Proposal for a regulation with amendments to Regulations relating to restrictions on the use of chemicals dangerous to health and the environment and other products (Product Regulations).

Sec. 3-x. PFOS and PFOS-related substances in textiles, impregnation agents and fire-fighting foam

It is forbidden to produce, import, export or sell textiles and impregnation agents that contain 0.001 percent or more by weight PFOS or PFOS-related substances.

It is forbidden to produce, import, export, sell or use fire-fighting foam that contains 0.001 percent or more by weight PFOS or PFOS-related substances. It is also forbidden to have a fire-extinguishing system with foam that contains 0.001 percent or more by weight PFOS or PFOS-related substances.

Fire-fighting foam that contains 0.001 percent or more by weight PFOS or PFOS-related substances must be delivered to an approved recipient for destruction.

By PFOS and PFOS-related substances, what is meant in this paragraph is perfluorooctyl sulphonates with the chemical formula $C_8F_{17}SO_2X$ (X = OH, metallic salt, halogenide, amide and other derivatives including polymers).

Assessment of need for ban/use restrictions on PFOS (perfluorooctyl sulphonate) and PFOS-related substances – Environmental Impact assessment

1. Summary

In the assignment letter dated 13 December 2004 the Ministry of the Environment requested that the Norwegian Pollution Control Authority evaluate the need for a ban or use restrictions, in addition to voluntary phasing out, for PFOS and PFOS-related substances. The Pollution Control Authority issued a response to the assignment letter on 19 December 2005 to the Ministry of the Environment. The Ministry of the Environment then in an assignment letter dated 28 February 2006 tasked the Pollution Control Authority with including textiles and impregnation agents in the working area for a proposal on a ban against PFOS and PFOS-related substances.

The national objective in Storting White Paper No. 21 (2004-2005) is for the emissions of ″individual PFOS-related substances″ to be significantly reduced before 2010. Fire-fighting foam is unquestionably the largest application area for PFOS and PFOS-related substances in Norway today, comprising more than 90 % of current use based upon the data we have assembled. Further use contributes directly to emissions to the environment. PFOS and PFOS-related substances have been used previously in textiles and impregnation agents. Low levels of them can be found in these products today. It is unacceptable that such a serious hazardous substance as PFOS is used in these consumer products. A ban against PFOS and PFOS-related substances in textiles and impregnation agents would have the effect of avoiding the use of this hazardous substance in these products in the future.

The EU also desires to ban new uses of PFOS and PFOS-related substances in products, but is proposing a higher concentration limit. The proposal for regulation in the EU will

also encompass new uses of fire-fighting foam, but not fire-fighting foam found in existing systems. The proposal for a ban is currently being discussed in the EU Council and Parliament, where it is expected that it will be voted on in September of this year.

The Pollution Control Authority proposes a ban against their use and a requirement that remaining quantities of fire-fighting foam containing PFOS or PFOS-related substances be replaced, as well as a ban against the use of PFOS and PFOS-related substances in textiles and impregnation agents. This would prevent around 8 tons of PFOS and PFOS-related substances being released into the environment in the next few years. The total cost of this regulation is computed to be approx. NOK 14.3 million. The cost of the measures per kg of PFOS and PFOS-related substances for the different types of companies is estimated to lie in a range between NOK 963 and 2760. The Pollution Control Authority does not believe that the ban against the use of PFOS and PFOS-related substances in textiles and impregnation agents would inflict any costs. The Pollution Control Authority does however emphasise that there is some uncertainty connected with the estimated costs. As far as the Pollution Control Authority is aware, no separate studies have been done of the costs of the damages from emissions of PFOS or PFOS-related substances. The properties of PFOS and PFOS-related substances are such that these substances are comparable with the substances on the priority list posing hazards of the highest degree. These substances have costs of damages that are far higher than our estimate for the costs of the measures. It thus is the assessment of the Pollution Control Authority that this regulation is socioeconomically beneficial.

2. Description of problem

2.1 Definitions and properties

Perfluoroalkyl substances (PFAS) is the collective term for a group of chemical substances that contain perfluoroalkyl groups. They have been used in both industrial applications as well as consumer products since the 1950s. Within the PFAS group, most of the emphasis has been placed on those that contain sulphur (perfluoroalkyl sulphonates), and particularly those with an eight-carbon chain length, known as perfluorooctyl sulphonates (PFOS and PFOS-related substances). PFAS substances are generally very stable substances with a unique combination of physico-chemical properties. They are neither fat nor water-soluble. At present, we know very little about the health and environmental effects of these substances, with the exception of PFOS and perfluorooctanoic acid (PFOA). The acronym PFOS stands for perfluorooctyl sulphonate, which is the fully fluorinated anion of perfluorooctanoic acid. The term PFOS-related substances is used to mean all substances containing one or more PFOS groups (defined as $C_8F_{17}SO_2$) and that can or are presumed to be able to degrade to PFOS in the environment. PFOS can bind to proteins in the blood and can accumulate in the body, primarily in the liver and gall bladder.

2.2 Effects on health and the environment

The substance PFOS itself does not break down further in the environment. In studies of mammals, PFOS has been found to show chronic toxicity and reproductive toxicity. Studies have also shown that PFOS is toxic to aquatic organisms.

The UK has prepared a risk assessment and a risk limitation strategy that includes an impact assessment. The risk limitation strategy has been evaluated by the EU's Scientific Committee on Health and Environmental Risks (SCHER). SCHER concluded that PFOS is very persistent, very bioaccumulative and toxic. PFOS thereby satisfies the EU's PBT criteria (Persistent Bioaccumulating Toxic).

With respect to PFOS-related substances in general, there is a lack of data on the effects, but since the substances can be broken down to PFOS they are also considered to satisfy the PBT criteria.

2.3 Occurrence

At present, PFOS is found in the environment and in organisms around the entire world. There is significant spreading of PFOS in Norway. The substance is very widespread in the environment in Norway. Studies of different species of animals show that PFOS and some individual other PFOS-related substances can also be accumulated in the food chain. Among other things, high levels of PFOS-related substances have been shown in polar bear livers from Svalbard. High levels of PFOS-related substances have been found in the blood of workers in the US who have been occupationally exposed during the production of the substances. PFOS-related substances have also been found in the blood of the general population in a number of locations around the world, including in pregnant women in Siberia where there are no known local sources of these substances. The World Wildlife Federation (WWF) analysed the blood of the members of the EU Parliament, and PFOS was among the 10 hazardous substances having the highest concentrations.

2.4 Need for regulation / use restriction

The Pollution Control Authority has sufficient knowledge of the health and environmental characteristics of PFOS and PFOS-related substances to be of the opinion that regulations are necessary. Even though the levels currently found in the environment are relatively low, it is important to halt continuing emissions of these substances as quickly as possible in order to prevent the levels in the environment from reaching concentrations that can bring about serious health and environmental effects.

2.5 Application areas

PFOS has unique physico-chemical properties. PFOS does not break down in an acidic or basic environment or at high temperatures. PFOS is not flammable and does not mix with liquids. PFOS thus has unique properties that have been exploited for various purposes, including their fire-fighting properties in fire-fighting foams.

<u>Fire-fighting foam</u>

The largest application area for PFOS and PFOS-related substances in Norway today is fire-fighting foam (AFFF, Aqueous Film Forming Foams). Fire-fighting foam that contains PFOS or PFOS-related substances is no longer sold, however surveys of the offshore industry, ships and relevant land-based enterprises show that remaining

quantities of fire-fighting foam containing PFOS in these enterprises is approx. 460,000 litres. This fire-fighting foam is mixed with a new foam without PFOS. The PFOS content thus varies considerably. Unmixed fire-fighting foam contains under 3% PFOS. In total a minimum of 57 tons of PFOS and PFOS-related substances have been emitted. The quantity of PFOS in the remaining foam was estimated in 2005 to be around 22 tons. Statoil and Hydro have stated in June 2006 that they have replaced their fire-fighting foam with PFOS content on their offshore installations, as well as their land-based facilities at Sture and Mongstad. Most of this fire-fighting foam has already been destroyed, and plans are to destroy the rest during the course of the month of September this year. These two operators jointly had around 13.8 tons of fire-fighting foam with PFOS content, both onshore and offshore. The quantity of PFOS in the remaining foam is now estimated to be around 8 tons. The fire-fighting foam has a lifespan of at least 10 years. The offshore industry, land-based petroleum enterprises and the armed forces have the largest amounts of fire-fighting foam with PFOS content.

Textiles and impregnation agents

PFOS and PFOS-related substances were used previously in textiles and as impregnation agents. Consumer products such as textiles and impregnation agents today contain a very small level of PFOS and PFOS-related substances. The Pollution Control Authority has analysed 11 textile samples for PFAS content, see the attached report, and the Norwegian Society for the Conservation of Nature has analysed a further 6 jackets from 5 different manufacturers for their content of various PFAS substances. The results of the analyses show that there are small quantities/impurities of PFOS and PFOS-related substances in the selected textiles.

The Pollution Control Authority has also analysed 4 different impregnation agents for their PFOS content, see the attached report. The results of the analysis show that there are impurities of PFOS and PFOS-related substances in the selected impregnation agents.

Metal plating industry (chromium plating)

PFOS and PFOS-related substances are also used in the metal plating industry, as mist suppressants during chromium plating. The substance prevents the vaporisation of hexavalent chromium, which is very hazardous to human health. PFOS or PFOS-related substances are the only substances that work under the very oxidative conditions with Cr^{6+}. In the hard chromium plating process (corrosion protection) hexavalent chromium must be used. For most of the other chromium plating processes (bright chromium plating), trivalent chromium can be used instead. Estimated use in Norway is 3-5 litres of PFOS concentrate per year. This is collected after being used and handled as hazardous waste and is not regarded as comprising any great risk.

Other application areas

Other application areas that have been identified in the UK and Sweden (see points 3.3 and 3.4 below) will on the basis of what we know today comprise a very small amount, but they will be surveyed in greater detail.

2.6 Means for phasing out PFOS and PFOS-related substances

The national objective in Storting White Paper No. 21 (2004-2005) is for the emissions of "individual PFOS-related substances" to be significantly reduced before 2010. In order to achieve this targeted national goal, the Pollution Control Authority believes that it is

necessary to halt further use of fire-fighting foam with PFOS content. It is also important to avoid having such a dangerous hazardous substance being incorporated into consumer products such as textiles and impregnation agents.

Fire-fighting foam is definitely the largest application area for PFOS and PFOS-related substances in Norway today, constituting more than 90 % on the basis of our surveys. Further use contributes directly to emissions to the environment. In order to prevent further emissions, the Pollution Control Authority has, in co-operation with Petroleum Safety Authority Norway, asked the oil companies to refrain from exercises using fire-fighting foam with PFOS content. Some of the enterprises have already begun replacing this foam.

Fire-fighting foam with PFOS content is currently being replaced primarily with fire-fighting foam containing telomers and which can be used in the same system. Telomers are also fluorinated substances (PFAS). Little documentation exists on the health and environmental effects of these, and one possible breakdown product is perfluorooctanoic acid (PFOA), which can also have unfortunate effects on human health and the environment. The Pollution Control Authority is however of the opinion that this is a step in the right direction. In addition, there are other alternatives on the market that appear to be more environmentally friendly, however the application areas in which they can be used vary and there are also variations in whether they can be used in existing systems.

The Pollution Control Authority is of the opinion that it is important to prevent emissions from the remaining fire-fighting foam with PFOS content and that a ban against the further use of fire-fighting foam would be the only effective means if it goes into force quickly. Use of other means or a transition period involving a number of years before a possible bans goes into force could lead to the remaining quantities of fire-fighting foam with PFOS content being used up and released to the environment, something which would be very unfortunate. The ban thus should have a short transition period and go fully into effect soon.

The Pollution Control Authority proposes using 0.001% as a limiting value in the ban. This then lets basis be taken in the detection limit for PFOS and embeds a good margin for avoiding fluctuations caused by possible impurities. The lowest limit that it otherwise would be natural to use is 0.5% because this is the limit for defining fire-fighting foam with PFOS as hazardous waste. Our surveys show however that there are large variations in PFOS concentrations in the remaining quantities of fire-fighting foam. The concentrations in new foam are of a magnitude of 1-3%, i.e. such that it only needs to be diluted 4 times to be below 0.5%. Analysis results from a number of companies show that the concentration lies below this. A limit value of 0.5% would thus probably be too high to capture the majority of the remaining foam with PFOS.

The Norwegian Institute for Air Research, the NILU, possesses good and sensitive analysis methods for PFOS. Their detection limit for PFOS content in materials is around 30 times lower than the proposed limit for the ban of 0.001%. In consultation with the experts at NILU, the Pollution Control Authority has assessed that setting the limit value for PFOS content to 0.001% would place us well within what is possible to detect with the available analysis techniques. At the same time, it is being ensured that the limit is

being set so low that it is not possible to add the hazardous substance PFOS to products either consciously or in consequence of any poor purity of the chemicals that are used in the processes.

PFOS was previously used in textiles and impregnation agents, and is found today in these products in low levels. PFOS and PFOS-related substances are probably not added to the textiles or impregnation agents, but rather are found as impurities. It is unacceptable that such a serious hazardous substance as PFOS and PFOS-related substances are found in these consumer products. A ban against PFOS and PFOS-related substances would have the effect of preventing this hazardous substance from once again being used in textiles and impregnation agents. The analyses that the Pollution Control Authority had done on the content of PFOS in textiles and impregnation agents gave values in the range of 0.1-346 ng/g. This is 3000 times lower than the limit value set in the EU's proposal for a ban against PFOS in products, and 30 times lower that the Pollution Control Authority's proposal.

3. Applicable policies in the area

3.1 OECD

The OECD has discussed PFOS and its derivatives since 2000 and decided in 2002 that the countries that produce PFOS (Italy, Japan, Switzerland and the UK) should investigate whether industry has plans to phase out their production. The OECD has also carried out a risk assessment of PFOS and ascertained that PFOS is persistent, bioaccumulating and toxic.

3.2 OSPAR

OSPAR has included two perfluorinated substances on its List of Substances of Possible Concern, and has decided to give priority to perfluorinated substances as a group based upon their similar chemical structure, and not as individual substances. The UK is heading the work on PFOS within OSPAR, and has published a document including proposals for measures to be implemented by OSPAR with respect to perfluorinated substances.

3.3 The UK

The UK has proposed that PFOS and PFOS-related substances be included in the restriction regulations (the Pollution Control Authority's product regulations). The British have established that the following industries consume PFOS-related substances, and propose the following measures for limiting risk and regulating the substances within them:

Metal plating industry (chromium plating): Proposes that a ban against the use of PFOS-related substances in this industry should go into force at once. No transition phase.

Fire-fighting foam: Proposes a five-year deadline for the implementation of a ban against PFOS-related substances in fire-fighting foam. This is because time is required to destroy the old foam in a responsible manner, however first and foremost in order for better knowledge to be gained of the health and environmental effects of the PFAS-content of the foam that will be replaced by.

Photography industry: Proposes a five-year transition phase due to financial considerations and due to working environment safety. At present no replacements exist for PFOS in some application areas. The British propose that the exception for this industry encompass requirements for handling waste and limiting emissions.

Photolithography and semiconductors: A direct ban would impact this industry financially and in terms of its competitiveness. The industry is in a period of expansion due to, among other things, digital technology and third generation mobile telephones. The British hence propose a five-year transition phase for a ban. The British propose that exceptions for this industry also encompass requirements for handling waste and limiting emissions.

Hydraulic fluids for aircraft: There are no safe alternatives here for PFOS-related substances in hydraulic fluids for aircraft. Their use is critical in relation to aircraft safety and would impact a substantial percentage of air traffic. Development and testing of alternative hydraulic fluids for the aerospace industry is time-consuming and very demanding of resources. The British propose that an exception with no time limitation be given for the use of PFOS-related substances in hydraulic fluids for aircraft. The British recommend that, as a precondition for this exception, documentation be required showing that research is being performed on alternatives.

Textiles and impregnation agents: According to what the information shows, PFOS is no longer being used for these purposes. The regulations proposed by the British would encompass these applications areas.

The proposal is being processed by the EU.

3.4 Sweden

Sweden has proposed that PFOS and PFOS-related substances be included in the Ordinance Concerning Changes in the Ordinance (1998:944) Concerning the Prohibition, etc., in Certain Cases in Connection with the Handling, Import and Export of Chemical Products.

The proposal involves PFOS and PFOS-related substances not being allowed to be sold or otherwise given to consumers. Nor would PFOS and PFOS-related substances be allowed to be sold, otherwise given or used professionally. Hydraulic oils used in aircraft are excepted from the ban. The ban would also apply to imported goods. The point in time for the regulation to go into effect varies between the different application areas, from 1 January 2007 to 1 January 2010.

Application area	**Time of implementation**
Hydraulic oils in aircraft	Exception with no time limitation
Preventing the release of chromium mist in chromium plating processes based upon hexavalent chromium, antireflex treatments, photoresist and etching of aluminium in the manufacturing of semiconductors in the photolithography industry.	Sales and conveyances allowed up to 2009-01-01 Professional use allowed up to 2010-01-01

Fire-extinguishing agent	Allowed for professional uses not including exercises up to 2010-01-01
Other applications	Ban against continued sales or conveyances beginning 2007-01-01 Ban against professional use beginning 2007-01-01

The proposal is being processed by the EU.

3.5 EU

There is at present no EU requirement connected with PFOS and PFOS-related substances, however the Commission has prepared a proposal for a ban based upon the proposals from the UK and Sweden. It is proposed that the ban be implemented in the limitation directive and contain all chemicals and products with more than 0.1% PFOS or PFOS-related substances. The ban will not apply to:

- photoresist or antireflex treatments in photolithographic processes
- individual processes in the photography industry
- foam suppressors for chromium plating
- hydraulic fluids for aircraft

The ban will, among other things, encompass textiles and impregnation agents and new uses of fire-fighting foam containing PFOS.

The proposal is being processed by the EU Council and the EU Parliament, and discussions are proceeding concerning lowering the concentration limit to 0.001 percent by weight. It is expected that the EU Parliament will vote on and adopt the proposal for a ban against PFOS in September this year.

A proposal for health and environmental classification of PFOS in the EU is under discussion and the following classification is being proposed:
R-48/25: Toxic: danger of serious damage to health by prolonged exposure if swallowed.
Carcinogenic: Carc. Cat. 3; R40: Limited evidence of a carcinogenic effect.
Reproductive hazards Repr. Cat. 2; R61: May cause harm to the unborn child.
R-51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

The processing of the proposal for health and environment classification has not been completed.

3.6 Comments of the Pollution Control Authority on the regulations proposed by the UK, Sweden and the EU

In the EU, it is proposed that the existing mass of fire-fighting foam be exempted from the ban. The arguments being used include that an alternative fire-fighting foam must be examined in more detail. We are of the opinion that knowledge about the alternatives is limited, but that on the basis of what we know about the properties of the substances they are, regardless, better alternatives for human health and the environment than PFOS and PFOS-related substances. A ban against new uses of fire-fighting foam containing PFOS would prevent fire-fighting foam with PFOS content from ever being

produced again, however it would not do anything about the main problem, which is old fire-fighting foam with PFOS content that is found in a number of Norwegian systems.

We also suggest a shorter transition period and a more rapid entry into force of a possible ban against the use of remaining quantities of fire-fighting foam with PFOS content than has been proposed by the EU. Norway desires a shorter transition period and more rapid entry into force in order to prevent further emissions into the environment as soon as possible. The longer the transition period, the greater the probability that the fire-fighting foam will be used up and released into the environment when the ban goes into effect.

The EU proposes an exception for the metal plating industry. Based upon the knowledge we have of working environment problems that can arise if one does not add PFOS or PFOS-related substances as mist suppressants in the chromium plating baths and the knowledge that we have at present that discarded chromium plating fluid is handled as hazardous waste, we are of the opinion that an exception for this industry is necessary.

We are also proposing a lower limit value for the content of PFOS and PFOS-related substances than the EU. By setting the limit value for the content of PFOS and PFOS-related substances to 0.001% one would lie well within what is possible in terms of analysis technology as well as ensure that the limit is low enough that it is not possible to add this hazardous substance to the products either consciously or in consequence of any poor purity of the chemicals used in the processes.

We have no other comments on the EU's proposal for regulation of PFOS and PFOS-related substances.

4. Assessment of alternative means

At present, fire-fighting foam containing PFOS is neither sold nor produced in Norway, so the problem thus involves whether the players should be enjoined to replace their inventories of fire-fighting foam containing PFOS. This is of significance to the Pollution Control Authority's proposal for the means to employ. Among other things, financial means would not be an alternative.

The Pollution Control Authority proposes to ban the use and sale of fire-fighting foam with PFOS content, as well as requiring replacement and destruction of remaining quantities of fire-fighting foam with PFOS content that are found in the business community.

PFOS and PFOS-related substances are probably not being added to textiles or impregnation agents, but are found in these products though as impurities. It thus is important in the choice of means that PFOS and PFOS-related substances be prevented from being used in the future in textiles and impregnation agents. A ban against the production, import and sale of textiles and impregnation agents with PFOS and PFOS-related substances would have the effect of preventing this hazardous substance from being able to be used in these consumer products in the future.

5. Beneficial effects associated with the proposal

As shown in section 2.2, PFOS and PFOS-related substances have a number of negative properties. The PFOS substance itself does not break down in the environment. PFOS and some other PFOS-related substances bioaccumulate in animals and humans, and concentrations are increasing in the food chain. PFOS-related substances are found in animals and humans across large parts of the world. It thus is important that further emissions of PFOS and PFOS-related substances be stopped.

A requirement to replace and destroy the remaining fire-fighting foam with PFOS content would prevent around 8 tons of PFOS and PFOS-related substances from being released into the environment.

A ban against PFOS and PFOS-related substances in textiles and impregnation agents would prevent this dangerous hazardous substance from being incorporated into consumer products again in the future.

6. A review of the application areas affected

6.1 Fire-fighting foam

No fire-fighting foam with PFOS content is sold today in Norway. The expenses in connection with the proposal would primarily be associated first and foremost with the purchasing of replacement foam, as well as costs for collection and destruction. Fire-fighting foam that does not contain PFOS and PFOS-related substances is by and large filled into the same tanks today that possibly hold old foam containing PFOS. For by far the majority of alternative types of fire-fighting foam there thus would be no investments costs that would accrue in association with a transition to more environmentally friendly alternatives.

In order to gain an overview of the costs of a ban, the Pollution Control Authority has been in contact with a number of the companies affected, as well as suppliers of alternative foam and enterprises that deal with disposal and destruction. The costs vary and, among other things, vary depending upon the type of alternative foam being switched to. Where we have not received specific cost-related information from the company concerned, the Pollution Control Authority has presumed that the least expensive alternative will be used. The cost of the measure will, in addition to the items of expense mentioned above, depend upon the concentration of PFOS and PFOS-related substances in the remaining foam. Average costs of the measure have been computed for the types of companies affected. For smaller enterprises, the costs can be higher than the average costs computed here.

The surveys of the Pollution Control Authority from 2005 showed that there were approx 1500 tons of fire-fighting foam left that contained PFOS and PFOS-related substances. On the basis of new information from the operators (June 2006) the quantities are estimated to be 460,000 litres. The quantity of PFOS and PFOS-related substances is estimated to be around 8 tons. Different enterprises that have fire-fighting

foam with PFOS content and the amounts of PFOS and PFOS-related substances in this foam is shown in the table below, which has been updated with respect to new information on the phasing out of fire-fighting foam with PFOS content.

Type of enterprise	Remaining quantity of foam with PFOS content, litres	Quantity of PFOS substances in remaining foam, kg	Previous emissions of PFOS substances, kg
Offshore operators	122,845	2,550	54,000
Mobile rigs	12,500	330	500
Ships and ferries	23,000	300	100
Land-based petroleum enterprises	154,300	2,180	2,300
Petrochemical and other relevant industries	31,000	530	< 100
Tank farms	24,000	400	160
Airports	2,000	34	unkn.
Armed forces	90,000	1,500	unkn.
Fire-fighting training sites	0	0	unkn.
Fire and rescue corps	1,000	13	unkn.
Total	460,645	7,837	Min. 57,160

Table 1. Compilation of responses concerning remaining quantities and previous emissions of fire-fighting foam with PFOS content.

6.1.1 Permanent offshore installations

As the table shows, the permanent offshore installations have significant residual quantities of foam with PFOS content. Prior to 2003, it primarily was 3M Light Water AFFF 1% and 3% that was used, which contained PFOS. This was replaced with Artic Foam, without PFOS, when 3M phased out its PFOS products. A few installations have used products manufactured by Angus, both before and after 2003. These products have never contained PFOS or PFOS-related substances.

Reduction in emissions

In total there are 122,845 litres of fire-fighting foam with PFOS content offshore. This foam contains 2,550 kg of PFOS or PFOS-related substances.

Costs

There are in total 6 operators who have remaining fire-fighting foam with PFOS content. We have been informed by one of the operators that the cost of new foam, disposal and destruction is a total of NOK 20 per litre of foam, and this figure is being used as a basis for the cost calculations for all of the permanent offshore installations. A requirement for

the replacement and destruction of the fire-fighting foam with PFOS content would thus cost approx. NOK 2.5 million. The cost of the measures per kg of PFOS and PFOS-related substances is NOK 963.

6.1.2 Mobile rigs

The mobile rigs essentially have smaller quantities of fire-fighting foam onboard than the permanent installations, on the order of 2000 litres per rig. The fire-fighting foam is primarily localised to helicopter decks, but smaller quantities can also be found other places. On some of the rigs, all the foam has been replaced in recent years due to reduced quality.

Reduction in emissions

In total there is approx. 12,500 litres of foam with PFOS content left. This foam contains approx. 330 kg of PFOS and PFOS-related substances.

Costs

The Pollution Control Authority has not procured a separate estimate of costs for the rigs. Based on general information from the different suppliers, we estimate the total expenses for the purchasing of new foam and disposal and destruction of the old foam to be NOK 30 per litre of foam. This gives a total cost of NOK 375,000. The cost of the measures is NOK 1137 per kg of PFOS and PFOS-related substances.

6.1.3 Ships and ferries

Our survey shows that among tanker companies and ship operators there is only one that has fire-fighting foam with PFOS content onboard its ships (of those that responded to the inquiry). Most of them use foam suppliers that have never supplied foam with PFOS content.

Of the three ferry companies that responded to the inquiry in connection with the survey, two of them state that they have foam with PFOS content onboard their ferries.

Reduction in emissions

In total, ships and ferries have approx. 23,000 litres of foam with PFOS content left. This foam contains 300 kg of PFOS or PFOS-related substances.

Costs

The Pollution Control Authority has no separate cost figures for ships and ferries, but rather is utilising an estimate based upon general information from the different suppliers. This estimate is NOK 30 per litre of foam with PFOS content. The total costs will then be NOK 690,000, which gives a cost for the measures of NOK 2300 per kg of PFOS and PFOS-related substances.

6.1.4 Land-based petroleum enterprises

The land-based petroleum facilities have foam in inventory, however the percentage of foam that contains PFOS-related substances varies a great deal between the different facilities. During the course of the last year, Statoil's Mongstad facility and Hydro's Sture facility have replaced their fire-fighting foam containing PFOS. There continues to be

three land-based facilities for petroleum products that have fire-fighting foam with PFOS content.

Reduction in emissions
In total, land-based petroleum industries have 154,300 litres of fire-fighting foam with PFOS content left. This foam contains 2,180 kg of PFOS or PFOS-related substances.

Costs
The Pollution Control Authority has received an expense overview concerning the replacement of foam having PFOS content at a number of the largest petroleum enterprises. For the other petroleum enterprises, the Pollution Control Authority is using an average cost per litre of foam that will have to be replaced. As a point of departure for this average-based calculation, the Pollution Control Authority is utilising the cost figures that we have received from the other petroleum enterprises affected. With this as a point of departure, the total costs will be approx. NOK 5,532,000. This gives a cost per kg of PFOS and PFOS-related substances for the measures of NOK 2,538.

6.1.5 Petrochemical and other relevant industries
Two industrial enterprises state they have large quantities of foam with PFOS content. The others have either very limited quantities or no fire-fighting foam with PFOS content.

Reduction in emissions
In total, petrochemical and other relevant industries have 31,000 litres of foam containing PFOS left. This foam contains approx. 530 kg of PFOS-related substances.

Costs
The Pollution Control Authority has received information on the costs of replacement from one of the players, and is taking this cost proposal as a basis for this entire category of enterprise. This gives a total cost of NOK 1,333,000. The cost of the measures is NOK 2525 per kg of PFOS and PFOS-related substances.

6.1.6 Tank farms
Of the tank farms we have received information about, most have fire-fighting foam with PFOS content in their fire extinguishing systems. Quantities vary from 50 litres to over 6000 litres. Two of the tank farms queried have not responded an we thus have no information concerning the extent to which they have fire-fighting foam containing PFOS.

Reduction in emissions
In total, tank farms have 24,000 litres with fire-fighting foam containing PFOS left. This fire-fighting foam contains 400 kg of PFOS or PFOS-related substances.

Costs
The Pollution Control Authority has not procured a separate cost estimate from the tank farms, but rather is using the average cost for land-based petroleum industries as a basis for its cost calculations. With this as a point of departure, the total cost for the replacement of fire-fighting foam containing PFOS is NOK 1,104,000. This gives a cost for the measures of NOK 2760 per kg of PFOS and PFOS-related substances.

6.1.7 Airports

Of the airports that have responded to the inquiry, one of them states that they continue to have fire-fighting foam containing PFOS in their inventories. The others have no remaining quantities of such foam. Airports do not have stationary fire extinguishing systems with AFFF foam. This foam is only used in the fire trucks, which contain a very limited quantity. Exercises are conducted relatively frequently, and the speed at which the foam is replaced thus is quite high.

Reduction in emissions

The relevant airport has 2000 litres of foam containing PFOS left. This fire-fighting foam contains 34 kg of PFOS or PFOS-related substances.

Costs

The Pollution Control Authority has not procured a separate cost estimate from the airport concerned, and thus is using the general cost estimate as a basis. With a total cost of NOK 30 per litre of fire-fighting foam containing PFOS, the total replacement cost would be NOK 60,000. This gives a cost for the measures of NOK 1765 per kg of PFOS and PFOS-related substances.

6.1.8 The armed forces

The armed forces have done a survey on a regional basis of their facilities with the Norwegian Defence Estates Agency and the military organisation. There are large variations between the regions, which is related to there being different types of facilities at different locations. The armed forces state that there is uncertainty associated with the information from the military facilities.

Reduction in emissions

The armed forces have approx. 90,000 litres of fire-fighting foam with PFOS content left. This foam contains approx. 1500 kg of PFOS or PFOS-related substances.

Costs

Based upon the general cost estimate of NOK 30 per litre of fire-fighting foam containing PFOS, the total cost of replacement would be NOK 2,700,000. This gives a cost for the measures of NOK 2308 per kg of PFOS and PFOS-related substances.

6.1.9 Municipal/Intermunicipal fire and rescue corps

Individual fire departments have small quantities of foam containing PFOS in their inventories, however remaining quantities are estimated to be low.

Reduction in emissions

In total the fire and rescue corps have 1,000 litres of fire-fighting foam containing PFOS left in stock. This foam contains 13 kg of PFOS or PFOS-related substances.

Costs

Based upon the general estimate for replacement costs of NOK 30 per litre of fire-fighting foam containing PFOS, the total replacement costs would be NOK 30,000. This gives a cost for the measures of NOK 2308 per kg of PFOS and PFOS-related substances.

6.2 Textiles and impregnation agents

PFOS and PFOS-related substances previously were added to textiles and impregnation agents. Through analyses, searches of the Authorities' Central Register of Chemical Products and by direct contact with the textile and impregnation industries, the Pollution Control Authority has evaluated whether PFOS or PFOS-related substances are in use today in these products. All studies show that there are no PFOS or PFOS-related substances in normally detectable quantities in these products. The quantity of PFOS and PFOS-related substances in these products lie far under the proposed limiting value of the ban. The Pollution Control Authority hence takes it as fundamental that the ban against PFOS and PFOS-related substances for these consumer products are not associated with any costs nor would it give any noteworthy reduction in emissions.

7. Assessment of socio-economic benefits

A ban against the use of and a requirement for the replacement of fire-fighting foam containing PFOS will prevent around 8 tons of PFOS and PFOS-related substances from being released into the environment in the next few years. The total cost of this regulation is computed to be approx. NOK 14.3 million. The cost of the measures per kg of PFOS and PFOS-related substances for the different types of companies is estimated to lie in a range between NOK 963 and 2760. The Pollution Control Authority emphasises that there is uncertainty associated with the cost estimates.

On the basis of our investigations, PFOS or PFOS-related substances are not added to textiles and impregnation agents. A ban against PFOS and PFOS-related substances in these products would prevent them from being used in the future.

As far as the Pollution Control Authority is aware, no separate studies have been done of the costs of the damages from emissions of PFOS or PFOS-related substances. The properties of PFOS and PFOS-related substances are such that these substances are comparable with the substances on the priority list posing hazards of the highest degree. These substances have costs of damages that are far higher than our estimate for the costs of the measures. It thus is the assessment of the Pollution Control Authority that this regulation is socioeconomically beneficial.

8. Other effects

Fire-fighting foam containing PFOS is neither produced in nor imported into Norway. Textiles and impregnation agents will probably not be encompassed by a ban either. The ban would thus not have any effects on employment. Costs would be able to accrue for

checking that textiles and impregnation agents do not contain PFOS or PFOS-related substances, however the costs would probably be low.