

Survey of fire-fighting foam

PM 5/15



The Swedish Chemicals Agency is supervisory authority under the Government. We work in Sweden, the EU and internationally to develop legislation and other incentives to promote good health and improved environment. We monitor compliance of applicable rules on chemical products, pesticides and substances in articles and carry out inspections. We review and authorise pesticides before they can be used. Our environmental quality objective is A Non-toxic Environment.

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Foreword

The Swedish Chemicals Agency (KemI) has been assigned by the Swedish Government to produce a national action plan for a toxic-free everyday environment: Action plan for a toxic-free everyday environment 2011 – 2014 – protect the children better.

Efforts are now going on in several areas, both in Sweden, within the EU and internationally and often in cooperation with other authorities. Reducing chemical risks in the everyday environment is one step towards attaining the Swedish Parliament's environment quality objective A Non-Toxic Environment, which is the objective that KemI is responsible for.

Within the framework of the action plan, KemI compiles knowledge in KemI's report and PM series elaborated by experienced colleagues, researchers or consultants. In this way, KemI presents new and essential knowledge in publications which can be downloaded from the website www.kemikalieinspektionen.se

This report is an account of a study on the use of fire-fighting foam, conducted by Sweco on behalf of the Swedish Chemicals Agency and the Swedish Civil Contingencies Agency (MSB) in spring 2014. The focus is mainly on the Swedish market but the European market has also been examined to a certain extent. The study involves compiling available knowledge about firefighting foams currently on the Swedish market, with respect to chemical content, use, handling and disposal. The information was gathered through telephone interviews with producers, suppliers, distributors and professional users of fire-fighting foam. Foreign parties have been contacted by e-mail.

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The opinions and recommendations presented in the report are entirely those of the author and do not necessarily reflect the Swedish Chemicals Agency's point of view.

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Summary

In a number of Swedish municipalities, it has been discovered that supplies of drinking water have been contaminated with perfluorinated alkyl substances (PFASs), likely originating from the use of fire-fighting foams, which has resulted in the complete or partial closure of water treatment plants and water wells and has forced water companies to install highly expensive filter systems.

In order to determine whether the current use of fire-fighting foam could give rise to similar problems to those caused previously by substances that are now banned, a clearer picture of the current use of fire-fighting foams is required.

This report presents a survey of producers and suppliers of fire-fighting foams that are currently on the market. The focus is mainly on the Swedish market but the European market has also been examined to a certain extent. The information was gathered through telephone interviews with producers, suppliers, distributors and professional users of fire-fighting foams. Foreign parties have been contacted by e-mail.

A few producers of fire-fighting foam are currently active on the Swedish market. The producers confirm that their products comply with Swedish law and that they do not contain perfluorooctane sulphonate (PFOS). The parties are fully aware of the problems concerning PFOS in fire-fighting foam, but state that current products contain neither PFOS nor substances that can be degraded to PFOS. However, it is thought that many of them have poor knowledge of other PFASs.

Parties included in the study do not import directly from producers outside the EU or US; the fire-fighting foam used is manufactured in the EU and US. However, the import situation may possibly be different in other parts of the EU market.

The information obtained from contacts made during this study suggests that fire-fighting foam is nowadays used only to a limited extent, with its use being restricted, both in training and in actual fire-fighting, as permission must be obtained from the municipal authority before foam can be used in training. However, one party stated that its use of foam was growing because the area of application for fire-fighting foam had expanded.

The information represents only a selection of users and does not constitute a complete survey. Information on quantities purchased or used over time was not requested.

Purchasing procedures vary between users. In the armed forces, for example, purchasing is heavily regulated whereas purchasing by fire and rescue services is decentralized.

The disposal of fire-fighting foam mainly takes place at SAKAB but, in some cases, also at Stena.

Nowadays the fire-fighting foam is mixed when used; water is mixed with concentrate on-site. Previously, the product had been ready mixed. This may be of significance when comparing purchase volumes from different periods of time.

Fire-fighting foam available on the Swedish market may contain a certain amount of various additives but the information on, for example, fluorosurfactants is often regarded as confidential. There is therefore a substantial lack of information on constituent perfluorinated substances, which are a type of fluorosurfactant. Producers regard constituent components/additives as trade secrets and therefore do not seek patent protection for their products. However, they may consider releasing information in special cases where a confidentiality agreement is involved.

Sammanfattning

I flera svenska kommuner har det uppdagats att dricksvattenstäckter är förorenade med perfluorerade alkylsubstanser (PFAS) som troligen kommer från användning av släckskum, vilket har orsakat total eller delvis stängning av vattenverk och brunnar, samt tvingat vattenproducenter att installera mycket dyra filterlösningar.

För att kunna bedöma om dagens användning av släckskum skulle kunna ge liknande problem som tidigare orsakats av idag förbjudna substanser, finns ett behov av att få en klarare bild av hur dagens användning av släckskum ser ut.

Denna rapport presenterar en genomgång av producenter och leverantörer av släckskum som finns på marknaden idag. Fokus ligger främst på den svenska marknaden, men den europeiska marknaden är också till viss del undersökt. Information har inhämtats via telefonintervjuer med producenter, leverantörer, distributörer och yrkesmässiga användare av släckskum. Utländska aktörer har kontaktats via mail.

Ett fåtal producenter för släckskum är verksamma i Sverige idag. Producenterna försäkrar att deras produkter följer svensk lagstiftning, och att de inte innehåller perfluoroktansulfonat (PFOS). Aktörerna är väl medvetna om problematiken kring PFOS i släckskum, men konstaterar att dagens produkter inte innehåller PFOS eller ämnen som kan brytas ner till PFOS. Kunskapen om övriga PFAS får dock hos många anses vara låg.

Bland de aktörer som ingår i studien förekommer inte direktimport från producenter utanför EU eller USA, utan det släckskum som används, produceras i EU och USA. Det är dock möjligt att importen ser annorlunda ut på andra delar av EU-marknaden.

Utifrån den information som framkommit från kontakter tagna i denna studie verkar det som att släckskum idag används i liten omfattning och har begränsats, både vid övning och vid riktig brand, eftersom tillstånd från kommunen krävs för att använda skum vid övning. En aktör uppgav dock att deras användning av släckskum ökar, då användningsområdet för släckskummet har utvidgats.

Informationen representerar ett urval av användare och inte en fullständig kartläggning. Information om inköpta eller använda kvantiteter över tid har inte efterfrågats.

Inköpsrutinerna hos användarna varierar. Inom exempelvis försvaret är inköpen hårt reglerade, medan inköpen sker decentraliserat inom räddningstjänsten.

Destruktion av släckskum sker framförallt hos SAKAB, men i något fall också hos Stena.

Idag blandas släckskummet vid användning, vatten blandas med koncentrat på plats. Tidigare var produkten färdigblandad. Detta kan vara av betydelse vid jämförande av inköpsvolymen från olika tidsperioder.

Släckskum som finns på den svenska marknaden kan innehålla en mängd olika tillsatser, dock är informationen om exempelvis fluortensider ofta betraktad som konfidentiell. Information saknas därför till stor del om eventuella ingående perfluorerade ämnen som är en typ av fluortensid. Producenterna ser de ingående komponenterna/tillsatserna som en affärshemlighet, och söker därför heller inga patent på sina produkter. De kan dock tänka sig att lämna ut informationen i speciella fall, mot sekretessavtal.

1 Introduction

The report aims to give a clearer picture of the current use of fire-fighting foam in order to assess whether today's use of fire-fighting foam might cause similar problems to those which occurred as a result of using fire-fighting foam based on perfluorooctane sulphonate (PFOS).

Through contacts with producers, suppliers and professional users information has been gathered about the market for fire-fighting foams together with information on the fire-fighting foam's chemical content, use, handling and disposal.

1.1 Background

Perfluorinated alkyl substances (PFASs) constitute a large group of substances that have been produced and used on a large scale since around the 1950s. At the start of the 2000s the first insight was gained into their environmental impact and this knowledge has since grown steadily. PFASs are extremely persistent substances that are water soluble, but they are nevertheless able to accumulate in living organisms and cause toxic effects. Their presence in the environment is widespread and they can be found in both humans and animals, as well as in lakes and drinking water.

In a number of Swedish municipalities, it has been discovered that supplies of drinking water are contaminated with PFASs which probably originate from the use of fire-fighting foams (Aqueous Film-forming Foam AFFF, for class B fires). This has resulted in the complete or partial closure of water treatment plants and water wells and has forced water companies to install highly expensive filter systems.

There are at present no maximum permitted level for PFASs in drinking water but the National Food Agency (Livsmedelsverket) has come up with an action threshold of 90 ng/l for the sum of seven (7) PFASs, which are listed in Table 1.

| Chemical name | Acronym |
|----------------------------|---------|
| Perfluorobutane sulphonate | PFBS |
| Perfluorohexane sulphonate | PFHxS |
| Perfluorooctane sulphonate | PFOS |
| Perfluoropentanoate | PFPeA |
| Perfluorohexanoate | PFHxA |
| Perfluoroheptanoate | PFHpA |
| Perfluorooctanoate | PFOA |

Table 1 National Food Agency recommendations for substances to include in the study of PFASs in drinking water. The sum of these 7 PFASs should not exceed the action threshold of 90 ng/l in drinking water

The use of PFASs in fire-fighting foam is nowadays only regulated for the substance PFOS in the EU. Fire-fighting foam containing >0.001 weight-% PFOS could not be sold after June 2008 and could not be used after June 2011 (Regulation 850/2004).

For the new generation of fire-fighting foams that have replaced PFOS-containing fire-fighting foams, there are various specifications for the chemical content. It can, for example, be based on other fluorinated substances, such as telomer alcohols (FTOH), 6:2 FTS, PFOA, or dodecafluoro-2-methylpentan-3-one. In many cases, however, information on the actual content is regarded as confidential information.

1.2 Method and Scope of Study

Details on manufacturers and suppliers were obtained via information from Swedish Chemicals Agency Report 6/06 (Kemikalieinspektionen, 2006) and Tema Nord 2013:542 (Nordiska Rådet, 2013), as well as internet searches and contacts with the chemicals industry and professional users.

Information was gathered via telephone conversations with Swedish suppliers and users and via mail to European parties.

Safety data sheets for fire-fighting foam were obtained from producers, suppliers and users who were contacted.

Information has been obtained on the chemical content of products and on any customer requirements with regard to chemical content.

Information has also been gathered from professional Swedish users about which products are used and how the products are purchased, handled and disposed of.

The environmental assessment of products has not been included in this survey.

1.3 Fire-fighting foam

The specific fire-fighting agents in foams include tensides (surfactants), which reduce surface tension thereby allowing the fire-fighting agent to penetrate the burning material. Some types of foam form a membrane above a burning liquid and choke off the fire. Fluorosurfactants (fluorotensides) are used because they can tolerate very high temperatures and are very good at forming films.

The use of PFASs in fire-fighting foam is now regulated in the EU only for PFOS. PFOS has to some extent been replaced in fire-fighting foams by other perfluorinated or polyfluorinated substances.

There are various types of fire-fighting foam intended for specific applications. This report attempts to differentiate film-forming foams from other types of foam. However, the safety data sheet does not always state whether or not the foam is film-forming and therefore it is not always possible to categorize the fire-fighting foam.

1.3.1 Film-forming foam

Film-forming foam is termed AFFF (Aqueous Film-forming Foam). The foam forms a covering which lies on the surface of the liquid and inhibits vaporisation and the radiation of heat. The fluorosurfactants in the foam form a film between the water and the liquid, which makes the foam flow more easily and improves its ability to seal and inhibit vaporisation.

Fire-fighting foam is often available in three different concentrations, as 1%, 3%, or 6% mixtures in water. Higher concentrations normally produce a greater fire-fighting effect. Film foam is mainly used for large-scale fire fire-fighting in fire prevention, fire and rescue services at airports, and high-risk industries.

Film-forming foam is dissolved by polar liquids (e.g., alcohols). To prevent dissolving polysaccharides are added; they act as a barrier, forming a layer between the fluorofilm and the flammable liquid. These foams are referred to as alcohol-resistant foam concentrates (ARC).

1.3.2 Other Fire-fighting foams

The group "other fire-fighting foams" includes detergent foams and foams for fat fires.

Detergent foam is used by fire and rescue services in conventional fire fighting. Additives can convert these into film-forming and alcohol-resistant foam concentrates.

1.3.3 Training foams

There is some concern that, despite the ban on PFOS, current foam concentrates may contain substances that affect the environment and have poor biodegradability. In spite of this, many of the foam concentrates used in fire training centres are the same foam concentrates that are used in accidents, though diluted to a lower concentration. More and more municipalities are therefore banning fire training that involves foam concentrates. As a result, many suppliers are offering 'training foams' in which the number of active components is reduced to a minimum in order to reduce the impact of fire-fighting foam on the environment.

2 Survey of manufacturers and suppliers

Information on the manufacture and distribution of foam has been gathered via telephone conversations with Swedish suppliers and producers and via mail to European parties.

A list of the producers and suppliers contacted can be found in appendix 1.

2.1 Producers

2.1.1 Sweden

There are two producers of fire-fighting foam concentrates/chemicals in Sweden: Fomtec AB and Kempartner. The Fomtec plant is located in Helsingborg. Fomtec distributes its products on the international market; distribution on the Swedish market occurs through Dafo, which also has part ownership in Fomtec. Fomtec also has production in Norway.

Manufacturing by Kempartner is located in Vadstena. It produces film-forming foams, both with and without fluorosurfactants. Its biggest customer is the Swedish Civil Contingencies Agency (MSB). Those fire-fighting foams that do not contain fluorosurfactants contain silicone-based chemicals instead. Kempartner is requesting more stringent legislation governing the content of fire-fighting foams and has expressed concern over the fluorosurfactants found in fire-fighting foam.

2.1.2 Europe

There are several manufacturers in Europe; Dr Sthamer, Angus, and Solberg are some of the largest producers.

According to their information, Dr Sthamer is the world's third-largest supplier of fire-fighting foam. The company is located in Hamburg, Germany and supplies products to Presto in Sweden as well as other companies.

Angus also has a daughter company, Kerr Fire, which produces fire-fighting foam. Angus produces several sorts of foam including AFFF, Protein foam and Film-Forming Fluoroprotein, FFFP. Production takes place in Great Britain, France and the US (Angus Fire, 2014). Angus sells to the Swedish market via the company Kidde Sweden.

Solberg manufactures foam and has local distributors in a number of European countries, but not in Sweden.

Nordic Fire and Rescue Service is a Norwegian/Swedish producer. The foam concentrate they sell is produced in Spain by VS Focum or is purchased from OneSeven of Germany GmbH. Clients include municipal fire and rescue services, industrial fire brigades and MSB's various fire training centres.

2.1.3 The Rest of the World

Many of the world's largest manufacturers of fire-fighting foam are based in the US; among them are Tyco Fire Protection Products, DuPont, and National Foam.

Tyco Fire Protection Products is a major producer of several brands, including Ansul. The largest quantity is produced in the US and Italy, while the subsequent product preparation takes place in many other countries. Almost all Tyco Fire Protection Products' fire-fighting foams are telomer-based and contain fluorosurfactants, the product HIEX being the exception. The company's website presents a full list of products and their safety data sheets. The company has replied by mail that neither its own products nor those of its daughter company Chemguard can give rise to perfluorooctanoic acid (PFOA¹) or its derivatives.

Chemguard, Tyco's daughter company, supplies fire-fighting foam to 60 countries, including all EU member states. The company has not revealed the quantities of foam it produces/supplies, nor who its customers are.

DuPont does not supply any fire-fighting foam products to Sweden, nor to any other Nordic countries.

After the discovery of problems associated with PFOS, many questions and concerns regarding fire-fighting foams were raised in the media. The industry in the United States believed that many publications were misleading and a number of producers and suppliers decided to form an association, the Fire Fighting Foam Coalition (FFFC) to educate and inform the public and authorities about fire-fighting foam. The board of FFFC has company representatives from all leading fire-fighting foam firms, such as Angus Fire, Ansul, Chemguard, DuPont, Dynax, and National Foam (Fire Fighting Foam Coalition, 2014). There is no equivalent on the Swedish market.

Angus Fire, Eau et Feu (a French company), National Foam, and Angus Fire Engineering are also involved in a collaboration.

2.2 Suppliers and distributors

The Swedish market for fire-fighting foams is dominated by the suppliers Presto, Dafo, and Kidde.

Presto purchases a large part of its products from Dr Sthamer (Hamburg, Germany) and ABC Fire Protection (England). ABC Fire Protection specializes in portable fire extinguishers.

¹ Unclear whether PFOS is actually meant in this case

Presto also buys in products from smaller unspecified European manufacturers when required.

Dafo has part ownership in Fomtec and distributes Fomtec's products on the Swedish market, to airports, oil terminals, and fire and rescue services.

Kidde purchases most of its fire-fighting foam from Angus in England and supplies industries, coast guard operations, and fire and rescue services in Sweden. It has two different types of foam, one of which is protein based, which should be more environmentally friendly. It has no inventory of its own but purchases by order. Depending on customer requirements, the product is supplied in tanks, in bulk, in containers or in cans. SAKAB is employed for disposal and customers are also given help with disposal.

It has not been possible to obtain information from suppliers about quantities on the Swedish market.

The fire-fighting foam used by parties participating this study are produced in the EU and US. There seem to be no direct imports from manufacturers outside the EU. It is possible, however, that the import situation is different in other parts of the EU market.

2.2.1 The market, the products and customer requirements

According to suppliers contacted in this study, PFOS has not been used in fire-fighting foam since 2003. The chemicals used today are PFOS-like substances which are part of the group non-specifically referred to as fluorosurfactants. The chemicals being used cannot be broken down into PFOS, though it is claimed that they are biodegradable². Fluorosurfactants are used because they tolerate high temperatures. The manufacturers also point out that the same fluorosurfactants which are now used in fire-fighting foam can also be found in clothing, Teflon pans, etc.

Some customers (e.g. Swedavia) require that the products contain no fluorosurfactants at all. On account of Swedavia, Presto therefore contacted its supplier Dr Sthamer and asked them to develop a product without fluorosurfactants. The product works well though it requires a larger amount to achieve the same fire-fighting performance. Presto thinks the market for fire-fighting foams without fluorosurfactants is growing.

As well as Sweden, Kempartner also sells fire-fighting foams to Norway. Norway imposes stricter environmental requirements on the products than do Swedish purchasers and does not purchase fire-fighting foams that contain fluorosurfactants.

When contacted, Dafo replied that very few customers imposed environmental requirements. The requirements are imposed in order that the products can be used to extinguish those fires that they are intended to extinguish. However, there are questions over whether Dafos' fire-fighting foams contain PFOS.

2.2.2 Disposal

Fire extinguishers and concentrates that have not been used and have been returned by the customer after their use-by dates have passed, are sent to SAKAB. SAKAB incinerates the fire-fighting foam at a high temperature. Suppliers give a shelf life of ca 5 years for fire-fighting foam, which is based on previous stipulations worked out in collaboration with SP Technical Research Institute of Sweden (SP Sveriges tekniska forskningsinstitut). However, information

² Unclear whether this means complete breakdown or breakdown to intermediates

obtained from contacts with one manufacturer indicate that fire-fighting foam can last for up to 50 years and that it therefore does not need to be disposed of to any great extent.

Fomtec offers its customers a service whereby they can have the performance of their fire-fighting foams tested annually so that they will know when disposal is necessary. It is still the case that fire-fighting foams which appear to contain PFOS are sent in for testing (mainly from customers in East European markets). In such cases Fomtec informs the customer that the fire-fighting foam should be disposed of.

2.3 The attitude of manufacturers and suppliers to fluorinated substances in Fire-fighting foam

Swedish manufacturers are well aware of the problems concerning PFOS and point out that today's products do not contain PFOS and cannot be broken down to PFOS.

According to Fomtec it has never used PFOS in its fire-fighting foams, only other fluorosurfactants. Nowadays polyfluorinated surfactants are used. These are, however, not quite as good as perfluorinated (fully fluorinated) surfactants, but they are perfectly acceptable to the market. Research and development is continuing, and Fomtec has a long-term vision of phasing out fluorinated surfactants as the market increasingly demands it. However, fluorine-free fire-fighting foam has disadvantages, such as slower extinguishing, and larger amounts of fire-fighting foam have to be used.

Many of the suppliers in the survey believe that the debate around perfluorinated substances in fire-fighting foam has become biased and that there is no basis for many of the assertions concerning environmental hazard. The suppliers believe there are publications that make false claims about the hazardous nature of fire-fighting foam. No association similar to the American special interest group FFFC, however, has been set up to protect the interests of suppliers. A press release from Nordic Fire & Rescue Service AS states that no fire-fighting foams currently used in the EU and EEA contain any environmentally toxic or bioaccumulative substances (Apeland, 2014). It is not thought that problems similar to those that previously occurred with PFOS will arise.

Representatives from the authorities, research and suppliers have already held joint meetings in which they have discussed the problems around PFASs and PFOS. Presto refers to a meeting held in 2006, amongst others; see list of participants in Appendix 2. The branch has requested ongoing dialogue within the sector.

3 Professional users

Professional users of fire-fighting foam were contacted to obtain a picture of the procurement, use and disposal of fire-fighting foam. Users contacted included fire and emergency services, airports, armed forces, the fire-fighting agents centre (SMC), MSB, training centres, and manufacturing industries. A list of users contacted can be found in Appendix 1.

These users account for the greatest use of fire-fighting foam in Sweden and were chosen to give a representative picture of how fire-fighting foam is used and handled in Sweden. Section 3.1-3.6 presents the responses from various parties.

Fire-fighting foams are used, amongst other things, to prevent the spread, for example, of petroleum products in car fires where the risk of spreading is great.

Routines for purchasing fire-fighting foams vary between different professional users. For most users purchasing is carried out via existing contacts rather than through tendering. The armed forces, however, procure all their needs for fire-fighting foam via the Swedish Defence Material Administration (Försvarets materielverk, FMV), whose purchasing is heavily regulated.

Replacing a fire-fighting product can require replacing equipment, which is why analysis is required before one product can be replaced by another.

Fire-fighting foam is disposed of by SAKAB or Stena. Often there are already agreements between users and suppliers concerning hazardous waste, and disposal of fire-fighting foam is included in the agreement. Sometimes suppliers act as an intermediary and take back unused products from the users. One user says that it tests performance annually to avoid unnecessarily disposal of usable fire-fighting foam.

3.1 Släckmedelcentralen (SMC, the fire-fighting agents centre)

In 1994 oil companies in Sweden formed the company Släckmedelcentralen – SMC AB with the aim of preventing and extinguishing fires at oil depots. SMC has invested in equipment and signed agreements with local fire and rescue services concerning emergency preparedness and operational activities. Besides the owners, other companies that store and handle petroleum products have also signed collaborative agreements with SMC.

SMC supplies expertise and equipment for fires and accidents in the oil industry, and has agreements with the fire and rescue services in Stockholm, Gothenburg, Malmö and Sundsvall; extinguishing equipment is located in these areas. 32 m³ foam concentrate is stored in both the Malmö and Sundsvall districts and 40 m³ in both the Stockholm and Gothenburg localities.

Fires occurring in the oil industry are difficult to combat and place heavy demands on those products used for extinguishing. Mixtures of alcohol in petrol are more difficult to extinguish with traditional fire-fighting foams and require an alcohol-resistant foam instead.

SMC uses different fire-fighting foams in the different regions. Alcolac FFFP-AR³ from Kidde Sweden is used in the northern and western regions, and Arc Miljö from Dafo in the southern region. The eastern region has also been contacted but no response was received within the time frame of the study.

Fire-fighting foam is nowadays used only to a small extent by SMC and is restricted with respect to both training and actual fires. SMC cannot use fire-fighting foam for training in Sweden; they must travel to France to carry out training with fire-fighting foam. Fortunately, there are very few accidents and therefore only small amounts of fire-fighting foam are used.

The most important conditions imposed by SMC when purchasing fire-fighting foam are that the product can be used in its equipment, that it has a long shelf life and that it conforms to current legal requirements.

3.2 Fire and rescue services

The Fire and Rescue Services in Stenungsund and Greater Gothenburg, as well as the Fire and Rescue Service South (Malmö) and the Fire and Rescue Service Höga Kusten-Ådalen (Härnösand) have been contacted. The fire and rescue services contacted use different

³ Alcohol-Resistant Film-Forming Fluoroprotein

products as procurement takes place at a local level. The fire and rescue services require that products comply with Swedish law.

Fire and Rescue Service South uses smaller amounts of fire-fighting foam as the legal requirements governing use are more stringent. Fire and Rescue Service South stores ca 8 m³ foam concentrate.

3.2.1 Höga Kusten-Ådalen Fire and Rescue Service

The Höga Kusten-Ådalen Fire and Rescue Service (HKÅ) is using less and less fire-fighting foam. Five different fire-fighting foams are currently used, in particular: Moussol APS-P and OneSeven Class A (other foams contain two types of OneSeven Class B-AFFF as well as Sthamex SVM). Both Moussol and OneSeven are used for fires in buildings. Moussol is an alcohol-resistant type of foam and in the last few years has been used in all first-response vehicles. The vehicles were previously equipped with detergent foam but the use of detergent foam has fallen considerably in recent years. Detergent foam is used in training and in acute situations in building fires. Purchasing takes place via Nordic Fire & Rescue service and via Höga Kusten Airport, with whom there is collaboration. For airport contacts the purchase of fire-fighting foam depends on finances and availability. OneSeven is relatively new as the appurtenant fire-prevention vehicles only became operational around two years ago.

3.2.2 Stenungsund Fire and Rescue Service

The Stenungsund Fire and Rescue Service comprises a part-time fire brigade, and the municipality has an agreement on fire extinguishing with the petrochemical industries based in the municipality. The “Foam System Stenungsund” agreement regulates the use and funding of equipment and consumable materials.

The Fire and Rescue Service uses Arc Miljö (ca 56 m³). In the event of an accident the industrial operation affected will always commence active fire extinguishing work before the fire and rescue services arrive on the scene. The Stenungsund Fire and Rescue Service tests the extinguishing capability of its foam annually. Training mainly takes place without fire-fighting foam; when training involves foam, the oldest foams are used (those closest to their ‘use by’ date). A working group within the Stenungsund Fire and Rescue Service is examining research into fire-fighting foam prior to any future replacement of products. The Stenungsund Fire and Rescue Service has only been performing fire fighting operations since 2007.

The Stenungsund Fire and Rescue Service has a contract with SAKAB for the disposal of fire-fighting foam.

3.2.3 Greater Gothenburg Fire and Rescue Service

The Greater Gothenburg Fire and Rescue Service is increasing its use of foam. This is thought to be due to a previous lack of knowledge about how fire-fighting foam can be used and what effects the foam has. Their new product, A-foam from Dafo, has a good extinguishing performance and its use will probably increase. A-foam is an extinguishing concentrate which consists of hydrocarbon surfactants and retardants which have a very strong extinguishing effect. The product has wetting properties which, in combination with compressed air, causes the product to adhere to burning objects rather than just flowing over them.

The fire and rescue service also uses an alcohol-resistant fire-fighting foam and a detergent foam for ethanol and building fires, though only to a very limited extent. Using fire-fighting

foam is an active choice, as the product is mixed on-site. Alcohol-resistant foam concentrates are more expensive and are therefore not used unless specifically required. Permission is required to use fire-fighting foam in training, though A-foam may be used in training without permission.

3.3 The Swedish Armed Forces

Armed Forces' airbases have their own fire and rescue services. Only one product is used by the Armed Forces: Sthamex-AFFF, 3%. The product is purchased from Presto but is produced by Dr Sthamer in Germany. Ordering is via FMV and requirements are stipulated in "Försvarssektorns kriterie- dokument – kemiska ämnen, kemiska produkter och varor" (the Defence Sector's criteria document - chemical substances, chemical products and goods).

Training in the Blekinge air squadron (F17, Ronneby) normally uses only water, though strong fire-fighting foam is used in very exceptional cases to demonstrate the foam's extinguishing effect. The foam concentrate for the products is stored in its original packaging, standing in banded pallets.

At Malmen Airbase (Lidköping) all fire and rescue vehicles carry foam concentrate. Mixing on-site only occurs in acute situations, i.e., fires involving petroleum products. Water is used with other types of fire. Training takes place at the armed forces training location in Halmstad, where fire-fighting foam is not used and training involves the use of water only.

F21 Luleå was also contacted but no response was received within the time frame of this study.

3.4 Airports

Contact has been made with Bromma Airport and Arlanda Airport.

In 2010 a test was carried out on the airport's fire engines, which showed that PFOS residues still remained in the vehicles' tanks. In June 2011, therefore, all fire engines at Arlanda were decontaminated. After the decontamination a new fluorine-free fire-fighting foam (Moussol 3/6-FF) was introduced into the fire engines. The new fire-fighting foam forms carbon dioxide and water when degrading (Swedavia, 2014).

Swedavia has ordered specially-produced fire-fighting foam from its manufacturer Presto, as they wanted a product free from fluorosurfactants. Presto contacted its supplier, Dr Sthamer, and asked them to develop a product without fluorosurfactants.

Training with fire-fighting foam is permitted at Arlanda Airport but not at Bromma Airport. The foam concentrate is delivered and stored in 1 m³ drums within a banded area. Disposal is carried out by contractors with whom Swedavia has agreements.

3.5 Training centres

MSB is responsible for two training centres, Revinge and Sandö, where training and instruction with fire-fighting foam takes place. Investigations into the source of PFOS in the environment are carried out at both locations.

OneSeven and Unifoam Bio Yellow are used at MSB Revinge for extinguishing fires on the training field. Arc Miljö and Fomtec AFFF 3-6 percent are used for demonstration purposes in the fire laboratory. The suppliers are Kempartner AB, Nordic Fire & Rescue service and DAFO Brand AB. In purchasing, requirement specifications are that the product should be environmentally friendly but should also function as intended and must be seen to function in

the biological purification facility at the training centre. In the event of a product being discontinued, it must be disposed of in accordance with the agreement with Stena Metall.

At Sandö fire-fighting foams containing PFOS and PFOA have not been used since the end of the 1980s. The Sthamex training foam was mainly used from 1988 to 2011 before being replaced by OneSeven in 2012. MSB Sandö has ongoing contact with the Technical Office in Kramfors Municipality and submits an environmental report each year. OneSeven is currently used at Sandö and is purchased from Nordic Fire and Rescue Service.

Swedish Rescue Training Centre (SRTC) Skövde is now a privately owned training centre that previously belonged to the Fire and Rescue Service. At SRTC, training and education are carried out for fire and rescue services personnel and for personnel in industry/company fire and rescue services. SRTC uses OneSeven from Nordic Fire and Rescue Service; clients may not use their own products and SRTC is always responsible for the products used.

3.6 The Petroleum industry

Preem (in Gothenburg and Lysekil) and Nynäs (Nynäshamn) refineries were contacted for information on their emergency preparedness and any handling of fire-fighting foam, but unfortunately no response was received within the time frame of this study.

4 List of chemicals

Safety data sheets for fire-fighting foams were collected for this survey, both from Swedish suppliers and from professional users. A list of the fire-fighting foams available on the Swedish market can be found in Appendix 3. Different fire-fighting foams are listed in the appendix together with information on manufacturers, suppliers, users and chemical content.

The manufacturers market a large amount of fire-fighting foam and it has not been possible to compile a complete list as part of this study. Full safety data sheets can be downloaded from the respective manufacturers. Safety data sheets do not always indicate the type of fire-fighting foam (film-forming, training foam, etc.) and it was therefore difficult to categorize listed fire-fighting foams as part of this study.

Fire-fighting foam available on the Swedish market may contain an amount of various additives but the information on fluorosurfactants is often regarded as confidential. There is therefore a substantial lack of information on any perfluorinated substances in the contents. Many producers and suppliers point out the degradability of the constituent chemicals, which in turn suggests why fully fluorinated alternatives are not used, but rather substances that can be broken down to some degree, such as 6:2 FTS. One column in Appendix 3 indicates whether or not it is stated that the fire-fighting foam contains fluorosurfactants. Note, however, that fluorosurfactants may still be found in the fire-fighting foam even though this is not stated in the safety data sheet.

Producers regard contents as trade secrets and therefore do not apply for patents for their products. However, they may consider releasing information in special cases, against a confidentiality agreement.

Information is available on the production of new, rather PFOS-like chemicals from China. None of the parties in this study directly import products from countries outside the EU or US; no information on which producers they purchased their chemicals from, however, was requested in this study.

5 Suggestions for further investigations

Questions arose during the course of this study concerning a number of areas which should be examined in greater detail in an extended study.

More in-depth studies of the different types of users should include more entities and a more comprehensive survey, for example courses of action and procedures for the supervision and disposal of extinguishing water during training. Routines for disposal amongst users and waste receivers (SAKAB, Stena) should be examined.

The frequency of responses to mail contact with overseas manufacturers in this study was low. In an extended study overseas manufacturers and users should be contacted by telephone in order to obtain a clearer picture of the European market for fire-fighting foam.

It appears to be broader areas of application for the new products, than mentioned in this investigation. An extended study should be able to observe how this affects the use of fire-fighting foam.

It has also emerged that some, but not all, municipalities impose conditions for the approval of training with foam. An extended study should look at what conditions the various municipalities impose on these approvals, how decisions on approval are arrived at, and whether such conditions should be regulated.

Norway has stricter regulations for fire-fighting foam. An appraisal of these regulations should be able to show whether these should also be applied in Sweden.

6 Bibliography

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7 Appendices

Appendix 1: List of producers, suppliers and users contacted

Appendix 2: List of participants, industry meeting 2006

Appendix 3: List of chemicals

APPENDIX 1

2014-05-12

Supplier contacts

| Supplier | Contact person |
|---------------------------------|---|
| Dafo Brand | Krister Eriksson |
| Foamtec | Jan Erik Jönsson |
| Kidde | Mats Hellstadius |
| Presto | Lars Östrand |
| Argus | Sent mail, unfortunately no reply |
| Dr Sthamer | Sent mail, unfortunately no reply |
| KemPartner AB | Kid Thor |
| Chemguard | Keith Ford |
| DuPont | Francis Auchincloss |
| Ansul | Sent mail, unfortunately no reply |
| National Foam | Sent mail, unfortunately no reply |
| Eau et Feu | Sent mail, unfortunately no reply |
| Nordic Fire & Rescue service | Daniel Apeland |
| The OneSeven® | Sent mail, unfortunately no reply |
| Solberg | Sent mail, unfortunately no reply |
| SP | Henry Persson, communication not received |
| Tyco Fire Protection | Claes Lundin |
| Kerr Fire belongs to Angus Fire | Louise Daly |

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Gjörwellsгатan 22
Box 34044
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Telephone +46 (0)8 6956000
Fax +46 (0)8 6956010
www.sweco.se

Sweco Environment AB
Org.no 556346-0327
Registered office: Stockholm

Johanna Hörstedt
Assignment
manager
Infrastructure
Telephone direct + 4686955815
Mobile +46 (0)768155815
johanna.horstedt@sweco .se

User contacts

| Company/authority | Name |
|--|---|
| MSB | Stefan Svärkvist |
| | Dan Holmqvist, MSB Revinge |
| | Tomas Ljunglund, MSB Sandö |
| SRTC Skövde | Anette Gustafsson |
| Sveriges tekniska provningsinstitut (SP) | Tommy Hertzberg, Släcksystem |
| Swedavia | Ulf Hansson, Bromma airport |
| | Christer Westberg, Arlanda airport |
| Släckmedelscentralen (SMC), SPBI | Tord Johansson, Region West |
| | Staffan Hjelm, Region East (no reply) |
| | Roger Josbrant, Region North |
| | Gerry Asplund, Region South |
| Fire and Rescue Services | Gerry Asplund, South |
| | Ulf Lindgren, Greater Gothenburg |
| | Ulf Lindström, Höga Kusten-Ådalen (Härnösand) |
| | Göran Antbacka, Stenungsund |
| The Swedish Armed Forces | Per Nilsson, F21 |
| | Emmy Carlsson, F17 |
| | Rikard Sjöberg, Malmen Airbase |
| Preem | Lars Gunnar Hansson, Lysekil fire service |
| Nynäs | Joakim Atterstam, Nynäshamn fire service |

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APPENDIX 1
2014-05-12

Appendix 2 List of participants

Meeting on perfluorinated substances in firefighting foam 2006-05-05

| <i>Name</i> | <i>Organization</i> |
|--------------------|---|
| Henry Persson | SP Sveriges Provnings- och Forskningsinstitut |
| Sören Lundström | Räddningsverket |
| Jens Hjort | Svenska Brandförsvarsförbundet |
| Lars Östrand | BST-PRESTO Brandskyddsteknik AB |
| Thomas Sparring | Dafo Brand AB |
| Krister Eriksson | Dafo Brand AB |
| Ann Mellström | Kidde Sweden AB |
| Birgit Ramfjord | FMV |
| Göran Wall | Plast & Kemiföretagen |
| Ingrid Båvenstrand | 3M |
| Maria Wallin | Naturvårdsverket |
| Lisa Anfält | Kemikalieinspektionen |
| Åsa Edell | Kemikalieinspektionen |
| Inger Cederberg | Kemikalieinspektionen |
| Inger Lindkvist | Kemikalieinspektionen |
| Bob Pugh | Ytkemiska institutet |
| Stellan Fisher | Kemikalieinspektionen |
| Peter Svensson | Kemi- och Miljökonsult AB |
| Vibeke Bernson | Kemikalieinspektionen |
| Ulf Rick | Kemikalieinspektionen |
| Leif Olofsson | Kemikalieinspektionen |

Appendix 3 List of chemicals

| Examples of professional users | Brand name | Manufacturer | Distributor | Chemical substances contained in the product according to safety data sheet | CAS Number of constituent substance | Contains fluorosurfactant | |
|--------------------------------|-------------------------|----------------|---------------|---|-------------------------------------|---------------------------|--|
| | Unilight AFFF-AR 3-6 % | Kempartner AB | Kempartner AB | Magnesium chloride | 7786-30-3 | | |
| | | | | Monopropylene glycol | 57-56-6 | | |
| | | | | 3-Lauroylamidopropyl betaine | 4292-10-08 | | |
| | | | | Xanthan gum | 11138-66-2 | | |
| | | | | Diethylene glycol monobutyl ether | 112-34-5 | | |
| | | | | 2-Methylpentane-2,4-diol | 107-41-5 | | |
| | | | | Fluorinated anionic surfactant | - | Yes | |
| | | | | 2-Phenoxyethanol | 122-99-6 | | |
| | | | | Methylparaben | 99-76-3 | | |
| | | | | Ethylparaben | 120-47-8 | | |
| | | | | Propylparaben | 94-13-3 | | |
| | Water | - | | | | | |
| | Unilight AFFF 1% EH | Kempartner AB | Kempartner AB | Diethylene glycol monobutyl ether | 112-34-5 | | |
| | | | | Fluorinated anionic surfactant | - | Yes | |
| | | | | Polyethylene glycol | 25322-68-3 | | |
| | | | | 3-Lauroylamidopropyl betaine | 4292-10-08 | | |
| | Water | - | | | | | |
| | Meteor Allround Ma-13 | Kempartner AB | Kempartner AB | Butyl diglycol | 112-34-5 | | |
| | | | | Polyethylene glycol | 25322-68-3 | | |
| | | | | Sodium lauryl sulphate | 73296-89-6 | | |
| | | | | Fluorinated anionic surfactant | - | Yes | |
| | | | | Water | - | | |
| MSB | Unifoam Bio Yellow | Kempartner AB | Kempartner AB | Ammonium alkyl sulphate | 67762-19-0 | | |
| | | | | Triethanolamine alkyl sulphate | 90583-18-9 | | |
| | | | | Sodium lauryl ether sulphate | 13150-00-0 | | |
| | | | | Decyl glucoside | 54549-25-6 | | |
| | | | | BDG | 112-34-5 | | |
| | | | | Xanthan gum | 11138-66-2 | | |
| | | | | Colourant/ azo pigment C.I. Acid Yellow 23 | - | | |
| | | | | Water | - | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | Unifoam S | Kempartner AB | Kempartner AB | Ammonium alkyl ether sulphate | 2235-54-3 | | |
| | | | | Triethanolamine alkyl ether sulphate | 139-96-8 | | |
| | | | | BDG | 112-34-5 | | |
| | | | | Water | - | | |
| | Unifoam | Kempartner AB | Kempartner AB | Ammonium alkyl ether sulphate | 2235-54-3 | | |
| | | | | Triethanolamine alkyl ether sulphate | 139-96-8 | | |
| | | | | BDG (2-(2-Butoxyethoxy)ethanol) | 112-34-5 | | |
| | | | | Water | - | | |
| | Presto AFFF 3 % | Dr Sthamer | Presto | 1,2-Ethanediol | 107-21-1 | | |
| | | | | Decyl sulphate | 142-87-0 | | |
| | | | | Fluorosurfactant | 161278-39-3 | Yes | |
| | Fomtec AFFF 1% A | Dafo Fomtec AB | Dafo Brand AB | Monopropylene glycol | 57-55-6 | | |
| | | | | Sodium alkyl sulphate | 90583-25-8 | | |
| | | | | Alkyl polyglycoside | 68515-73-1 | | |
| | | | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | | |
| | Fomtec AFFF 1% F | Dafo Fomtec AB | Dafo Brand AB | Monopropylene glycol | 57-55-6 | | |
| | | | | Sodium alkyl sulphate | 90583-25-8 | | |
| | | | | Alkyl polyglycoside | 68515-73-1 | | |
| | | | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | | |
| | | | | Polyethylene glycol 400 | 25322-68-3 | | |
| | Fomtec AFFF 1% Plus | Dafo Fomtec AB | Dafo Brand AB | Sodium alkyl sulphate | 90583-25-8 | | |
| | | | | Alkyl polyglycoside | 68515-73-1 | | |
| | | | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | | |
| | Fomtec AFFF 1% Ultra LT | Dafo Fomtec AB | Dafo Brand AB | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | | |
| | | | | 1,2-Ethanediol | 107-21-1 | | |
| | | | | Monopropylene glycol | 57-55-6 | | |
| | | | | Sodium alkyl sulphate | 90583-25-8 | | |
| | | | | Alkyl polyglycoside | 68515-73-1 | | |

| | | | | | | |
|---|--|--------------------------|---------------------------------|--|-------------|-----|
| | Fomtec AFFF 3% ICAO | Dafo Fomtec AB | Dafo Brand AB | Sodium alkyl sulphate | 90583-25-8 | |
| | | | | Alkyl polyglycoside | 68515-73-1 | |
| | | | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | Fomtec AFFF 3% S | Dafo Fomtec AB | Dafo Brand AB | Monopropylene glycol | 57-55-6 | |
| | | | | Sodium alkyl sulphate | 90583-25-8 | |
| | | | | Alkyl polyglycoside | 68515-73-1 | |
| | | | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | Polyethylene glycol 400 | 25322-68-3 | |
| | Fomtec AFFF 3% | Dafo Fomtec AB | Dafo Brand AB | Monopropylene glycol | 57-55-6 | |
| | | | | Sodium alkyl sulphate | 90583-25-8 | |
| | | | | Alkyl polyglycoside | 68515-73-1 | |
| | | | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | Polyethylene glycol 400 | 25322-68-3 | |
| Swedavia | MOUSSOL®-FF 3/6 | Dr Sthamer | Presto | 1,2-Ethenediol | 107-21-1 | |
| | | | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | Triethanolamine lauryl sulphate | 139-96-8 | |
| | | | | Xanthan | 11138-66-2 | |
| | Foammousse 3% | Dr Sthamer | Presto | Iron (ii) sulphate 7-hydrate | 7782-63-0 | |
| | | | | Ammonium chloride | 12125-02-9 | |
| | Moussol APS F-15 | | Presto | 1,2-Ethenediol | 107-21-1 | |
| | | | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | Fluorosurfactant | 161278-39-3 | Yes |
| | | | | Alkyl polyglycoside | 68515-73-1 | |
| Fire and Rescue Services | Moussol APS P | Dr Sthamer | Presto | 1,2-Ethenediol | 107-21-1 | |
| | | | | 2-Butoxyethanol | 111-76-2 | |
| | Training foam | | Presto | Sodium alkyl ether sulphate | 73665-22-2 | |
| Fire and Rescue Services | Sthamex SVM | | Presto | Ethylene glycol monobutyl ether | 111-76-2 | |
| | | | | Sodium alkyl ether sulphate | 73665-22-2 | |
| | | | | Tris(2-hydroxyethyl)ammonium dodecyl sulphate | 139-96-8 | |
| | | | | Sodium lauryl ether sulphate | 68891-38-3 | |
| | Towalex 3X3F | | Presto | 1,2-Ethenediol | 107-21-1 | |
| | | | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| Fire and Rescue Services | OneSeven Foam Concentrate Class A | OneSeven of Germany GmbH | Nordic Fire & Rescue Service AS | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | 1-propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-coco acyl derivate, hydroxide, Inner Salts | 61789-40-0 | |
| | | | | Alcohols, C9-11, ethoxylated, sulphates, ammonium salts | 160901-27-9 | |
| | | | | Sulphuric acid, mono C12-C14 alkyl esters, compounds with triethanolamine | 90583-18-9 | |
| | | | | 2-Methyl-2,4-pentenediol | 107-41-5 | |
| Fire and Rescue Services | OneSeven® Foam Concentrate Class B-AFFF | OneSeven of Germany GmbH | Nordic Fire & Rescue Service AS | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | Sodium octyl sulphate | 142-31-4 | |
| | | | | Sodium 3-[2-(2-heptyl-4,5-dihydro-1H-imidazol-1-yl)ethoxy] propionate | 68877-55-4 | |
| | | | | D-Glucopyranose, oligomers, decyl octyl glycosides | 68515-73-1 | |
| | | | | (Carboxymethyl)dimethyl-3-[(1-oxododecyl)amino]propyl ammonium hydroxide | 4292-10-08 | |
| Fire and Rescue Services | OneSeven® Foam Concentrate Class B-AFFF-AR | OneSeven of Germany GmbH | Nordic Fire & Rescue Service AS | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | Surfactants | | |
| | | | | Sodium octyl sulphate | 142-31-4 | |
| | | | | Sodium 3-[2-(2-heptyl-4,5-dihydro-1H-imidazol-1-yl)ethoxy] propionate | 68877-55-4 | |
| | | | | (Carboxymethyl)dimethyl-3-[(1-oxododecyl)amino]propyl ammonium hydroxide | 4292-10-08 | |
| | | | | 2-Methyl-2,4-pentenediol | 107-41-5 | |
| MSB, Slackmedelscentralen, Fire and Rescue Services | ARC Miljo | | Dafo Brand AB | Sodium alkyl sulphate | 90583-25-8 | |
| | | | | Alkyl polyglycoside | 68515-73-1 | |
| MSB | UniFoam Bio Yellow | Kempartner AB | | Ammonium alkyl sulphate | - | |
| | | | | Triethanolamine alkyl sulphate | - | |
| | | | | Sodium lauryl ether sulphate | - | |
| | | | | Decyl glucoside | - | |
| | | | | BDG | - | |

| | | | | | | |
|--------------------------|-----------------------------------|--------------------------------|-----------------|--|------------|-----|
| | | | | Xanthan gum | - | |
| | | | | Colourant/ azo pigment C.I. Acid Yellow 23 | - | |
| | | | | Water | - | |
| MSB | AFFF 3-6 % | | Dafo Brand AB | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | Sodium n-octyl sulphate | 142-31-4 | |
| | | | | Sulphuric acid, mono decyl | 142-87-0 | |
| | | | | Ethanol | 64-17-5 | |
| MSB | OneSeven Class A Foam concentrate | Gimaex-Schmitz Fire and Rescue | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | Surfactant | - | |
| Swedavia | Moussol-FF 3/6 | Dr Sthamer | Presto | 1,2-Ethandiol | 107-21-1 | |
| | | | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | Triethanolamine lauryl sulphate | 139-96-8 | |
| | | | | Xanthan | 11138-66-2 | |
| | Arctic Foam 201AF AFFF1% | Solberg Scandinavia AS | Kidde Sweden AB | Water | - | |
| | | | | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | 1,2-Ethandiol | 107-21-1 | |
| | | | | Alkyl polyglycoside | 68515-73-1 | |
| | | | | Alkylate salts | 205-535-5 | |
| | | | | Polyfluoralkyl | - | Yes |
| | | | | Tolytriazole | 2938543-1 | |
| Slackmedelscentralen | Alcoseal 3-3% | Angus Fire | Kidde Sweden AB | Hexylene glycol | 107-41-5 | |
| | | | | Hydrolyzed protein | - | |
| | | | | Fluorosurfactant | - | Yes |
| | | | | Bactericide | - | |
| | | | | Polymer | - | |
| | | | | Water | - | |
| | Extra Eco + | Kidde Products | Kidde Sweden AB | Diethylene glycol monobutyl ether | 112-34-5 | |
| | | | | Hydrocarbon surfactants | 142-31-4 | |
| | | | | Chelated substances | 64-17-5 | |
| | | | | Fluorosurfactant | - | Yes |
| | | | | Biocide | - | |
| | | | | soluble phosphate <20% | - | |
| | | | | Water | - | |
| | Foam X without ethylene glycol | Chubbe Fire Limited | Kidde Sweden AB | Diethylene glycol monobutyl ether | 112-34-5 | |
| | | | | Hydrocarbon surfactants | 142-31-4 | |
| | | | | Sodium salt | 1964-02-08 | |
| | | | | Fluorosurfactant | - | Yes |
| | | | | Biocide | - | |
| | | | | Water | - | |
| | Niagara 1-3& % | Angus Fire | Kidde Sweden AB | Hexylene glycol | - | |
| | | | | Sodium chloride | 107-41-5 | |
| | | | | Fluorosurfactant | 7647-14-5 | Yes |
| | | | | Hydrolyzed protein | - | |
| | | | | Batericide | - | |
| | | | | Water | - | |
| | Tridol ATF 3-3% | Angus Fire | Kidde Sweden AB | Hexylene glycol | 107-41-5 | |
| | | | | Fluorosurfactant | - | Yes |
| | | | | hydrocarbon surfactant | - | |
| | | | | polymer | - | |
| | | | | Water | - | |
| Fire and Rescue Services | Forest A-skum | | Dafo Brand AB | 2-(2-Butoxyethoxy)ethanol | 112-34-5 | |
| | | | | Sodium alkyl sulphate | 90583-25-8 | |
| The Swedish Armed Forces | Sthamex-AFFF-P 3% | Dr Sthamer | Presto | 1,2-Ethandiol | 107-21-1 | |
| | | | | Surfactants with fluoro additives | - | Yes |
| | | | | Surfactants with hydrocarbons | - | |



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