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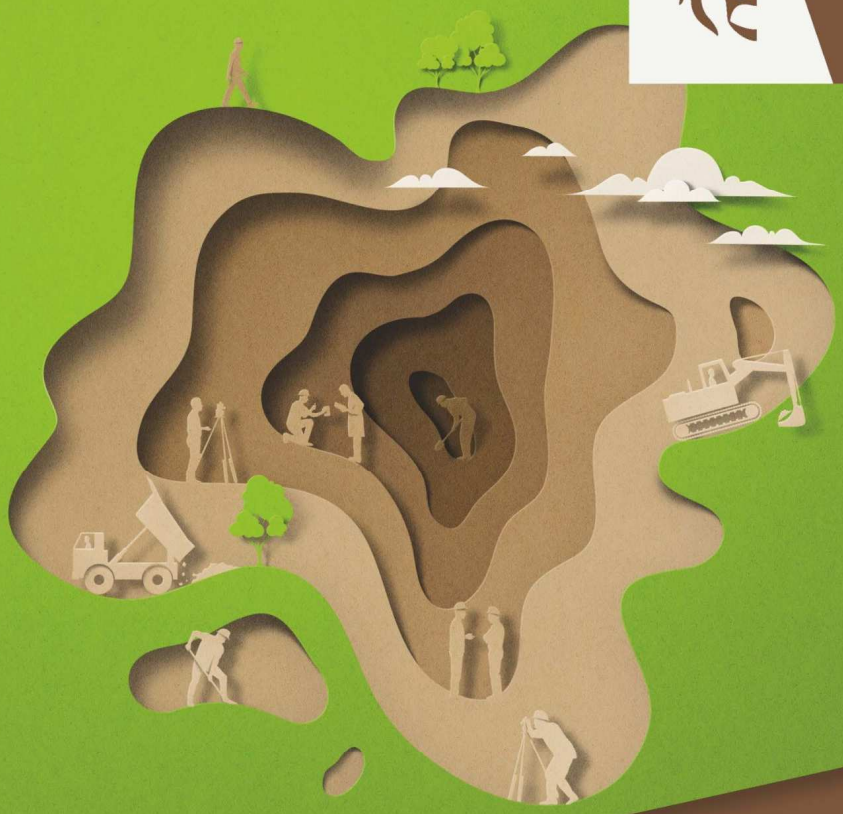

USE OF FLUORINATED FOAM ON FIRE TRAINING AREAS

RECOMMENDATIONS FOR DEALING WITH EXCAVATED SOIL AND GROUNDWATER EXTRACTION

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Use of fluorinated foam within the firefighting sector – preventive measures for a healthy soil

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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**.

3 RECOMMENDATIONS APPLICABLE FOR FIRE SERVICE TRAINING AREAS

In areas where many fire service exercises take place or took place in the past and where foam is/was used in training exercises, there is an increased risk of soil and groundwater contamination. Therefor it is important to deal critically with excavation works or with extracting groundwater in these areas in order to prevent the uncontrolled spread of these components into the environment (or outside the boundaries of the training areas).

In the current situation, but also in the future, it is advisable for the fire service sector to be (more) cautious when carrying out **earthworks (excavations of soil)** and taking into account **possible soil contamination with fluorinated compounds**.
Also when **groundwater** is **extracted**, for example during drainage (groundwater drainage to make excavation possible), it is recommended to take into account **potential groundwater contamination with fluorinated compounds**. Discharges of extracted groundwater are therefore not possible without prior control of the effluent water.

3.1 EARTHMOVING – EXCAVATION WORK AT SITE –CONTROL SOIL SAMPLES

Recommendations:

- If earthworks are planned at the site, it is recommended that a certified soil remediation expert takes **control samples** of the soil and has them analyzed **for PFAS components**. The certified soil remediation expert can then indicate how and where the soil can be (re) used.
- Soil that is excavated on fire service training areas and where no control samples were/are taken, is **preferably reused on site**. The permitted concentrations of PFAS are so low that **reuse outside the fire service parcels is discouraged** to prevent the uncontrolled spread of PFAS into areas such as residential areas, etc.

3.2 EXTRACTION OF GROUNDWATER – GROUNDWATER CONTROL SAMPLES

Recommendations:

- If groundwater is extracted (also occasionally) at a fire service terrain or at locations where exercises with foam have taken place in the past (for example in case of excavations/infrastructural works), this **extracted groundwater is preferably controlled before discharging** (in sewers or surface water).
- It is recommended that a certified soil remediation expert takes control samples of the groundwater and has them analyzed **for PFAS components**. The certified soil remediation expert can then advise on **preventive measures** to be taken and/or the **need for water treatment** prior to discharge.