which then overflowed to bund.	Niagara 3/3	20	To dedicated retention facility
Previous owners of the site had an incident which required the use of the sprinkler systems and foam cannons	National Foam Universal Gold 1/3	20	To dedicated retention facility
Air Handling Unit of Hanger	Unknown	20	To dedicated retention facility
Leak of dilute fire fighting foam - All material was retained on site and as agreed with the EPA and Irish water, was discharged directly to the Irish Water Sewer.	Fomtec Arc 3X3	20	To foul sewer
Leak of FFF - South of production buildings	Fomtec Arc 3X3 S	15	To foul sewer
Commissioning / testing of Oil Wharf fire fighting system.	FP70	not reported	Direct to water (sea)

LEGEND	
Foam product clearly indicated as containing no PFAS	No
Unable to determine content (or otherwise) of PFAS	Possibly
Foam product clearly indicated as containing PFAS	Yes

Commentary

Information provided in relation to accidental releases of AFFF at Type 1 and 2 facilities typically identifies (relatively) small quantities of PFAS containing (or potentially) containing foam concentrate release that has generally been captured in dedicated retention facilities, onsite wastewater treatment plants or to foul sewer. In addition, such releases are generally infrequent, with the 10 incidents reported by 8 survey respondents spanning a period from 2006 to 2020 and each being reported as a specific incident in accordance with relevant licence conditions, where applicable.

5.3 Identification of suppliers of foam to the Irish market

Using the list of foam brands identified in Table 10 earlier, an internet search was conducted to identify suppliers of foams to the Irish Market. Table 15 provides a summary of the results of this exercise. No Irish manufacturers were identified.

Table 15 Foam suppliers to the Irish market

Supplier Name	Brands	Comments
MSC Fire	Exclusivity of Angus Fire	-
Firetrade	Ever Tuff, Ansul, Solberg	-
ABC MacIntosh Ltd	3F	-
Action Fire Security Services	Ansul	-
Vanguard Fire & Rescue	Fomtec	-
Fire Products Direct	Moyne Roberts	Handheld foam extinguishers
Apex Fire	Moyne Roberts	Part of the Moyne Roberts Group
Antifyre Ireland	Not specified	Handheld foam extinguishers
Amber Fire	Not specified	A wide variety of FFF concentrates reported on their website as: • Protein 3% & 6% • Fluoroprotein 3% & 6% • FFFP – Film Forming Fluoroprotein 3% & 6% • FFFP-ARC Alcohol Resistant Film Forming Fluoroprotein 3% x 3% & 3% x 6% • Avalanche – Low Viscosity Alcohol Resistant Film Forming Fluoroprotein 3% x 3% & 3% x 6% • FFF – Aqueous Film Forming Fluoroprotein 1%, 3% & 6% • Alcohol Resistant AFFF 3% x 3% & 3% x 6% • High Expansion Training Foams
Advanced Fire Protection	Not specified	Handheld foam extinguishers
Standard Fire Safety Ltd	Not specified	Handheld foam extinguishers, Ansul kitchen fire suppression system
AutoFireX Ltd	Orchidee	-

6 Conclusions and Recommendations

In considering the survey responses and findings based on information provided, a number of points are made:

- Given the wide variation in type of respondents surveyed, differences in the level of detail provided in responses and the lack of responses by some surveyees, the findings of the surveys undertaken should be considered as a 'snapshot' of the current situation that pertains to the use of PFAS containing foams in Ireland - this snapshot however allows a number of conclusions to be drawn.

- The primary users of foam concentrate, from a volume perspective, are those 'Type 1' facilities with tank farms and/or significant quantities of stored solvents, fuels and other chemicals which can be specified as power generation plants, pharmaceutical/chemical facilities, fuel storage facilities and aviation hangers.

- A knowledge gap remains in relation to the quantification and extent of the use of handheld extinguishers. Initial discussions with some large-scale public sector 'Type 2' organisations indicated the likelihood of thousands of buildings/facilities coming within their control, each containing a number of handheld units.

- Similarly, little information was provided in relation to the Type 3 'marine operations' locations – it is understood that only two offshore drilling platforms are in place off the Irish coast which are undergoing decommissioning. However, initial discussions did indicate the presence of FFF on these platforms. In addition, initial discussions with a port facility indicated the use of FFF on tugs used in port related operations.

- The 1,112,797L of PFAS containing foam currently in stock in the respondent sites is largely held at a relatively small number of large industrial fuel storage/processing facilities or at large pharmaceutical facilities with solvent/fuel tank farms for use in automated or other onsite fire fighting systems. The median value of PFAS containing foams held at Type 1 facilities is 1,000L.

- Given the number of survey non-respondents and other location that were not include within the survey long list, the actual total volume of PFAS containing foams (across all identified uses) in stock at locations nationally is likely to be a significant multiple of the 1,112,797L identified.

- Approximately two-thirds of the 1,112,797L identified as being currently in stock comprises brands associated with two manufacturers – 3F and Angus.

- No large scale releases to the environment have been reported associated with 'Type 1' facilities. Where releases have typically been identified as c.20L of foam concentrate – notwithstanding the lack of survey responses overall, information provided on accidental releases, particularly as sites operating under licence/permit, generally indicate the capture of these releases in retention facilities or onsite WWTPs. However, in these instances, PFAS release to the environment is likely to have occurred post wastewater treatment.

- Releases of PFAS containing foams to the environment appears to be commonplace in terms of both fire fighting training and actual fire fighting incidents by local authority fire fighting services and thus pose the highest degree of risk of environmental contamination. While some fire services have indicated the use of fluorine free alternatives in training and fire fighting, the majority of foams used are PFAS containing (or possibly PFAS containing).

- Capture of FFF at fire fighting training locations is typically non-existent, with infiltration to ground being common or capture in a foul sewer network if relevant to the particular site. A 'ball-park' estimate of annual PFAS foam concentrate release to the environment from all national local authority fire fighting training activities is 4,000 – 5,000L.

- Similarly, capture of PFAS containing foams at individual fire fighting events appears uncommon, with some significant use (and therefore release) of foams occurring – one incident covered by Dublin Fire

Services resulting in 10,000L of foam concentrate being used. PFAS containing foam release to the environment nationally through fire fighting is estimated at 45,000L over the last ten years.

- Engagement with stakeholders has indicated a significant knowledge gap on PFAS matters including the forthcoming restrictions which will have significant consequences for manufacturers, suppliers (and importers) and users of PFAS containing foam.
- While there is a willingness by users to change to fluorine-free foam, the availability of information on foam products specification in relation to PFAS content is highlighted as an issue. This was evident from the number of sites who were unable to determine from SDSs and TDSs whether the foam they were using was PFAS containing. For example, "PFOS-free" foam products may still contain PFHxS.

6.1 Recommendations

Based on the findings of the study, the following recommendations are made.

Recommendation No. 1 - Awareness Initiatives

It is clear from the survey results and the consultation conducted with umbrella organisations in the fire fighting sector, that there is a need for awareness raising and knowledge sharing. The successful measures undertaken by regulatory agencies in the countries examined in this study are models of how some '*low hanging fruit'* initiatives have been successful.

In an Irish context, this could include the establishment of a national PFAS steering group or network involving industry stakeholders such as IBEC (BioPharmaChem Ireland), the National Directorate of Fire and Emergency Management, the Institution of Fire Engineers, the Health and Safety Authority (non-licenced Seveso sites) as well as a number of FFF suppliers, functioning as a forum for information sharing on technical and legislative developments. Engagement with Irish Water is also required to highlight the significant potential for PFAS release from their facilities.

Work may be required on the use of fluorine free AFFF in existing systems given that a like-for-like substitution may not be possible in all cases, due to some technical constraints. International case studies have indicated that some testing, modification of equipment, storage considerations and training has been required on sites where successful transition has been made to fluorine free foams but the secondary consequence of this is that the transition has in some cases taken several years. Early engagement with industry is therefore paramount and consideration is required as to whether the focus of this engagement should be a complete switch to fluorine free foam from the outset to account for the likely ban of PFAS (or further individual PFAS substances) containing FFF in the future.

Recommendation No. 2 - Fire services sector

Given that fire training activities and fire fighting activities are important sources of potential (or actual) release of PFAS to the environment, the following recommendations are made:

- Due to time constraints associated with this study, further engagement/follow-up with each local authority fire service who did not respond to the survey was not possible – it is recommended that a more detailed study of each local authority fire fighting service be undertaken, through direct engagement in the form of discussions/meetings with each Chief Officer, in order to:
    - Quantify the extent of use of PFAS containing foams for each fire service for training exercises and use in incidents

- Identify (through site visits) each relevant location within the local authority area used for fire fighting training and subsequently map these areas to identify and potential impacts on nearby drinking water sources. This can be done in conjunction with the Geological Survey of Ireland (GSI)

- Ascertain the location of large fire fighting incidents that released PFAS foams in the last 10 years for each local authority fire service

Such a study could be directed more prominently through the National Directorate of Fire and Emergency Management (NDFEM) and/or the Chief Fire Officers Association (CFOA), from a stakeholder engagement perspective, and it would provide more specific detail that may inform any further sampling/assessment work undertaken in relation to potential PFAS-contamination 'hot spots'.

- Undertake a similar exercise in further engagement with selected entities where fire fighting training (or actual fire fighting) occurs and who did not respond[36] and the National Maritime College.

- In engaging with NDFEM and other stakeholders, explore the potential for development of specific guidance documents in relation to legislative developments concerning PFAS foams, the promotion of fluorine free alternatives and best practice in relation to AFFF[37]. In addition, it may be beneficial to assess the potential for revision/amendment of existing NDFEM guidance and standard operational procedures documentation to take account of aspects related to PFAS foams. For example, an initiative in Michigan recommends that fire fighting services only use 'Class B' foam in instances of 'saving of life' or for 'critical infrastructure', with reporting requirements applying when these foams are used[38]. In addition, this initiative has run alongside a Class B foam 'take back' scheme operated by the Michigan Department of Environment, Great Lakes and Energy[39] and such a take back (or similar combined management) scheme related to the fire fighting services could be considered, given the greatest risk of PFAS release to the environment is associated with fire-fighting activities.

- Engagement with the National Standards Authority of Ireland (NSAI) in relation to the revision of the IS291:2015 standard in relation to portable hand held fire extinguishers is recommended as a useful means of influencing the content of foam contained therein as well as changes to address the management of foams discharged from hand held units.

- Potential PFAS exposure associated with firefighter clothing (known as 'turnout gear') is a related topic of potential future consideration[40], with the water-resistant properties of the clothing resulting from its treatment/manufacture with PFAS compounds.

Recommendation No. 3 – Expansion of Monitoring Programme for Priority Substances

The EPA are conducting a separate, limited monitoring contract in relation to some potential hotspots for PFAS-contamination identified by this study. Given that the survey conducted as part of this report has highlighted the use of PFAS containing foams at fire training locations and mostly likely at airport facilities, monitoring of surface and ground waters in these areas should be prioritised and in particular in any waterbodies used as drinking water sources. It is recommended that any future monitoring encompass the 20 PFAS substances that have been added to the new Drinking Water Directive. This data in turn can be used in the development of EQS values for Ireland under the new GWD.

[36] Response provided but further engagement beneficial – number of locations of interest
[37] For example: "Fire Fighting Foam Coalition – Best Practice Guidance for Use of Class B Fire fighting Foams"; available here: https://docs.wixstatic.com/ugd/331cad_188bf72c523c46adac082278ac019a7b.pdf
[38] https://www.michigan.gov/pfasresponse/0,9038,7-365-86514-496805--,00.html
[39] https://www.michigan.gov/documents/pfasresponse/Letter_re_Collection_and_Disposal_of_Class_B_AFFF_Containing_PFAS_683826_7.pdf
[40] https://www.firerescue1.com/personal-protective-equipment-ppe/articles/study-finds-high-levels-of-pfas-in-turnout-gear-CMRo7kC9SBX1pDLw/

Sludge arisings from Irish Water WWTPs require testing also to characterise PFAS concentrations which could influence the management of these waste streams[41]. This is particularly important where sludges are being applied to agricultural lands. For example, Sweden has taken the step to suggest limit levels for PFAS in sludge used in agricultural applications.

Recommendation No. 4 - Examination of disposal routes for discarded foam and accidental release

Consultation with foam suppliers has indicated a varying shelf life of foams can result in not all foams being used before expiration. Disposal of these foams and 'legacy foams', which will arise from likely further PFAS restrictions requires consideration from an emissions perspective given that they are resistant to thermal destruction at lower temperatures. For example, studies by the US EPA showed that temperatures of 1000°C and a residence time of 2 seconds were sufficient to destroy PFOA[42]. However, for more PFAS compounds, temperatures of at least 1,100°C in addition to longer residence times is needed for complete destruction. International studies have also shown that treatment at industry norm WWTPs (primary and secondary only) to be largely ineffective in the destruction of short and long chain PFAS substances.

There is currently no suitable national waste treatment capacity for PFAS containing foams, and while a number of Irish waste contractors were listed for the potential management of FFF in some survey responses, it is unclear how such foams would be managed.

Evidence from the survey also indicates that even facilities with dedicated retention capacity will ultimately end up discharging PFAS containing run-off/effluent direct to water or indirectly via on-site WWTPs or sewer in the event of an incident, an accidental release or after regular fire fighting training activities. In some instances, there may be no alternative solution given the volumes that are involved and consequently substitution of fluorine free alternatives is critical in these circumstances. Further data on possible PFAS contamination levels is therefore required from Irish Water facilities responsible for treating this waste (refer to recommendation 4 above).

Recommendation No. 5 - Development of Sector Specific Guidance/Fact Sheets

It is recommended that a number of sector specific guidance documents and/or fact sheets be developed to address a number of topics relevant for different stakeholders, with the following suggested:

- Guidance for the Identification of PFAS containing firefighting foams brands, where analysis or other relevant information confirms the presence of PFAS compounds – it is understood that the Agency intends to undertake testing of AFFFs used in an Irish context for the presence of PFAS compounds, the results of which can inform the development of such guidance. In addition, this guidance could also include a simple methodology that can be applied to identify 'probable' PFAS content, where compositional analysis may not be available

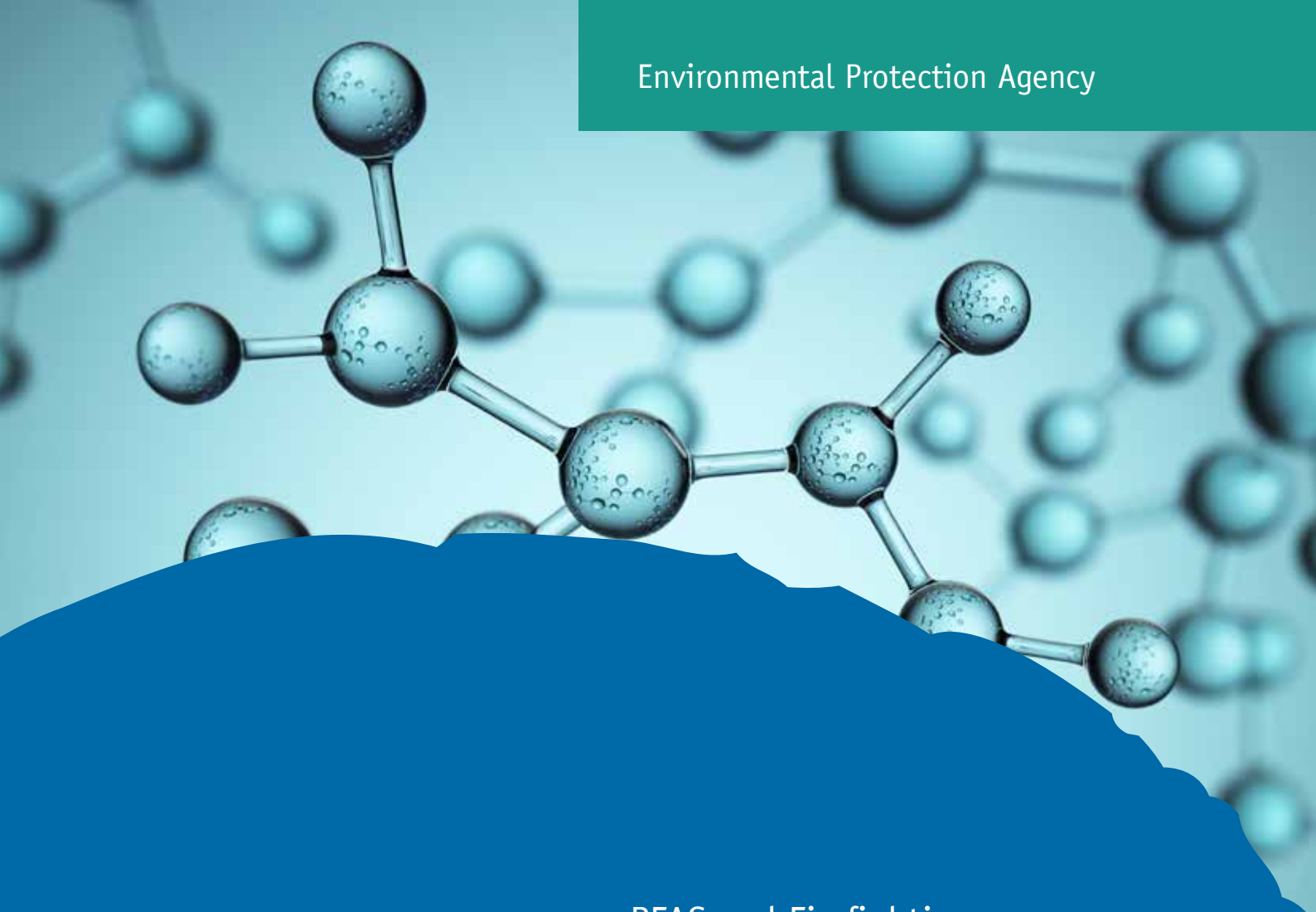
- Best practice in relation to the disposal, treatment and management of PFAS containing concentrates and PFAS containing fire water

- The promotion of fluorine free foams in training and best practice in relation to the capture of run-off from 'live' emergencies as soon as practicable. It is recommended that this address both industry and fire authority activities, particularly where there is no containment.

[41] "Long-chain perfluorinated chemicals in digested sewage sludges in Switzerland" Sun H. et al, 2010; available from; https://www.academia.edu/14154871/Long_chain_perfluorinated_chemicals_in_digested_sewage_sludges_in_Switzerland
[42] UNEP, 2012 available at The use of PFAS and Fluorine Free Alternatives in fire fighting foams prepared on behalf of EC DG Environment/European Chemicals Agency. June 2020

In developing such guidance, it is recommended that PFAS ‘as a whole’ is considered, rather than focussing on a small number of individual PFAS compounds. While the legislative position currently focusses on PFOA and upcoming amendments, the potential PFAS ‘ban’ in firefighting foams as a result of the ECHA proposal for restriction of same indicates the direction of movement on this topic. Therefore, identification of the relevant issues and promotion of best practice and alternatives should be addressed in the context of PFAS overall.

Appendix A – PFAS Factsheet



PFAS and Firefighting Foam Fact Sheet

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

PFAS Fact Sheet

CHEMISTRY AND NAMING OF PFAS

"PFAS" is an abbreviation for "per- and polyfluoroalkylated substances" which are organic chemicals with fluorine attached to a carbon chain. This is a very large and diverse group of chemicals consisting of at least 4,700 substances.

It should be noted that less than 40 PFAS are commonly identified using available analytical technologies. Available health and toxicity studies are limited to even fewer PFAS. In essence, there is very little or no information on the behaviour and toxicity of >99% of known PFAS.

PFAS USAGE

PFAS have been used in industrial and consumer applications since the 1950s. The physical and chemical properties of PFAS impart friction reduction, surfactant abilities, repellence against oil and water as well as chemical and thermal stability in products to which they are added. PFAS are hence used in many sectors including the semiconductor, aerospace, automotive, medical, construction, and electronics industries. PFAS are common in everyday consumer products such as outdoor equipment, food packaging, carpets, clothing, furniture and cosmetics. They are also used in cleaning products and paints.

FIREFIGHTING FOAMS

> The main function of PFAS is to give firefighting foam products *spreading* and *sealability* properties.

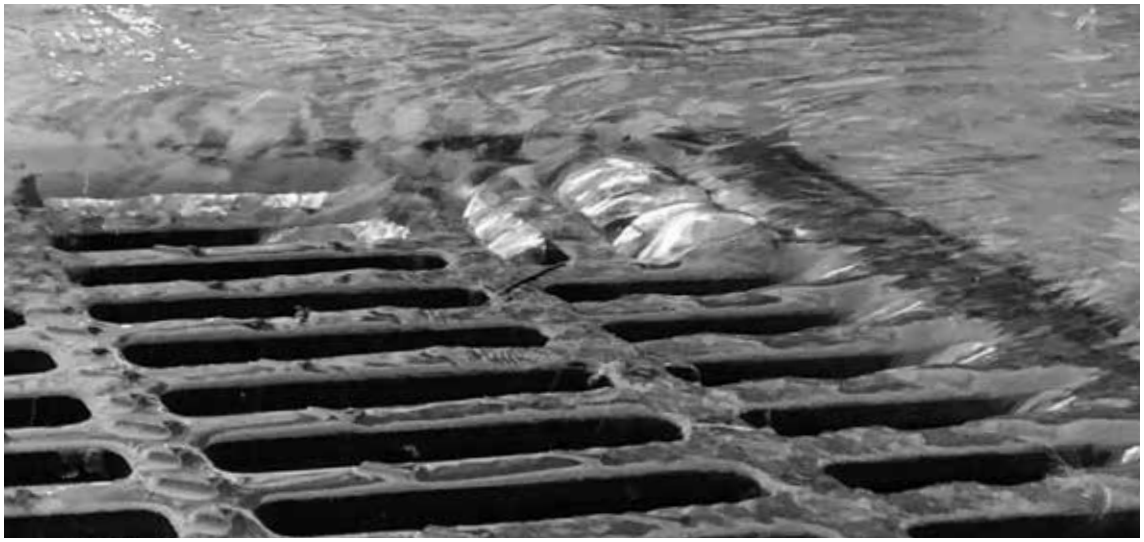
Spreading relates to the surface-tension lowering properties of PFAS which facilitates the rapid spreading on burning liquids while sealability relates to ability of the film to display resistance to the diffusion of flammable vapours. PFAS are also very chemically stable so that the film persists in fire conditions.

PFAS are used in Class B firefighting foams which are surfactant solutions used to combat Class B flammable fuel fires[1]. Class B foams are produced in two forms:

1. fluorinated foams that contain PFAS; and
2. fluorine-free foams that do not contain PFAS.

Perluorooctanesulfonic acid (PFOS), a perflourinated PFAS was very common in firefighting foams. While it is still permitted for certain uses under the EU POPs Regulation, Ireland does not avail of any of the exemptions for use of these substances. Similarly, the use of Perfluorooctanoic Acid (PFOA), its salts and PFOA-related compounds is also prohibited. While PFOA is generally not an intended ingredient in AFFF, it is a side product created during the manufacturing process.

[1] fire in flammable liquids or flammable gases, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, or alcohols.



It should be noted that firefighting foams denoted as e.g. *PFOS-free* are not per definition PFAS free. Such a designation only means that a specific PFAS is not contained within that particular foam.

There are many firefighting foam products and brands containing PFAS in different formulation. The following types of PFAS containing Class B foams have been or are used:

- **Aqueous film-forming foams (AFFF)** is the most common formulation and has been in use within all sectors of firefighting.
- **Alcohol-resistant aqueous film-forming foam (AR-AFFF)** is a universal foam product where the PFAS also imparts foam stabilisation (KEMI 2015).
- **Film forming fluoroprotein foam (FFFP)** has been used for airplane related fire suppression at airports (KEMI 2015).
- **Alcohol-resistant aqueous film-forming fluoroprotein foam (AR-FFFP).**
- **Fluoroprotein foams (FP)** have been used for fire protection within the petroleum industry and onboard ships (KEMI 2015).
- **Alcohol resistant fluoroprotein foam (FPAR).**

For example, Class B foams are stored and used in automated and handheld fire suppression systems, as well as in flammable vapour suppression fire training at refineries, bulk storage facilities and chemical manufacturing plants. They are also used in the same manner by the defence forces, marine industry and at airports. Local authority fire departments have used and may maintain firefighting foam in their inventories for use in training and emergency response.

PFAS PROPERTIES AND FATE

As PFAS encompass a very large number of substances, there is a high variability in their chemical properties. Known properties of PFAS commonly present in firefighting foams include:

i. Many PFAS present in firefighting foams are *highly stable* meaning that their degradation in the environment is very slow or non-existent. The stability causes these PFAS to persist indefinitely in the environment.

ii. There are some PFAS in firefighting foams that *do* degrade, but the degraded end-products are commonly the very stable PFAS described in the paragraph above.

iii. Many PFAS present in firefighting foams are relatively *water soluble* and therefore can be easily transported offsite via surface water and groundwater discharges.

iv. Many PFAS present in firefighting foams are both *bioavailable* and *bioaccumulative*. This means that they are easily taken-up by humans, fish etc where they persist.

HEALTH EFFECTS

PFAS encompass a very large number of substances and the health effects of most of these are not known. A recent study by the European Food and Safety Authority evaluated the health risks to humans associated with PFAS on the:

- immune system
- blood cholesterol levels
- liver cells; and
- birth weight.

Of these, effects on the immune system is considered to be the most proven and also the most critical. It was also estimated that some PFAS are excreted from the body within days while others require several years.

OBLIGATIONS ON 'HOLDERS'

The 1998 Protocol on Persistent Organic Pollutants and the Stockholm Convention are aimed at the reduction and elimination of Persistent Organic Pollutants (POPs). There are currently 30 substances listed under the Stockholm Convention (including some PFAS compounds such as PFOS and PFOA) which are controlled at EU level and within Ireland through the POPs Regulations.

The POPs Regulations set out obligations on each Member State in addition to specific requirement for 'holders' of listed substances:

1. An obligation on a holder of a stockpile greater than 50kg, consisting of or containing any of the listed substances to notify the EPA within one year of its listing.
2. To manage such stockpiles in a safe and environmentally sound manner to protect human health and the environment,
3. Appropriate management of waste streams containing POP listed substances.

It is worth noting that PFAS are encompassed within a number of other legislative provisions including REACH, CLP and the Water Framework Directive.

USEFUL REFERENCES

The following additional sources will provide further information on POPs and PFAS:

National Implementation Plan on POPs 2018, Environmental Protection Agency, December 2018:
www.epa.ie/pubs/reports/waste/haz/IE_NIP-Final-Dec_2018%20_website.pdf

For information on the most up to date list on substances covered by the Stockholm Convention visit:
www.pops.int/TheConvention/ThePOPs/tabid/673/Default.aspx

The European Chemical Agency also provides information on POPs legislation and reporting requirements at:
www.echa.europa.eu/hot-topics/perfluoroalkyl-chemicals-pfas

FURTHER SUPPORT

For further information on POPs and the Stockholm Convention, consult the EPA's webpage on:

www.epa.ie/waste/hazardous/pops

Any queries relating to the topic of PFAS please email pops@epa.ie.

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Headquarters

PO Box 3000,
Johnstown Castle Estate
County Wexford, Ireland

T: +353 53 916 0600
F: +353 53 916 0699
E: info@epa.ie
W: www.epa.ie
LoCall: 1890 33 55 99

Regional Inspectorate
McCumiskey House,
Richview, Clonskeagh Road,
Dublin 14, Ireland

T: +353 1 268 0100
F: +353 1 268 0199

Regional Inspectorate
Inniscarra, County Cork,
Ireland

T: +353 21 487 5540
F: +353 21 487 5545

Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny, Ireland

T +353 56 779 6700
F +353 56 779 6798

Regional Inspectorate
John Moore Road, Castlebar
County Mayo, Ireland

T +353 94 904 8400
F +353 94 902 1934

Regional Inspectorate
The Glen, Monaghan, Ireland

T +353 47 77600
F +353 47 84987

Regional Offices

The Civic Centre
Church St., Athlone
Co. Westmeath, Ireland
T +353 906 475722

Room 3, Raheen Conference Centre,
Pearse House, Pearse Road
Raheen Business Park, Limerick,
Ireland
T +353 61 224764

Printed on environmentally friendly paper stock

Appendix B – Surveys

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Survey Selection

Please select the appropriate survey according to the category which best describes your organisation or individual facility:*

* denotes compulsory questions

Please select the relevant survey type:

Type 1:
- Individual Licenced/Permitted facilities (i.e. COMAH, IPC/IED, VOC, waste);
- Aviation locations (i.e. airport or aerodrome operators, aircraft maintenance facilities) or
- Port facilities
- Firefighting training location (marine only)

Type 2: Organisations (i.e. HSE, OPW, Defence Forces, utilities)

Type 3: Marine users (offshore locations, shipping operators and/or individual vessels) or

Type 4: Local Authority Fire Services only

Type 1

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

General Instructions

Please note that questions posed in the surveys may not 'fit' the circumstances relevant to each respondent exactly.

You are requested to provide as much information as possible, but if a particular question does not apply to you, this can be skipped.

The surveys allow the attachment of various documents, so feel free to provide any relevant information specific to the circumstance of your facility/organisation as an attachment if the questions do not exactly apply.

In terms of quantities of firefighting foams, please provide estimates/approximation where specific data is not available. If you have any queries or require guidance in relation to any aspect of these surveys, please email *pfas@sweco.ie*

Please also note that you can populate and return to the survey at different times before submitting and data will be retained within the survey, provided the same device and browser is used each time – accessing the survey from different devices and browsers will result in any previous data being lost.

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

General Information

Survey Contact Details:

Title:

-Please Select-

Name:

Organisation

Contact Email:

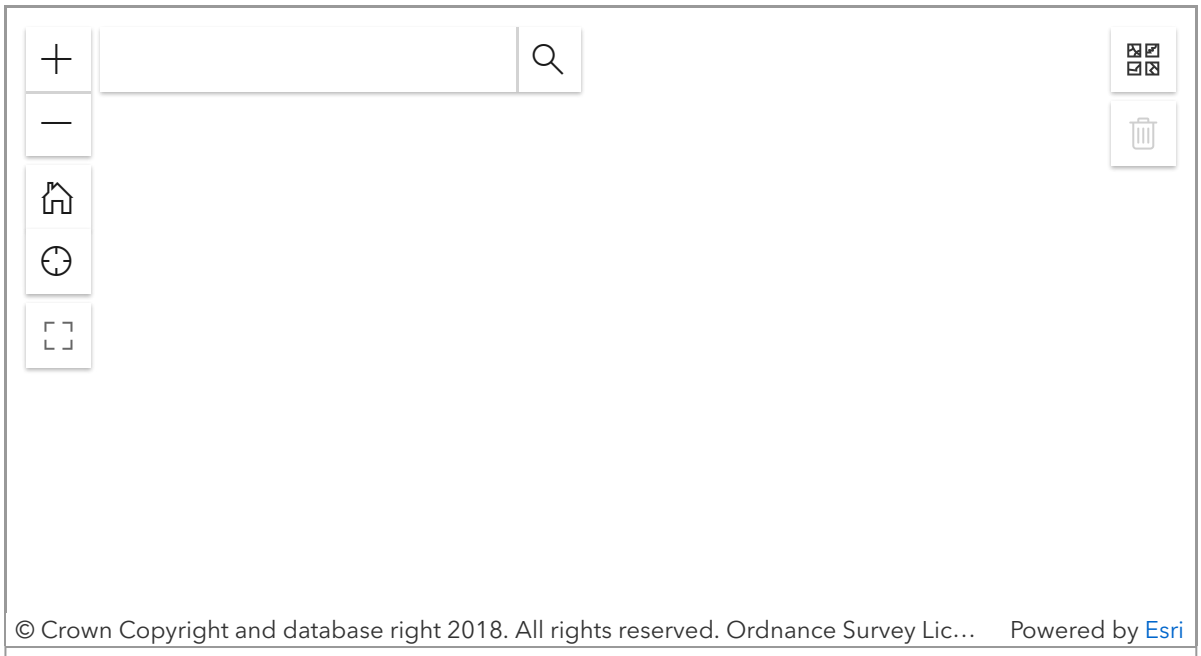
Contact number:

+353

Site / Location Details:

Type 1 - Site Name:

Reset Saved



No geometry captured yet.

Address:

1000

County:

Province:

Eircode:

Reset Saved

If applicable to the site.

VOC Permit reference: (Type 1 only)

If applicable to the site.

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Type 1 - Organisational Use of Firefighting Foam

Type 1 - Organisational Use of Firefighting Foam

1

Please add uses (if appropriate) by clicking the '+' symbol shown below this section, and complete according to the number of uses under the following headings:

- Automated fire suppression system
- Handheld fire extinguishers (training or other use)
- Other fire-fighting systems
- Other fire-fighting training
- Preventative use e.g. use in prevention of fire in fuel leaks, spills etc.

Brief description of use:

Please describe in a few word the site specific usage e.g. Benzene tank static fire suppression system.

PFAS Use:

-Please Select-

Location(s) of use at this site:

Please provide detail of location of this use at this site e.g. grid ref, location map, text description etc. - where the same use occurs at more than one location please add as another use

Location - document upload:

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Reset Saved

Details of system:

Where automated system, describe system; where handheld units, describe number of units; where other, provide general details

1000

Foam description:

If type of firefighting foam known, please describe.

Period of use from:

Please identify any use from commencment of site operations or from 1960 onwards, if known

dd/mm/yyyy

Period of use to:

dd/mm/yyyy

Foam brand/ Product used:

Please provide any relevant brand, model identifier information - if available, please attach a photograph below..

Foam brand/ Product used photo upload 1:

Attach photo

Select image file

Reset Saved

Foam brand/ Product used photo upload 2:

Attach photo

Select image file

Foam brand/ Product used photo upload 3:

Attach photo

Select image file

Frequency of use (per Annum):

Include for any testing or annual maintenance

123

Please select a unit of measurement for quantities for firefighting foam in stock/released:

-Please Select-

Details of foam concentrate storage:

Storage of firefighting foam associated with this use i.e. location, nature and size of storage containers etc.

1000

Any other relevant detail 1:

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc.

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Reset Saved

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc.

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Any other relevant detail 3:

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc.

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Please add uses (if appropriate) by clicking the '+' symbol shown below this section.

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Type 1 - Releases to the Environment

Has there even been an incident involving the release of fire fighting foam to the environment other than in the uses previously identified (e.g. actual fire fighting event, accidental spillage, leak from storage facilities) at this site?

- ○ Yes
- ○ No

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Type 1 - Management of released fire-fighting foam

Provide detail as to IF and/or HOW firefighting foams released during training, maintenance or accidental release are captured/contained:

1000

Provide detail as to how captured/contained firefighting foams are disposed of:

1000

Waste management organisation(s) typically employed for firefighting foam disposal:

1000

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Submit Data?

Please ensure you have recorded all relevant information and you are ready to submit.

Back Submit

Page 9 of 9

Powered by ArcGIS Survey123

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Survey Selection

Please select the appropriate survey according to the category which best describes your organisation or individual facility:*

* denotes compulsory questions

Please select the relevant survey type:

Type 1:
- Individual Licenced/Permitted facilities (i.e. COMAH, IPC/IED, VOC, waste);
- Aviation locations (i.e. airport or aerodrome operators, aircraft maintenance facilities) or
- Port facilities
- Firefighting training location (marine only)

Type 2: Organisations (i.e. HSE, OPW, Defence Forces, utilities)

Type 3: Marine users (offshore locations, shipping operators and/or individual vessels) or

Type 4: Local Authority Fire Services only

Type 2

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

General Instructions

Please note that questions posed in the surveys may not 'fit' the circumstances relevant to each respondent exactly.

You are requested to provide as much information as possible, but if a particular question does not apply to you, this can be skipped.

The surveys allow the attachment of various documents, so feel free to provide any relevant information specific to the circumstance of your facility/organisation as an attachment if the questions do not exactly apply.

In terms of quantities of firefighting foams, please provide estimates/approximation where specific data is not available. If you have any queries or require guidance in relation to any aspect of these surveys, please email *pfas@sweco.ie*

Please also note that you can populate and return to the survey at different times before submitting and data will be retained within the survey, provided the same device and browser is used each time – accessing the survey from different devices and browsers will result in any previous data being lost.

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

General Information

Survey Contact Details:

Title:

-Please Select-

Name:

Organisation

Contact Email:

Contact number:

+353

Site / Location Details:

Type 2 - Site locations within your organisation:

Reset Saved

Address:

1000

County:

Province:

Eircode:

Please identify locations/instance of use within your organisation where firefighting foams are used or have been used in the past – upload list here:

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Type 2 - Organisational Use of Firefighting Foam

Type 2 - Organisational Use of Firefighting Foam

1

This section relates to the use of firefighting foams at the locations/site within your organisation – if firefighting foams are used in a number of ways in your organisation, please add uses (if appropriate) by clicking the '+' symbol shown below this section, and complete according to the number of uses under the following headings:

- Automated fire suppression system
- Handheld fire extinguishers (training or other use)
- Other fire-fighting systems
- Other fire-fighting training
- Preventative use e.g. use in prevention of fire in fuel leaks, spills etc.

Identify the locations/sites within your organisation to which this specific use applies:

Location - document upload:

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Brief description of use:

Please describe in a few words the specific usage that applies to the sites where this general use applies e.g. benzene tank static fire suppression system.

Firefighting Foam Use:

-Please Select-

Reset Saved

Details of system:

Where automated system, describe system; where handheld units, describe number of units; where other, provide general details

1000

Foam description:

If type of firefighting foam known, please describe.

Period of use from:

Please identify any use from commencment of site operations or from 1960 onwards, if known

m/d/yyyy

Period of use to:

m/d/yyyy

Foam brand/ Product used:

Please provide any relevant brand, model identifier information - if available, please attach a photograph below

Foam brand/ Product used photo upload 1:

Attach photo

Reset Saved

Foam brand/ Product used photo upload 2:

Attach photo

Select image file

Foam brand/ Product used photo upload 3:

Attach photo

Select image file

Frequency of use (per Annum) at individual locations/sites across your organisation:

Include for any testing or annual maintenance

123

Please select a unit of measurement for quantities for firefighting foam in stock /released :

-Please Select-

Details of foam concentrate storage:

Storage of firefighting foam associated with this use i.e. location, nature and size of storage containers etc.

1000

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc. – note one attachment only per link below

Relevant detail 1:

Reset Saved

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Relevant detail 2:

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Relevant detail 3:

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc.

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Please add uses (if appropriate) by clicking the '+' symbol shown below this section.

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Type 2 - Releases to the Environment

Has there even been an incident involving the release of fire fighting foam to the environment other than in the uses previously identified (e.g. actual fire fighting event, accidental spillage, leak from storage facilities) at this site?

If yes, fields will populate below – populate for each release and add additional fields per release, as necessary by clicking the '+' symbol shown below this section.

- ○ Yes
- ○ No

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Type 2 - Management of released fire-fighting foam

Provide detail as to IF and/or HOW firefighting foams released during training, maintenance or accidental release are captured/contained at locations across your organisation:

1000

Provide detail as to how captured/contained firefighting foams are disposed of:

1000

Waste management organisation(s) typically employed for firefighting foam disposal:

1000

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Submit Data?

Please ensure you have recorded all relevant information and you are ready to submit.

Back Submit

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Survey Selection

Please select the appropriate survey according to the category which best describes your organisation or individual facility:*

* denotes compulsory questions

Please select the relevant survey type:

Type 1:
- Individual Licenced/Permitted facilities (i.e. COMAH, IPC/IED, VOC, waste);
- Aviation locations (i.e. airport or aerodrome operators, aircraft maintenance facilities) or
- Port facilities
- Firefighting training location (marine only)

Type 2: Organisations (i.e. HSE, OPW, Defence Forces, utilities)

Type 3: Marine users (offshore locations, shipping operators and/or individual vessels) or

Type 4: Local Authority Fire Services only

Type 3

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

General Instructions

Please note that questions posed in the surveys may not 'fit' the circumstances relevant to each respondent exactly.

You are requested to provide as much information as possible, but if a particular question does not apply to you, this can be skipped.

The surveys allow the attachment of various documents, so feel free to provide any relevant information specific to the circumstance of your facility/organisation as an attachment if the questions do not exactly apply.

In terms of quantities of firefighting foams, please provide estimates/approximation where specific data is not available. If you have any queries or require guidance in relation to any aspect of these surveys, please email *pfas@sweco.ie*

Please also note that you can populate and return to the survey at different times before submitting and data will be retained within the survey, provided the same device and browser is used each time – accessing the survey from different devices and browsers will result in any previous data being lost.

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

General Information

Survey Contact Details:

Title:

-Please Select-

Name:

Organisation

Contact Email:

Contact number:

+353

Site / Location Details:

Type 3 - Site locations within your organisation:

Reset Saved

Address:

1000

County:

Province:

Eircode:

Please identify locations/instance of use (e.g vessels) within your organisation where firefighting foams are used or have been used in the past – upload list here:

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Type 3 - Use of Firefighting Foam

Type 3 - Use of Firefighting Foam

1

This section relates to the use of firefighting foams within your organisation, which may include land-based site or sea-going vessel or rigs. If firefighting foams are used in a number of ways in your organisation, please add uses (if appropriate) by clicking the '+' symbol shown below this section, and complete according to the number of uses under the following headings:

- Automated fire suppression system
- Handheld fire extinguishers (training or other use)
- Other fire-fighting systems
- Other fire-fighting training
- Preventative use e.g. use in prevention of fire in fuel leaks, spills etc.

Identify the locations/instances (e.g. vessels) within your organisation to which this specific use applies :

Location/instance: document upload:

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Brief description of use:

Please describe in a few words the specific usage that applies to the locations/instances of use where this general use applies e.g. benzene tank static fire suppression system.

Firefighting Foam Use

-Please Select-

Reset Saved

Details of system:

Where automated system, describe system; where handheld units, describe number of units; where other, provide general details

1000

Foam description:

If type of firefighting foam known, please describe.

Period of use from:

Please identify any use from commencement of site operations or from 1960 onwards, if known

m/d/yyyy

Period of use to:

m/d/yyyy

Foam brand/ Product used:

Please provide any relevant brand, model identifier information - if available, please attach a photograph below

Foam brand/ Product used photo upload 1:

Attach photo

Reset Saved

Foam brand/ Product used photo upload 2:

Attach photo

Select image file

Foam brand/ Product used photo upload 3:

Attach photo

Select image file

Frequency of use (per Annum) at individual locations/instances:

Include for any testing or annual maintenance

123

Please select a unit of measurement for quantities for firefighting foam in stock /released :

-Please Select-

Details of foam concentrate storage:

Storage of firefighting foam associated with this use i.e. location, nature and size of storage containers etc.

1000

Only use one unit of measurement in the following questions:

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc. – note one attachment only per link below:

Reset Saved

Relevant detail 1:

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc.

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Relevant detail 2:

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Relevant detail 3:

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Please add uses (if appropriate) by clicking the '+' symbol shown below this section.

Back Next

Page 6 of 9

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Type 3 - Releases to the Environment:

Has there even been an incident involving the release of fire fighting foam to the environment other than in the uses previously identified (e.g. actual fire fighting event, accidental spillage, leak from storage facilities) at any individual land location or sea-going vessel/rig?

If yes, fields will populate below – populate for each release and add additional fields per release, as necessary

- ○ Yes
- ○ No

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Type 3 - Management of released fire-fighting foam

Provide detail as to IF and/or HOW firefighting foams released during training, maintenance or accidental release are captured/contained in situations specific to your organisation:

1000

Provide detail as to how captured/contained firefighting foams are disposed of:

1000

Waste management organisation(s) typically employed for firefighting foam disposal:

1000

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Submit Data?

Please ensure you have recorded all relevant information and you are ready to submit.

Back Submit

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Survey Selection

Please select the appropriate survey according to the category which best describes your organisation or individual facility:*

* denotes compulsory questions

Please select the relevant survey type:

Type 1:
- Individual Licenced/Permitted facilities (i.e. COMAH, IPC/IED, VOC, waste);
- Aviation locations (i.e. airport or aerodrome operators, aircraft maintenance facilities) or
- Port facilities
- Firefighting training location (marine only)

Type 2: Organisations (i.e. HSE, OPW, Defence Forces, utilities)

Type 3: Marine users (offshore locations, shipping operators and/or individual vessels) or

Type 4: Local Authority Fire Services only

Type 4

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

General Instructions

Please note that questions posed in the surveys may not 'fit' the circumstances relevant to each respondent exactly.

You are requested to provide as much information as possible, but if a particular question does not apply to you, this can be skipped.

The surveys allow the attachment of various documents, so feel free to provide any relevant information specific to the circumstance of your facility/organisation as an attachment if the questions do not exactly apply.

In terms of quantities of firefighting foams, please provide estimates/approximation where specific data is not available. If you have any queries or require guidance in relation to any aspect of these surveys, please email *pfas@sweco.ie*

Please also note that you can populate and return to the survey at different times before submitting and data will be retained within the survey, provided the same device and browser is used each time – accessing the survey from different devices and browsers will result in any previous data being lost.

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

General Information

Survey Contact Details:

Title:

-Please Select-

Name:

Organisation

Contact Email:

Contact number:

+353

Site / Location Details:

Location:

Find address or place

Reset Saved

No geometry captured yet.

Address:

1000

County:

Province:

Eircode:

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Type 4 - Use of Firefighting Foam by Local Authority Fire Service

Firefighting Foam Purchase Records

Firefighting Foam Purchase Records

1

This section relates to quantifying the amount of firefighting foams currently and historically used within your Local Authority Fire Service. Where specific information is lacking, please provide estimates. Please also provide detail in relation to firefighting foam purchased as far back a time period as possible. Please add an individual record for each firefighting foam product (if appropriate) by clicking the '+' symbol shown below this section

Firefighting Foam Details:

Start of purchase period:

m/d/yyyy

End of purchase period:

m/d/yyyy

Please select a unit of measurement for quantities for firefighting foam in stock /released :

-Please Select-

Foam brand/ Product purchased:

Please provide any relevant brand, model identifier information - if available, please attach a photograph below

Reset Saved

Foam brand/ Product used photo upload:

Attach photo.

Select image file

Please add records (if appropriate) by clicking the '+' symbol shown below this section.

Training

Training

1

This section relates to the identification of training facilities currently and historically used by your Local Authority Fire Service. Please provide detail for as far back a time period as possible. Please add an individual location by clicking the '+' symbol shown below this section

Location(s)

Please provide detail of location of this use at this site e.g. grid ref, location map, text description etc.

Upload location information if appropriate:

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Period of use from:

Reset Saved

m/d/yyyy

Period of use to:

m/d/yyyy

Foam description:

if type of firefighting foams used at this location are known, please describe.

Foam brand/ Product used:

Foam brand/ Product used photo upload 1:

Attach photo

Select image file

Foam brand/ Product used photo upload 2:

Attach photo

Select image file

Foam brand/ Product used photo upload 3:

Attach photo

Select image file

Frequency of use at this location:

How often does training occur/ did training involving use of firefighting foams occur?

Reset Saved

Please provide detail as to if and/or how firefighting foams released during training at this are/were captured/contained:

255

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc. – note one attachment only per link below:

Relevant detail 1 :

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc.

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Relevant detail 2:

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc.

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Relevant detail 3:

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc.

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Please add records (if appropriate) by clicking the '+' symbol shown below this section.

Reset Saved

Firefighting

Firefighting

1

This section relates to the identification of major firefighting events managed by your Local Authority Fire Service. You are requested to provide detail, where available, on what you consider to be the largest firefighting event each year over the last 10 years where significant quantities of firefighting foam were utilised – should you feel that there are more than 10 events over this period that should be identified, please feel free to include more. Please add an individual event by clicking the '+' symbol shown below this section.

Location(s) of event:

Please provide detail of location of this use at this site e.g. grid ref, location map, text description etc. - where the same use occurs at more than one location please add as another record.

Upload location information if appropriate:

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Date of event:

m/d/yyyy

Desciption of event:

Reset Saved

Foam description:

if type of firefighting foams used at this location are known, please describe.

Foam brand/ Product used:

Please provide any relevant brand, model identifier information - if available, please attach a photograph below

Foam brand/ Product used photo upload:

Select image file

Please describe how firewater was managed during this incident:

If known

255

Any other relevant detail:

255

Please provide any further relevant detail relating to this training location or firefighting foams used – note one attachment only per link below:

Reset Saved

Relevant detail 1:

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc.

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Relevant detail 2:

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc.

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Relevant detail 3:

Please provide any further relevant detail for this foam e.g. MSDS sheet, photographs etc.

Select file (Support: pdf, doc, dot, docx, xls, xlt, xlsx, pptx, ppt, txt)

Please add records (if appropriate) by clicking the '+' symbol shown below this section.

Back Next

Reset Saved

Environmental Protection Agency – PFAS in Firefighting Foams

Submit Data?

Please ensure you have recorded all relevant information and you are ready to submit.

Back Submit

Page 7 of 7

Powered by ArcGIS Survey123

SWECO

Contact

Maeve English
Technical Director
+353 21 206 3960
+353 87 655 9960
maeve.english@sweco.ie

Cork Office: Glandore, 3rd Floor City Quarter, Lapps Quay, Cork, T12 Y3ET

Reg. Office Address: Sweco UK Limited, Grove House, Mansion Gate Drive, Leeds, LS7 4DN
+44 (0)113 262 0000 | info@sweco.co.uk | www.sweco.co.uk
Sweco UK Limited, a company incorporated in England & Wales (Reg. number 02888385)