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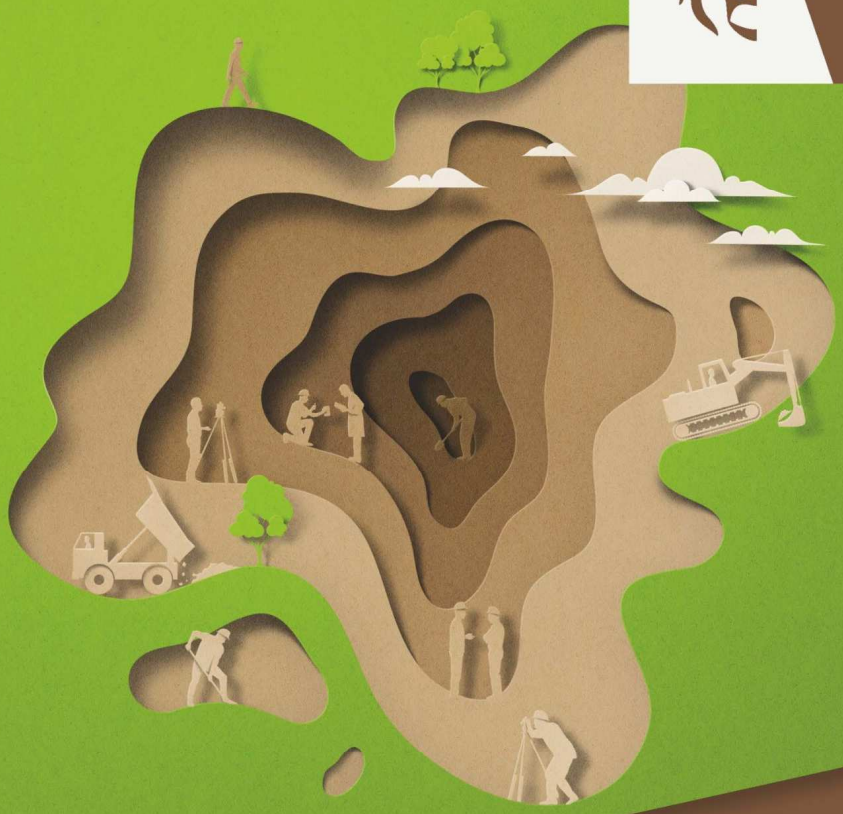

USE OF FLUORINATED FOAM WITHIN THE FIREFIGHTING SECTOR

PREVENTIVE MEASURES FOR A HEALTHY SOIL

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Use of fluorinated foam on fire training areas - Recommendations for dealing with excavated soil and groundwater extraction

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1 FLUOR COMPOUNDS IN FIRE-FIGHTING FOAM

1.1 WHAT IS THE PROBLEM?

Fluorine-containing compounds have been evident compounds in fire-fighting foam for many years.
The specific properties of these compounds have been crucial in the development of high-performance synthetic fire-fighting foams in recent decades.

For many years there has been concern about the **harmful environmental aspects** of fire-fighting foams.
The fluorine-containing compounds in fire-fighting foam have the important disadvantage that they don't degrade in the environment. As a result, these substances can end up in the soil, groundwater, surface water and in drinking water.

Recent trends indicate a **toxic effect** of these substances on humans and animals.

1.2 WHICH FLUOR COMPOUNDS?

The group of **poly- and perfluorinated alkyl compounds (PFAS)** comprises more than 6000 individual substances. PFAS have the similarity that they contain a complete (per-) or partially (poly-) fluorinated carbon chain, with a varying length, normally 2 to 16 carbon atoms.

The best known PFAS are **PFOS** (perfluorooctane sulfonic acid) and **PFOA** (perfluorooctanoic acid). These were the most important components of fire -fighting foam.

Since 2000, the production of PFOS and later also PFOA has been systematically phased out for environmental reasons. The use of foam containing **PFOS** as a primary component was **definitively banned in 2011** by the Stockholm Convention: the fire brigade therefore had to dispose of fire-fighting foam containing PFOS. Since 2015, the 8 largest PFOA suppliers no longer make PFOA. **PFOA** may **no longer** be placed **on the market** after **mid-2020**.

Fire-fighting foam manufacturers have replaced the fluorinated compounds, phased out since 2000, with **alternative fluorinated compounds**, in order to continue to guarantee the best foam quality. PFOS and PFOA were thus replaced by other fluorine compounds (eg "6:2 FTS"). However, these other substances still belong to the PFAS group.

1.3 WHY ARE PFAS USED IN FIRE-FIGHTING FOAM?

The fluorine components are **chemically and thermally very stable**. At high temperatures and under extreme conditions (for example with aggressive, acidic or basic products)., the compounds remain intact and the foam remains effective.

The structure of PFAS consists of a **hydrophilic** (water) and **hydrophobic** (fat, oil, fuels) **part**.
This property makes it possible to develop fire-fighting foam that forms a fast-sealing, aqueous film layer, the so-called "aqueous film forming foam" or AFFF. This unique property ensures that no fuel is absorbed in the extinguishing foam. The foam is less affected by the fire in the area and thus extinguishes a fire faster.

2 WHY SHOULD WE AVOID PFAS?

Studies show that perfluorinated compounds have **important harmful effects**.

The use of the most harmful fluorine compounds, such as PFOS and PFOA, was already banned in 2011. Scientists have meanwhile shown that the harmful effects apply to many different PFAS. That is why the entire group of PFAS is now being targeted to the attention.

Although **PFAS do not occur naturally**, **PFAS are widespread in the environment**. This is due to their high solubility, low/moderate sorption to soil and sediment and their persistent properties so that they do not degrade biologically and chemically.

PFAS can spread into the environment via the **following spreading pathways**:

- Fire-fighting foam on unpaved terrain ends up **in the groundwater via the soil** (leaching) and can then spread further via the groundwater
- **Spreading by air**: foam particles spread by air into the wider (unpaved) environment and end up in the soil or surface water through deposition.
- **Spreading by (contaminated) sediment** (collected in water treatment discharge)
- Spreading of contaminated soil through **(uncontrolled) excavation work** at the site (**earthmoving**)
- Discharge of pumped groundwater can result in spreading of the contamination.

PFAS are not converted in the body. PFAS do not bind very much to fats, such as other contaminants, but to proteins. In this way **PFAS accumulates in the body**. Scientists suspect a relationship with **several adverse health effects**.

A tolerable daily intake (TDI) is derived based on toxicity studies. In recent years there has been a downward trend in the TDIs that have been derived for PFOS. This substance, and by extension the PFAS-group, require therefor more and **more attention**.

The **fire brigade must handle the use of fluorinated fire-fighting foam with caution**, because of the potential **adverse effects on people and the environment**.

3 WHAT CAN THE FIRE SERVICE DO IN PRACTICE TO PREVENT SOIL CONTAMINATION?

3.1 CHOOSE FLUOR-FREE EXTINGUISHING FOAMS WHERE POSSIBLE

3.1.1 Different fire extinguishing foams

A distinction can be made between different fire extinguishing foams:

- Foam for operational use with fluorine-containing components
- Foam for operational use without fluorine-containing components (fluor free)
- Foam for fire-fighting exercises

In the recent past, extinguishing foam manufacturers have replaced the banned fluorine-containing compounds with alternative fluorine-containing compounds, from the PFAS-group. When using extinguishing **foam with fluorine-containing components**, important adverse environmental aspects are present. This type of foam can therefore not be used for training.

In the meantime, foam suppliers also offer **fluorine-free extinguishing foam**. It is generally established that the quality thereof is more than sufficient for smaller incidents where foam extinguishing is required. Although the most harmful fluorine component in fluorine-free extinguishing foam has banned from the composition, this does not mean that these foams are environmentally friendly. The substitutes remain, although to a lesser extent, environmentally harmful. This type of foam is therefore not suitable for training.

Training foam is also available in the market. This type of foam is the standard for training purposes. The environmental impact of this foam has been minimized.

3.1.2 Evaluation of the presence of PFAS in fire-fighting foam

The information provided on an SDS (Safety Data Sheet) for the fire extinguishing foam is often not sufficient to be able to determine which PFAS is present in the foam. The substances used are often trade secrets or the concentrations are too low to be included on the SDS.

The terms **PFOS-free** and **PFOA-free** do not mean that no harmful fluorine compounds are present in the fire-fighting foam: often other PFAS will not be displayed.

When the term **PFAS-free** or **PFC-free** (PerFluorinated Compound) is used, it can be assumed that no other PFAS is present in the foam.

3.1.3 Foam selection for fire-fighting training

In areas where a lot of fire exercises take place and where foam is used for training, there is an increased risk of soil contamination due to frequent and repeated use. It is therefore important to **deal critically with the use of (fluorinated) fire extinguishing foams in these areas**.

Recommendation:

- For training purposes, it is recommended to always use **training foam.** Although the environmental impact of training foam has been minimized, this does not mean that training foam is environmentally friendly. Discharge into a ditch or sewer without water treatment is not automatically permitted and should be evaluated, possibly in consultation with the internal or external environmental coordinator.
- (Additional) **soil pollution** on the sites of fire services and third parties must absolutely be avoided. This is only possible **by limiting the use of fluorinated foams for fire-fighting training to suitably equipped training sites,** e.g.at fire stations.

3.1.4 Use of foam during fire-fighting interventions

The operational use of extinguishing foam must be weighed against the adverse effects on the environment. Therefore, always evaluate whether the use of fire-fighting foam is necessary during interventions.

Recommendation:

- Preferably **do not use extinguishing foams**
- Only use extinguishing foam **when absolutely necessary and in case the use of water is not an alternative**. For example, the use of fire-fighting foam is not strictly required for a traditional car fire.
- If it is still necessary to use fluorine-containing foam (e.g. in industrial firefighting), it is recommended to prepare a **register** to gain insight into the quantity and location where foam with fluorine-containing components was used.
- Continue to follow-up of trends for **fluorine-free fire-fighting foam** and replace fluorine-containing fire-fighting foams as soon as the service life requires it and a guaranteed, **equal quality fluorine-free fire-fighting foam** is available.

3.2 PREVENTION BEGINS WITH AN INVENTORY, KNOWLEDGE AND EXPERTISE AND ADJUSTING THE SETUP

To arrive at insights and agreements regarding the use of fire -fighting foams, the following recommendations for (industrial) fire service organizations are appropriate:

- Make an **inventory** of the use of foam in installations and fire-fighting vehicles etc. Determine where and how much fluorine-containing agents are used.
- **Make an inventory and evaluate** in which cases fire-fighting foam is necessary and in which cases fluorinated foam is an added value to be able to extinguish safely
- Encourage **knowledge and expertise** regarding the environmental effects of fire-fighting foam.
- Evaluate where, how and to what extent fire fire-fighting foam can end up in the soil, surface water, water treatment, sewage, etc. and see how this **spreading pathway to the environment can be limited and avoided:**
    - Try to install (liquid-tight) pavement at locations where fire-fighting foam can end up in the soil (e.g. training areas, product storage of foams)
    - Try to collect fire-extinguishing water at locations where fire-fighting foam can end up in the soil.
- Evaluate where, how and to what extent training foam can get into the surface water and see how this **spreading pathway to the environment can be limited and avoided**:
    - The training foam may not end up in the surface water. A discharge in the sewer is allowed if it is treated via a public sewage treatment plant and licensed.
    - As soon as the business activity is aimed at organizing fire-fighting exercises, it must be examined, in consultation with the internal or external environmental coordinator, whether additional measures are required, such as the installation of (liquid-tight) pavement and the collection of fire-fighting water, possibly supplemented with a water purification installation suitable for this specific waste water.
- If **there is a suspicion of a possible contamination**, it is recommended to contact a **certified soil remediation expert** as soon as possible to ascertain what actions should be taken.