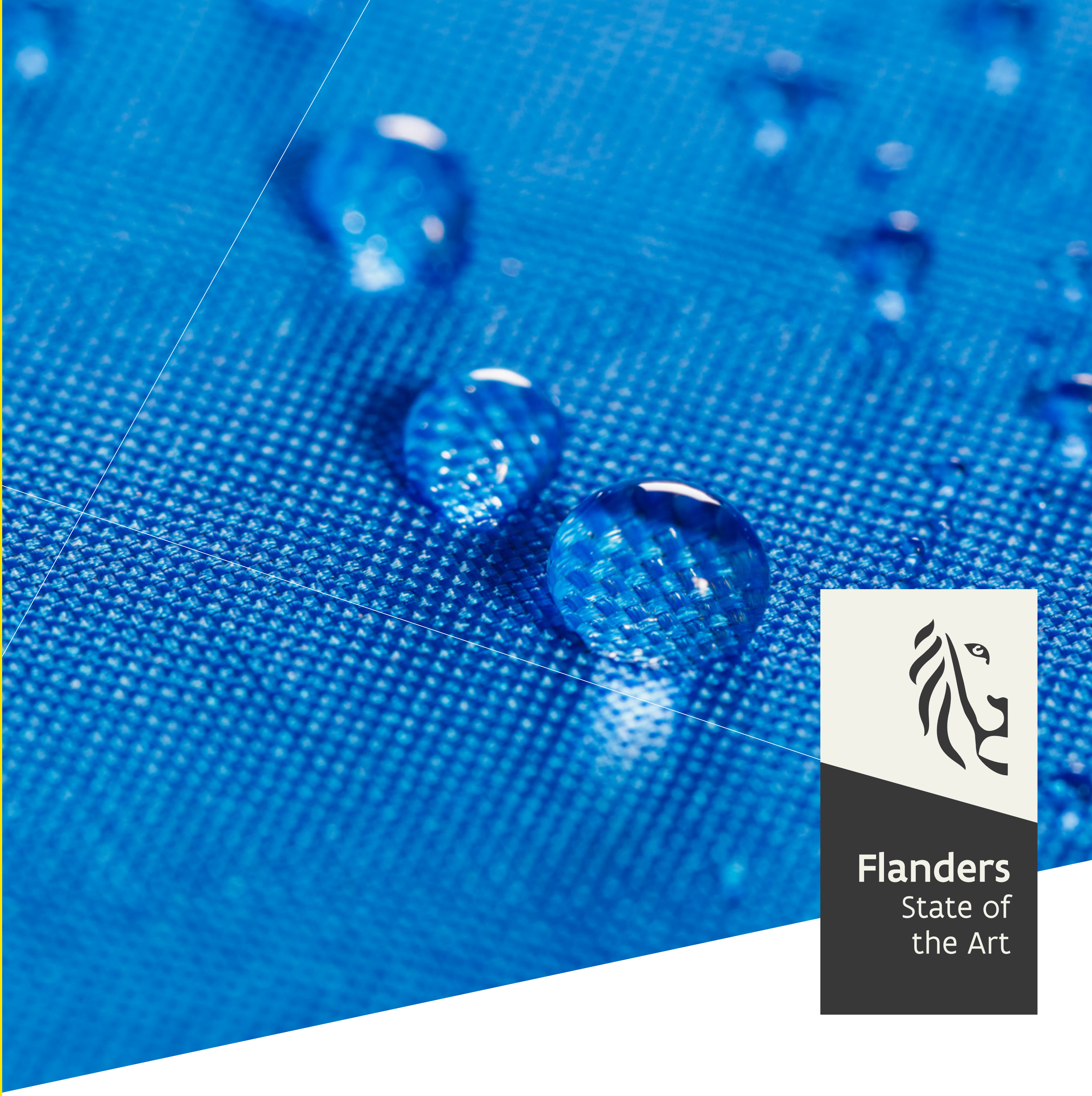

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Personal summary of the first interim report on the PFAS contamination

By PFAS commissioner Prof. Dr. Karl Vrancken
Translated from the original Dutch version

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As commissioned by the Government of Flanders, PFAS commissioner Karl Vrancken presented a first interim report on the PFAS contamination in Flanders in September 2021. That extensive document (in Dutch) was the result of the cooperation between and input from numerous experts, each working within their own competence and field of expertise.

The interim report is accompanied by a personal summary in which the commissioner presents a state of affairs and insights. It is based on his work with experts and meetings with various stakeholders during the first 3 months of his assignment.

This document is the English translation of the summary. It is provided merely for information purposes.

Since my appointment by the Government of Flanders, three pillars have been crucial in fulfilling the assignment:

- Bringing together experts from the many departments, organisations and research institutes involved should lead to an integrated approach that will make it possible to offer tools for a strong and well-founded policy in the medium to long term, which will also allow Flanders to join the cockpit at European level.
- By uniting all the parties involved and involving the various stakeholders (citizens, businesses, etc.), we should succeed in communicating transparently and (re)building citizen trust.
- Based on the expertise that we are compiling in the context of PFAS, we aim to establish a more robust and stronger approach to persistent organic pollutants in Flanders.

Within that context, I would like to share the following thoughts on this first report.

Karl Vrancken

What are PFAS and what risks do they pose?

Poly- and perfluoroalkyl substances or PFAS[1] is the collective name for more than 6,000 substances that include a combination of fluorinated compounds and alkyl groups. Due to their water, grease and dirt-repellent properties and their resistance to high temperatures, PFAS are used in many industrial processes, applications and consumer products. Examples include non-stick coating in pans, cosmetics, packaging materials, textiles, fire extinguishing foam, cleaning agents or lubricants.

The behaviour and mobility of PFAS molecules are largely determined by the length of the carbon chain. In the past, mainly long carbon chains were used (8 or more carbon atoms, C8 = octyl, e.g. PF**O**S, PF**O**A). These molecules accumulate in fat and have limited mobility. Due to their high level of stability, they also degrade very slowly in the environment or in the human body. Once the use of these products was banned due to their toxicity, production shifted to shorter chains. First to C6 and then to short-chain PFAS (4 carbon atoms, C4 = butyl, e.g. PF**B**S, PF**B**A, PF**B**SA). These products have similar grease and water repellent properties. However, their smaller molecular form makes them more mobile and they therefore behave differently in water, soil and other media. The short molecules accumulate less, but they are more easily dispersed and are very persistent.

The combination of stability (and therefore longevity or persistence) with accumulation (accumulation in fat, eggs, organs, etc.) partly determines the toxicity of these components. The effects vary depending on the component studied, but mainly include restriction or disruption of the immune system, disturbance of hormone balance and disruption of liver function.

Since 2008, successive medical studies have driven the health-related limit values for PFOS and PFOA significantly downwards. The health effect considered to be decisive–the critical effect–may vary between institutions and has evolved over time. In the 12 years since its first publication in 2008, the European Food Safety Authority (EFSA) permissible values have tightened by a factor of about 1,000 for PFOS and by a factor of just under 10,000 for PFOA.

For the sum of 4 PFAS (PFOA, PFOS, PFNA (C9), PFHxS (C6)), EFSA derived a Tolerable Weekly Intake (TWI) of 4.4 ng/kg body weight per week. Initial model-based calculations suggest that this health-related limit value is exceeded when considering typical exposure for almost everyone living in Flanders. In the coming weeks and months, the study under this assignment aims to provide more insight into the exposure of residents in both the known contaminated areas and in other areas.

We are also developing a calculation method that considers more components than just the EFSA-4 in the risk assessment. The RFF method (relative fate factor) estimates the risk of each of the products based on the structure of their molecule (chain length, functional group, branching) and takes into account ingestion, bioaccumulation (to what extent does ingestion increase the concentration of a substance in an organism, e.g. the body) and how quickly the product breaks down (half-life).

[1]For more information: see the PFAS fact sheet on the PFAS website.

Where are and have PFAS been used and are they able to enter the environment?

Based on current knowledge, the risk of PFAS entering the environment is linked on the one hand to industrial activities where PFAS is or has been produced or processed, and on the other hand to large-scale use as a fire extinguishing agent. We distinguish four main categories:

Production: plants where PFAS are or have been produced. This concerns two sites in Flanders: 3M in Zwijndrecht and Chemours in Mechelen.

Applications in industry: PFAS is used in many products and applications to make materials grease and water repellent. The industrial processes with the highest risk of spreading PFAS are galvanising, paper processing and textile finishing.

Fire brigade training areas and the extinguishing of industrial fires: up until 2010, PFOS and PFOA were used in fire-fighting foams, mainly to extinguish chemical and oil fires. There is a high risk of soil and groundwater contamination at fire brigade training sites (in municipalities, industry, airports, etc.) and at sites where major fires have been extinguished with fluorinated extinguishing foam.

Waste management companies: landfills, water treatment and waste incineration plants process materials containing PFAS. The risk of PFAS dispersion is reduced by emission control measures (encapsulation, filtration, flue gas cleaning), but requires further investigation.

In response to the PFAS problems around 3M, since June 2021, the Public Waste Agency of Flanders (OVAM) is conducting a survey into sites with a potential risk of PFAS soil contamination. On the one hand, known soil records have been re-evaluated with a focus on PFAS contamination. This has led to further analyses at various sites such as Broek De Naeyer in Willebroek, Dageraadstraat fire station in Mechelen and the Molenbeek in Ronse. On the other hand, a broad survey was launched with the cooperation of the Flanders Environment Agency (VMM), the local authorities and the Fire Brigade Network. Based on data from the VLAREBO database and the environmental permits, a list of possible risk locations was drafted per Flemish municipality. Local authorities were asked to provide more detailed information on the activities and possible incidents at these companies. In addition, a list was requested of sites at which a major fire took place in the past and where a fire was put out or training took place with fluorine-based extinguishing foam. The list of potential risk locations comprised more than 4,000 sites. Based on the additional information, the OVAM, together with experts in environmental permits, assesses the risk and the need for further investigation. In doing so, the OVAM assesses the size of the source of PFAS and whether there are any vulnerable groups in the vicinity. Priority is given to sites close to residential areas and drinking water catchment areas. Sites where a fire was put out or training took place with fluorine-based extinguishing foam were given the highest priority. By the end of August 2021, additional studies for more than 80 sites had already been started or planned. An exploratory soil survey will be carried out at these sites. After a visit to the site and soil and groundwater measures, it will be estimated whether there is clear indication of serious PFAS soil contamination (CISC method).The site will be assigned a CISC score and the Agency for Care and Health (AZG) and OVAM will evaluate whether measures need to be taken and what further investigation is required, and in what time frame. According to current planning, around 40 sites can be examined per month. The progress and results of the survey can be found on the PFAS website.

The survey and other studies generate a large volume of information. Procedures for data handling and data management have been developed within the scope of the PFAS commissioner. This ensures that the vast amount of data coming in from the various surveys is properly labelled to remain available for assessment and interpretation. This should make it easier to share information between administrations and with stakeholders and the public. This makes information and decision-making processes more transparent.

In cooperation with the Data handling task force, the PFAS commissioner compiles measurement data from various studies initiated by the Flemish or local authorities, companies and study bureaus. The aim of this is to link different data sets. For example, the linking of soil and crop measurement data can provide insight into the poisoning of crops. Soil measurement data can be plotted on maps according to intended use in order to obtain an immediate overview of breaches of the design standard. The report includes summary maps of measurement data around the 3M site.

Where and how were PFAS found in the environment?

Since PFAS accumulate in the human body, even exposure at very low levels poses a potential risk. It is therefore important to be able to measure very low concentrations in various substances such as soil, water, foodstuffs and blood. Concentrations can be as small as µg/kg. One µg/kg is 1/1,000,000 of a gram (microgram) in 1,000 grams of material (kilogram), also called 1 particle per billion particles (ppb). The same unit is ng/g or nanogram (1 billionth of a gram) per gram. The analysis must be able to measure the PFAS particles among a large variety of other substances. This requires highly specific techniques and closely controlled procedures for taking and storing the samples, and for measuring the many different PFAS molecules. We work with commercial and university laboratories to ensure that the procedures have been carried out correctly and that the measurements are therefore reliable. The commercial laboratories have proven their quality through repeated blind tests and are recognised by the Government of Flanders or ISO-accredited through BELAC (the Belgian Accreditation body). University laboratories are not subject to this approach. Their quality is ensured by their work in scientific contexts and international research projects.

As discussed above, PFAS sampling and measurement is complex. In addition, the spread of contamination depends on many site-specific factors. This should be taken into account when interpreting the results. Four soil samples from the same 10m plot^2 will give readings in the same order of magnitude but with small differences. Therefore, measurement campaigns are aimed at determining contamination contours or zones of similar quality. For the same reason, it makes no sense to draw conclusions about contamination for an individual garden or plot.

Given that PFAS comprises a very broad family of products, agreements are made as to which range of components the various analyses will measure. The development of measurement methods and legislation go hand in hand here. The Laboratories and Analysis and Data Handling task forces standardised the list of abbreviations used and reconciled the list of PFAS to be measured in water and soil samples. This includes both long-chain PFAS (C8 and above, e.g. PFOS) and short-chain PFAS (C4, e.g. PFBS), precursors and derivatives (6:2 FTS, ADONA, GenX). PFBSA, an intermediate in the production of PFBS, is not currently included on the list. PFBS is however measured by default. PFBSA analyses can be performed, though currently not yet under the formally accredited approach. Some laboratories have taken the initiative of extending their accreditation to PFBSA.

Measurement of PFAS in blood poses specific challenges, especially in terms of preventing contamination of the samples. As an example, the use of incorrect sample holders or pipettes may result in sample contamination. In Flanders, only VITO is accredited for these measurements (as from late August 2021).

Measurement methods and accreditations for air and flue gas are still under development. This topic was dealt with at an accelerated pace within the PFAS commissioner's expert group.

The FASFC (Federal Agency for the Safety of the Food Chain) acknowledges the appropriate laboratories. Two laboratories were specifically approved for food analysis. In the short term, three laboratories are expected to be fully accredited for the analysis of PFAS from food of animal and plant origin. Foodstuffs examined in a context other than FASFC supervision can also be analysed by other laboratories that do not necessarily employ accredited methods.

In addition to the accreditation and development of the methods, attention is also being paid to the tightening and, where necessary, standardisation of the limits of quantification to be achieved. These should ultimately make it possible to assess whether products comply with the (draft) standard values, which are often at very low concentrations.

How do we ensure that PFAS exposure is kept to an absolute minimum?

If elevated levels of PFAS are measured in soil, water, food or other materials, human intake of these substances should be avoided. In other words, exposure must be limited. It is currently assumed that exposure occurs mainly through food, drinking water and dust (especially in children through hand-to-mouth behaviour or ingestion of household dust). Dermal absorption is likely less significant. The importance of air as a route, and more specifically airborne particles, requires more research. Measurement methods for this are being developed at an accelerated pace. To this end, test measurements around the 3M site and at one background location are in progress (September 2021).

Based on available measurements, background knowledge of toxicology and insights from the RIVM (National Institute for Public Health and the Environment, the Netherlands) and the Support Centre Environment and Health, the Agency for Care and Health formulated so-called 'no-regret' measures. This was done in consultation with the OVAM, the contractor and the local authority. - They are based on the precautionary principle. These measures are taken based on data as known to date and in the acknowledgement and clear communication that significant information is not yet available or is incomplete. They are recommendations to the population in the risk zone as to how to limit exposure and avoid PFAS accumulation. The measures take account of the severity of the contamination and the local risk of exposure.

At present, no-regret measures apply to three types of sites:

Production sites (3M) with a large impact perimeter, Industry in which PFAS-containing sewage is being or has been discharged (e.g. Broek De Naeyer, Willebroek), with a more fluctuating perimeter depending on the spread of contaminated sludge,

Fire brigade-related sites with a limited soil perimeter and potentially larger groundwater perimeter (e.g. Dageraadstraat, Mechelen).

An up-to-date overview of the no-regret measures is available on the PFAS website.

No-regret measures are recommendations for citizens. They indicate what you can do to limit your exposure. Most measures relate to personal behaviour and cannot be enforced (e.g. moderation in the consumption of home-grown vegetables). Some measures have been transformed into enforceable measures by municipal decree (e.g. covering loose soil, limiting soil drift, not allowing children to play on fallow land etc.).

The Operating Framework task force brings together the necessary background knowledge to model and evaluate exposure risks. It evaluates the scientific literature on health-related limit values, risk limits and standards from a multidisciplinary perspective. It prepares a comprehensive modelling of possible exposure routes and scenarios using the S-Risk model. S-Risk answers the question: how much PFAS is a person exposed to when living in a particular environment? To make this prediction, the model has to make assumptions about the behaviour of a given person in a given place. This modelling provides insight into the relative contribution of various routes with regard to the overall exposure of people (food, air, water etc.), the background exposure in zones where no hotspot is present, and the possible tolerable extra dose that does not cause a health risk near the hotspots. Once that information is fully processed, a further evaluation of the current set of no-regret measures can be conducted. This is scheduled for October 2021. With all these data at hand, it should be possible to refine or adjust current measures where necessary. In a subsequent phase, these insights should also allow for a further debate on the applicable draft soil remediation standards and guideline values for free reuse of excavated soil.

In addition to the no-regret measures, accredited soil remediation specialists can also take precautionary or safety measures. They will need to do this if the soil survey shows that there is a major or acute risk. This option has not yet been used in the current PFAS files.

Various no-regret measures address the food sources of the inhabitants of the polluted areas. This is because food is generally regarded as one of the main PFAS exposure routes for humans. Fish and seafood are a very significant source of exposure. It can also be found in meat (mainly offal or derived products), eggs, dairy products, as well as fruit, potatoes, and vegetables. For individuals with their own vegetable garden and/or chicken coop, home grown produce may be a significant source of exposure. There are currently no European or Belgian standards for PFAS in food. The process of setting such standards for PFAS was recently initiated following the 2020 advice from the European Food Safety Authority (EFSA). The current European Commission proposal lists design standards for PFOS, PFOA, PFNA and PFHxS for a number of products of animal origin. However, as it currently stands, the European proposal does not specify any preliminary standards for fruit and vegetables. This standardisation process is monitored by the FPS Public Health, which has the relevant authority. Pending harmonised European standards, the Federal Agency for the Safety of the Food Chain (FASFC) applies action limits for products from professional agriculture. Food products that exceed these limits may not be placed on the market.

The accumulation of PFAS in food is determined by several factors, including the size of the molecules. Short-chain PFAS (e.g. C4) generally have a higher transfer rate from soil to plant compared to long-chain PFAS (e.g. C8), and the measured concentrations decrease mostly from root to leaf to fruit (EFSA 2020). For animal products, the reverse is often the case, i.e. longer chains accumulate to a greater extent than short-chain PFAS. Based on European average data from EFSA, it can be concluded that the Belgian population is mainly exposed to PFOS and PFOA (both C8) through fish and shellfish, meat, fruit and eggs. According to the same data, the tolerable weekly intake is exceeded by all age categories except adolescents. Through ongoing research and modelling, we wish to gain further insight into the current situation around the 3M hotspot, as well as in non-polluted areas. Current measurements around 3M show that all measurements for PFOS from eggs from hens grazing on the contaminated soil are high compared to background values. For vegetables, a value above the detection limit was measured for a limited number of PFAS. More background data on home-grown food in non-contaminated areas is needed to fully assess its significance in PFAS exposure. FASFC is conducting a broad measurement campaign in commercial food originating from background areas. Meanwhile, the no-regret measures remain in force, recommending, among other things, that home-grown vegetables be consumed in moderation and recommending a good mix of fruit and vegetables from food stores. Consumption of eggs from own hens is not recommended within a 5 km radius of 3M. The full set of measures can be consulted on the PFAS website.

For the protection of employees in high pollution areas, employers are obliged to take possible preventive measures based on a risk analysis. The advice of the competent preventive services should be sought as a matter of priority. The company prevention advisor and the occupational physician should also be involved. The risk analysis considers the PFAS-containing products used, frequency and nature of use, exposed workers and preventive measures taken. The first priority is to avoid exposure. The FPS Employment has compiled a list of possible preventive measures that can be considered for construction works in PFAS-contaminated soil. Within CoPREV, which coordinates the prevention services, a reference point is established with several occupational physicians.

The expert group's current working method and approach (still) focuses on limiting exposure to the contamination that is already present. Given the accumulative properties of PFAS, such contamination is usually related to past emissions. This is particularly true when it comes to PFOS and PFOA, products that have been banned for many years now. Meanwhile, substitute products are appearing on the market whose health effects are still insufficiently known. It is therefore necessary to work towards a more proactive approach, in which prevention of exposure is 'safe and sustainable by design', by avoiding potentially risky ingredients and designing products in such a way that no persistent compounds are (or need be) used. This type of approach should be incorporated through European cooperation. Targeted action to (intelligently) phase out PFAS and other persistent chemicals and to ensure that substitute materials pose no new risk can only be taken at a European level. Flanders can take action in this regard and use the accumulated knowledge within the PFAS assignment in the European PFAS debate, within both the scientific and the political framework.

How will we proceed?

New integrated remediation and management concepts are needed for PFAS contamination. Due to the low toxicological criteria, we are approaching the limits of a risk-based approach. The application of the most recent EFSA 4 values will in fact lead to soil decontamination standards that are lower than the measured background values in Flanders. In the case of PFAS contamination, it is becoming clear that there are disadvantages to a compartmented approach (food, water, soil, air). Ongoing research and modelling, coupled with the cross-domain expert consultation, will allow for better insights into the health risks, an appropriate approach to exposure reduction and the regulation of contamination.

By working in teams around the PFAS commissioner, we will accelerate the acquisition and exchange of scientific knowledge on PFAS. Simultaneously, we will strengthen the cooperation between Flemish and federal government services and the research field. The PFAS file will thus become a starting point for a better substantiated and stronger approach to persistent chemicals in Flanders.

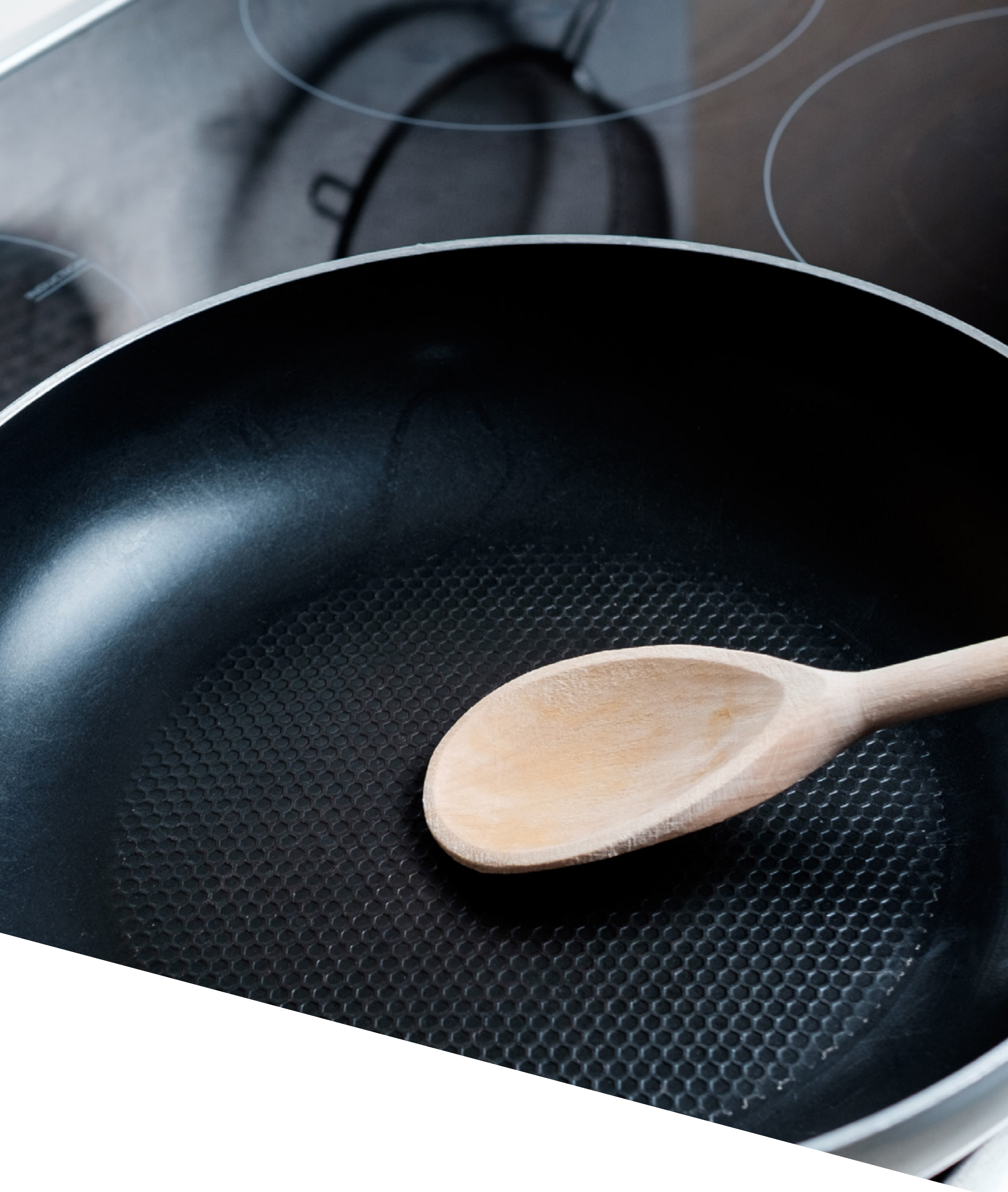
Experts from the various administrations and research institutes have been working diligently in the working environment and processes set up by the PFAS commissioner. This will lead to new actions and proposals. It is however clear that this increased activity can only be sustainable in the longer term if it is matched by resources. At the same time, there are indications from affected sectors and local administrations that they are seeking financial compensation. Consideration will have to be given to how these funds can be generated and how they will be recovered from the polluters of the various hotspots. Especially in places where the original polluter is no longer present, or the pollution is not caused by an identifiable actor (e.g. when extinguishing fires), there is no obvious answer. At the same time, industrial players should be encouraged to take responsibility for the (social) costs generated by pollution.

The management of contamination in the environmental compartments or the material flows also draws attention to challenges associated with the reuse of materials. While reuse should not lead to enrichment and increased exposure to chemicals, overly strict reuse conditions for materials may hinder the circular economy and thus create impacts on other environmental compartments (energy, materials, climate). We must remain aware that the PFAS issue is only one of a range of environmental challenges. Only through a systemic approach can we ensure that solving one problem does not lead to new problems popping up elsewhere.

Prof. Dr. Karl Vrancken

Commissioner for the Government of Flanders in tackling the PFAS contamination

10 September 2021



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