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Executive summary of the second interim report “From Knowledge to Action” on the PFAS contamination

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

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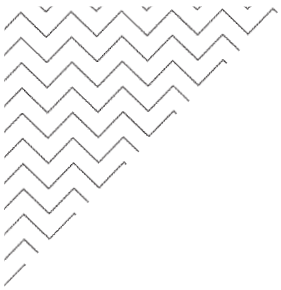

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EXECUTIVE SUMMARY OF THE SECOND INTERIM RAPPORT "FROM KNOWLEDGE TO ACTION" ON THE PFAS CONTAMINATION

Karl Vrancken – PFAS commissioner for the Government of Flanders
March 2022
Translated from the original Dutch version

As commissioned by the Government of Flanders, PFAS commissioner Karl Vrancken presented a second interim report on the PFAS contamination in Flanders in March 2022. That extensive document (in Dutch) was again the result of the cooperation between and input from numerous experts, each working within their own competence and field of expertise.
The second interim report is accompanied by a summary and a personal conclusion after 9 months of activities, in which the commissioner presents a state of affairs and insights. It is based on his work with experts and meetings with various stakeholders in the period September 2021-March 2022.
This document is the English translation of the summary. It is provided merely for information purposes.

BACKGROUND

From knowledge to action

This is the second interim report in the context of my assignment to coordinate the PFAS approach in Flanders. This assignment started in June 2021 and resulted i.a. in a first report in September 2021. Until now, considerable attention and effort has been devoted to measuring and mapping the pollution, gathering new knowledge about the risks and dispersion of PFAS. With this report, we offer the insights that all this research yielded. Together with a group of experts, we present an overview of the results and bottlenecks. At the same time, a survey of all the parties involved (stakeholders) both at the Flemish level and local level (in Zwijndrecht) provided an initial picture of the expectations and possible directions for solutions.

The PFAS pollution is not limited to the surroundings of 3M in Zwijndrecht. PFAS pollution has also been detected in most fire-fighting training grounds in Flanders, both in soil and in groundwater. PFAS can also be found in food products. The results of recent measurement campaigns and investigations are presented in **section 1** of this second report. While known exposure routes are mapped out even better, we are also starting measurements indoors to know how house dust in seating, carpets, shoes, etc. can contribute to our exposure. In **section 2** of this report, we also provide a first step towards an policy framework that suggest more stringent limits to the emission of PFAS in various media.. In **section 3**, we look ahead to the desired approach of the PFAS issue in the medium term and in a European context.

Meanwhile, it is time to turn knowledge into action. Based on the interaction between science, public and policy, concrete actions must be formulated in order to tackle the problem and to solve it. That is the challenge for the coming period. We are now at the pivotal point where, we need to plan the right actions

based on the knowledge we gathered. The keys for a successful science-to-policy approach are formulated in the box below, as taken from a recent report of the European Environmental Agency.

> In times of greater questioning of established institutions and scientific advice, scientific evidence must be **communicated** in a transparent and accountable way that explicitly and honestly assesses uncertainties, ambiguities and tensions.
>
> Collaborative, **co-creation and partnership** approaches to knowledge development are crucial in this context. They include interdisciplinary and transdisciplinary approaches for more integrated knowledge developments; public-private partnerships to promote societal, ecological and economic transformations; the integration of citizen science; and partnerships at the science-policy-society interfaces to better facilitate the uptake and use of knowledge.
>
> There are many established and emerging initiatives in this area, such as **knowledge centres** and information and stakeholder platforms.
>
> *From: Knowledge for Action, Empowering the transition to a sustainable Europe, EEA-Report No 10/2021.*

The PFAS assignment is built around these three core concepts: **communication, partnerships and knowledge**. In this summary by the PFAS commissioner, I explain how we put these three elements into practice and which new insights this has brought. This report should form the basis to set up actions in the following period around remediation, policy framework and phasing out PFAS. In the meantime, a need for research remains. In summer 2022, all these elements should result in an adapted version of the PFAS action plan, as a basis for a thorough vision and approach to the PFAS problem for the coming years.

"The commissioner should have an independent position in the debate, with the focus on solving the current situation. Together with the various parties, we must look for common ground in order to find a solution to a complex challenge which ultimately concerns our entire society."
From the Government of Flanders Order of 2 July 2021.

The assignment has a temporary character and focuses on expanding tools, working methods and partnerships that can lead to rapid action now and which can exist further in the future, without the mediation of a commissioner. By setting up new tools and processes, the assignment ensures that the approach to PFAS and other persistent substances is facilitated within the government and in society.

Stakeholder interaction

Stakeholder consultation is an important part of the commissioner's approach. For this reason, the first section of this second interim report, the research report, was distributed widely in January with the aim of **gathering feedback** from the various stakeholders involved in the PFAS problem.

With the insights gained from these responses, we aim to increase support for the policy recommendations that will follow later. The input was requested both orally and in writing during a specific session for the council members of the Minaraad [Environment and Nature Council of Flanders] and a round table in Zwijndrecht. Citizen groups, authorities, nature organisations, agricultural organisations, etc. were invited to that round table (see also below).

THE PFAS ASSIGNMENT AS A BRIDGE BETWEEN KNOWLEDGE AND POLICY

Communication

Three new tools were established to streamline the communication on PFAS between the authorities and with citizens and to facilitate access to information. Through these tools, available information is shared with all interested parties. In addition, the commissioner actively establishes contact with all parties involved, through mail, direct consultations, presentations and the organisation of meetings.

- The PFAS-website provides current information and background for various user groups. Citizens of affected municipalities can find the measures that apply in their neighbourhood. Current information is shared using news items. All studies, reports and press releases are freely accessible for professionals and citizens looking for more detailed information.

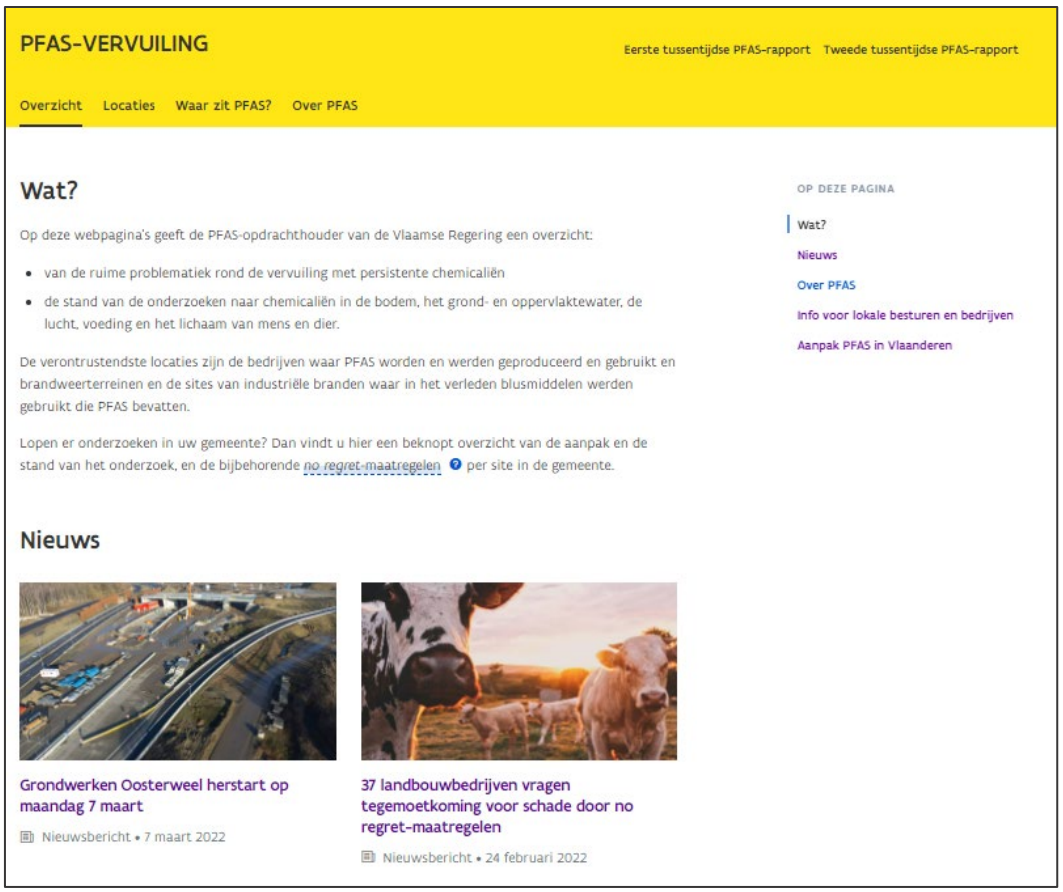

Figure 1: Illustration of the updated PFAS website

- The PFAS-mailbox (pfas@vlaanderen.be) answers all questions. The mailbox is equipped with a tracking system, which distributes questions to the various administrations and returns answers in a coordinated way to the questioner.

- The PFAS explorer gathers measurement data for various compartments (water, soil, air) across Flanders. This data platform is constructed within the Databank Ondergrond Vlaanderen (DOV - Database of the Subsoil in Flanders) and is growing into the central data hub in the PFAS approach.

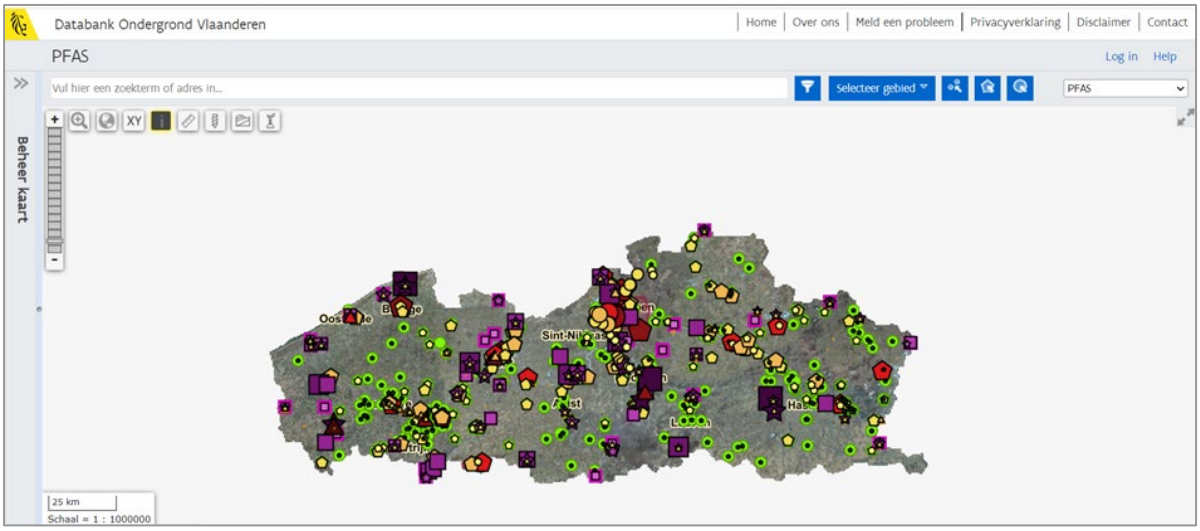

Figure 2: Illustration PFAS explorer

Co-creation in partnerships

The commissioner focuses on organised substantive consultation by actively seeking interaction with representatives of government, industry and civil society. For this reason, the first part of this second interim report, the research report, was distributed widely among various stakeholders in January 2022 in order to request their written input on the knowledge accumulated in the recent months. In addition, there was also a process with the members of the Minaraad and a process for the Zwijndrecht stakeholders using specific questions in order to receive maximum feedback.

On 14 February 2022, the first **round table** was organised for stakeholders in Zwijndrecht. This meeting brought together key local stakeholders for consultation, followed virtually by representatives of the administrations that participate in the expert group. It was the first time that 3M and Lantis sat together at the table, with representatives from citizen platforms, local authorities and agricultural organisations. This round table was the starting point for further dialogue between the local parties on the remediation approach to follow. A second round table was held at the end of April 2022, where the various parties engaged in discussions around a sustainable approach for the future of Zwijndrecht.

A **soil remediation task force** was formed after this first round table. The initial focus was on the remediation of PFAS hotspots and the scalability of certain techniques. Through interaction between resident groups, researchers and the remediation sector, an overview was made of feasible and known, as well as innovative techniques for soil and groundwater remediation. At the same time, opportunities for upscaling, social side effects, and legislative thresholds have been examined. This task force identified innovative ideas and techniques, which can be proposed for implementation in the remediation plan of 3M, both for the site and the surroundings. In this way, stakeholders are closely involved in thinking about the best approach to remediation.

The soil displacement task force of the expert group includes, in addition to the administrations, representatives of sector organisations of soil remediation and soil remediation experts. In this way, we have a place where the bottlenecks faced by the daily operation of soil displacement can be discussed.

Knowledge platforms

Within the scope of the commissioner, there is a strong focus on the exchange of knowledge. The **expert group** has more than 40 members and meets weekly in order to strengthen insights. Since September, the group has been expanded (including Federal Public Service Economy, Federal Public Service for Public Health) and the operation has been clustered differently in order to focus more sharply on the current situation, reality and the acquired insights.
This expert group is a temporary structure, the operation of which will have to be taken over by other platforms and consultation forums. The following **knowledge platforms** are already in place, or in formation. They bring together expertise and can play an important role in building up knowledge for policy preparation.

- Knowledge Hub Environment and Health, with collaboration between experts from the environmental and health administrations with a focus on human biomonitoring. The knowledge hub will also operate as a steering group of a research consortium that performs human biomonitoring research.
- Coordination task force for risk management of chemicals: existing working group with experts from Flemish agencies, focused on the PFAS action plan and the strategy on hormone-disrupting substances.
- Flemish Task Force on Substances of Very High Concern: expert group that will draft assessment frameworks for the health impact of substances of very high concern, as a basis for health-based guidance values.
- OVAM (Public Waste Agency of Flanders) Project Substances of Concern: programmatic approach by the OVAM, with partners, to assess the risk of substances of concern in the material chains and to develop policy around this subject.
- CCIM PFAS sub-task force: consultation between experts of the regional and federal administrations to exchange knowledge and prepare coordinated Belgian positions for input at European level.
- Research consortia PARC, EmConSoil, REACH-Up, HBM4EU: Flemish researchers and government experts play a leading role in various European research consortia, which focus on the risks of chemicals, soil pollution, phasing out persistent substances and human biomonitoring. This knowledge development is of great importance for setting up an overarching European approach for PFAS and persistent chemicals. Moreover, through these networks the experts ensure that the Flemish knowledge is passed on to the European level.

The Federal Public Service for Public Health and the Federal Agency for the Safety of the Food Chain (FASFC) actively participate in the policy preparation around PFAS in food and other products at European level. This will lead later in 2022 to, for example, a new regulation around PFAS standards in food products.

Specific action on site

The collected knowledge leads to proposals for changes to the policy framework and new research, and it supports the input of Flanders and Belgium at the international forum. This is discussed in more detail in the sections below. In addition, there is specific action on site.

The commissioner acted as mediator in the elaboration of a **reimbursement scheme for farmers** in the wide vicinity of 3M. An agreement was developed with the agricultural organisations to reimburse the damage caused by the implementation of the *no regret* measures. This may include loss in turnover, additional production costs and investments or costs made by the company for transitioning. The farmers who have submitted a file received a financial proposal from 3M.

Major PFAS pollution has been discovered at the site of the former De Naeyer paper factory in **Willebroek** in an area where a new residential area is in full development. Due to the specific situation, it has been decided in consultation between the local administration, OVAM, the Minister for Environment's office and the commissioner, to proceed with **accelerated remediation**. Since February 2022, the excavation and the replacement of the living layer in gardens and unpaved public areas has started.

A **concrete remediation approach** is being developed for the pollution around the 3M site in **Zwijndrecht**. At the request of 3M, ERM conducted a descriptive soil investigation (BBO) that lays the foundation for the remediation of the residential zone in Zwijndrecht. Specific plans for the remediation of the construction and industrial sites are also being prepared. Subsequent to the round table with local stakeholders, a task force on remediation was set up to collect and discuss existing and innovative techniques.

POLICY FRAMEWORK FOR REDUCING PFAS EXPOSURE

In the second section of the second interim report, a **temporary policy framework for PFAS** in various environmental compartments is proposed. It is an optimisation, expansion and alignment of existing and new legislative and policy frameworks. It focuses on maximal reduction and prevention of PFAS exposure, whereby it is essential that all sources and exposure routes are assessed. The elaborated framework is directed at the various environmental compartments. Exposure through food and product use fall under the competence of the Federal Government and are not addressed here. Tackling the source (phasing out PFAS) takes place via European initiatives. When assessing and imposing permit conditions for emissions and discharge, the principle of best available techniques (BAT) must be considered. Permit conditions must provide the best level of protection for the environment through the use of economically viable and technically available techniques. The policy framework pays specific attention to a targeted approach in risk locations and in particular for environmental health focus areas (MGAG or hotspots).

From the many PFAS studies (see section 1 of the second interim report) and the ongoing social debate, it became clear that the **existing Flemish framework of environmental standards must be made more stringent**. There is a lot of new information, but several knowledge gaps remain to be answered in order to reach a conclusive human risk assessment framework for PFAS: e.g. uncertainties in the transfer of PFAS

from soil to crops/eggs, contribution of inhalation to human exposure, uncertainty on measured values at very low concentrations, mixture toxicity.
It is necessary to be in line with the evolving European framework of health-based assessment values (e.g. EFSA TWI) and standards for PFAS. At the same time, calculation of limit values in e.g. soil, based on the EFSA 2020 TWI (tolerable weekly intake) leads to a zero standard. The background exposure via food already leads to an exceedance of this threshold. Therefore, there is a need (as with other pollutants) for a different, risk-based approach. It is therefore proposed to use a **risk ladder**: the higher the measured or calculated exposure to PFAS, the more stringent the measures to reduce exposure will be, in order to reduce the chance of adverse health effects in highly exposed populations. From exchanges between various domains of expertise, we arrived at a shared vision on the policy framework: EFSA 2020 is the long-term objective, in the proposed approach we work with, temporary policy framework that is stricter compared to the current framework, in anticipation of further knowledge development. The policy framework proposed here will therefore need to be reviewed regularly. In addition to the **environmental perspective**, we apply a **preventive health approach** in this framework.

The proposed approach provides a pragmatic application of the precautionary principle. It is based on the most recent scientific insights that are applied in current specific dossiers and risk assessments. The starting point is the scientific opinion of EFSA 2020. The action framework must guarantee clarity and legal certainty for all actors, in anticipation of a definitive policy framework embedded in legislation.

Draft policy framework for risk locations and environmental health focus areas

In order to protect human health as best as possible, both the assumptions behind the human risk model S-Risk (a state-of-the-art model for assessing exposure and human health risks at contaminated sites) and those used in deriving the EFSA TDI value are conservative. It is currently not possible to combine both for the calculation of risk threshold values for soil, taking into account background exposure. This would lead to a risk threshold value of 0 µg/kg ds, because the background exposure already exceeds the tolerable dose.

Therefore, a policy framework is proposed that takes into account the **background concentration** in the soil, is within the analytic possibilities the **most conservative** and is based on the **precautionary principle**. This is applied by:

- setting lower values in residential areas where locally grown food and/or chickens are found, as these contribute most to the exposure according to the scenario calculations;
- to lower the provisional soil remediation value for destination type V (industry) for PFOS from 1949 to 110 µg/kg ds, in line with the value for recreation;
- In addition, the DAEB-approach[1] (Clear Indication of Serious Soil Pollution) takes in account the neighbouring grounds and vulnerable locations (e.g. residential areas with locally grown food/ chickens).

[1] DAEB: Duidelijke Aanwijzing van een Ernstige Bodemverontreiniging [Clear Indication of Serious Soil Pollution]

Proposal for the provisional soil remediation value for the solid part of the soil (blue = proposed values with increased stringency)

Zoning type[2]	I/II	III	IV	V
PFOS (µg/kg ds)	3.8	3.8*/18	110	110
PFOA (µg/kg ds)	4.3	4.3*/89	643	643

* Residential area where there are vegetable patches/free-range chickens.

The European limit for drinking water is applied as a proposed soil remediation standard for groundwater. This amounts to **0.1 µg/l** for the sum of 20 PFAS and **0.5 µg/l** for the sum of all PFAS. This means an increased stringency in the current values for groundwater (0.12 µg/l for PFOS and 0.12 µg/l for PFOA).
Through the increased stringency of both the provisional soil remediation value for the solid part of soil and that for groundwater, a significant portion of the exploratory soil investigations (VBOs) shall need more in-depth risk assessments as part of a descriptive soil investigation (BBO).

Environmental health assessment and follow-up for residential areas

The current risk-oriented use of the no regret measures is based on the principle of the risk ladder (based on the scenario calculations, taking into account EFSA 2020) with specific attention for vulnerable population groups. This leads to a range of risk threshold values for **soil in residential areas** between 0.16 and 200 µg/kg ds PFOS depending on the land use. These measures aim at a significant reduction of the exposure in high-risk locations and environmental health focus areas (cf. so-called hotspots).

In order to assess the risk of the exposure route linked to pumping up contaminated **groundwater** as drinking water (well water) in residential areas, the concentration found in groundwater was assessed against the drinking water standards and against the temporary analysis of the health threshold values (GGW) of EFSA 2020 (4 ng/l). If necessary, people with a well within the contaminated zone will be advised to stop using the well water for drinking, cooking or food preparation.

Draft policy framework soil displacement

The current framework for soil displacement is included in the Guideline PFAS-research (in Dutch), which can be found on the OVAM website. Based on the precautionary principle, the following values for PFAS-containing soil materials are proposed:

- An assessment value/value free use of **3 µg/kg ds** for PFOS and **3 µg/kg ds** for PFOA.
- An assessment value/value free use of **8 µg/kg ds** for the sum of the PFAS.

Parameters whose measured value is below the reporting threshold are not included in the sum.
The justification for the standard for soil use in construction of 70 µg/kg ds is outdated and will be revised within an assignment given to VITO (Flemish Institute for Technological Research). While waiting for a definitive legal standard for soil use in construction, it is proposed to work with a restrictive application

[2] Zoning types are: I/II: agriculture / residential area with rural character; III: residential area; IV: recreation; V: industry

of soil materials in non-leachable applications as a **temporary solution**. For this purpose, a classification list of (non-)leachable applications will be established (green-orange-red).

The application of this list, which shall be temporary while waiting for a new standard for soil use in construction, shall be the subject of a policy decision. Thereby, attention must be paid to such matters as the transition provisions, control mechanisms and traceability (through markings in the soil management reports).

Draft policy framework soil improvers

Currently, the same policy framework is used for soil improvers and for the free use of soil (with the exception that PFOS and PFOA are not counted in the sum parameter of 8 µg/kg ds).
In the meantime, a new criterion was derived, considering the frameworks for soil remediation and for soil displacement. For waste materials used in or as soil improvers, fertilisers and end products of biological processing (compost and digestate), an assessment value of **15 µg/kg ds** is proposed for the sum of 20 PFAS compounds that are included for the assessment of the European drinking water standard of 0.1 µg/l. As a result, PFOS, PFOA and the most frequently detected short chain PFAS compounds are included in the assessment. This criterion was derived considering the current proposed soil remediation values and the European drinking water standard of 0.1 µg/l.

Policy framework drinking water

The European Drinking Water Directive is the legal framework for the regulation of drinking water quality requirements and for the mitigation of health risks. The new **European drinking water directive** includes two parameters for PFAS:

- Sum of PFAS (sum of 20 selected substances): 0.1 µg/l
- Total PFAS (sum of all PFAS): 0.5 µg/l

The Flanders Environment Agency (VMM) and the Flemish Agency for Care and Health (AZG), both competent entities for the legislation around drinking water quality, are currently reviewing the options for the Flemish policy framework for PFAS in drinking water that needs to be **anchored in the drinking water legislation by January 2023**. A first in principle approval of this transposition in national legislation is foreseen in the spring of 2022.

Draft policy framework for the return of drainage water

The return of drainage water should, from a quantitative perspective and linked to the drought problem, become more and more self-evident for most of Flanders. Also qualitatively, return of drainage water with PFAS in the same aquifer is preferable over transferring it into another environmental compartment (by discharge into the watercourse or sewers). However, it will always be necessary to assess locally what the best course of action will be across environmental compartments.

Currently it is being assessed whether it is feasible to draw up specific guidelines for dealing with the return of drainage water in PFAS risk areas, in collaboration with relevant stakeholders such as the Flemish Construction Confederation (VCB) and the Technical Centre for the Construction Sector (WTCB).

Pillars in the guidelines are:

- limit the need for drainage as much as possible;
- estimate the effect of drainage on the pollution (displacement);
- focus on a thorough preliminary investigation by the applicant;
- effect assessment considering specific risks by the permit issuer and inclusion of specific permit conditions around the return of the drainage water.

Taking into account the existing legislation (BVR 27 March 1985 and VLAREM), the proposal is to **allow the return of draining water as default, if the following conditions are met**:

- The return takes place in the same aquifer.
- Sum of PFAS 20 (total concentration of 20 selected substances) is lower than 0.1 µg/l.
- Sum of the quantitative components is lower than 0.5 µg/l.

Return of the drainage water that does not meet these conditions can only take place in the following instance:

- The return takes place in the same aquifer.
- Return within the boundaries of the installation AND within the pumping cone of the drainage system;
- Sum of the quantitative components (including PFOS and PFOA) is lower than 0.5 µg/l.

The assessment values proposed in this framework are adopted from the European Drinking Water Directive. It was assessed that this temporary framework for the return of drainage water containing PFAS, taking into account the current knowledge, is a pragmatic framework and at the same time offers adequate guarantee for the protection of both humans and groundwater.

Policy framework surface water

So far, PFOS is the only perfluorinated compound for which **environmental quality standards** (EQS) have been established at European level in the European Daughter Directive on Priority Substances (transposed into Flemish legislation). For freshwater, an annual average EQS of 0.00065 µg/l and a maximum EQS of 36 µg/l. For transitional and marine waters, an annual average EQS of 0.00013 µg/l and a maximum EQS of 7.2 µg/l apply. The low annual average EQS is a recalculation of the biota EQS (9.1 µg/kg wet weight) to an equivalent value in water.

However, recently a **new European file has been prepared** in the framework of the priority substances where the EQS are calculated for 24 perfluorinated compounds. This considers the sharpened EFSA insights into the toxicity of PFAS. The file on the revision of the policy framework for surface water is currently in the drafting phase and is being closely monitored by the VMM.

Policy framework discharge wastewater

For discharge of wastewater containing PFAS, the vision is that this wastewater should **be purified as much as possible** (to below the reporting threshold). In the near future, the Flemish reporting threshold will be lowered from 100 to 20 ng/l. However, at this moment it is impossible to say which standard is achievable for each of the PFAS compounds. Research started in 2022 should provide more clarity on what can be

considered the best available technique (BAT) and which more advanced techniques are available (BAT+) and for which wastewater discharge the latter can be made feasible and thus enforceable through the permit. While awaiting the completion of the BAT study, an assessment of the applicable techniques can be made on a site-specific basis, based on the BAT-principle, before drawing up permit conditions. This involves evaluating which technique offers the best protection of the environment (considering all compartments) and is technically feasible and economically viable for the installation or sector.

Discharge industrial wastewater

Industrial wastewater may only be discharged if the discharge conditions in the permit are met. There are currently 30 companies that have a permit with specific emission limit values for PFAS. The Department of Environment and Spatial Development has started an adjustment procedure of the permits of all companies with specific emission limit values for PFAS. The intention is, on the one hand, to further restrict the load of PFAS by incorporating stricter emission limit values in the permit, but also to put a time limit on the discharge.
Parallel to this, a proposal is being developed to update the VLAREM (industrial emissions regulation, currently in public consultation). This proposal aims on the one hand to clarify the general provisions concerning the discharge of hazardous substances, so that it is more clear when a permit update for permit specific emission limit values is mandatory. On the other hand, sectoral emission limit values for PFAS will also be updated.

Discharge of domestic wastewater

Measurements by VVM show that municipal wastewater treatment plants (RWZIs) are also a source of PFAS emissions to surface water, through both industrial and domestic wastewater.
VVM is currently collaborating with Aquafin on a **pilot project** at the municipal wastewater treatment plant in Aartselaar, in which an investigation will take place into whether micropollutants (PFAS, pharmaceutical residue, phenols and a number of pesticides) can be removed from the wastewater using new techniques such as ozone and active carbon.

Discharge of drainage water

As for the return of drainage water, a general framework has also been developed for the discharge of drainage water. It is important here that the preference must be given successively to:

- restricting drainage as much as possible;
- return of the drainage water;
- As a last resort, if both these options are not possible, discharge can take place into the watercourse or, if that too would be impossible, into the sewers. It remains necessary to assess locally what the best course is across the environmental compartments.

While awaiting the conclusions of the BAT study around the purification of PFAS from wastewaters, which has already been started, the discharge of drainage water containing PFAS must be **remediated as far as possible**. The current reporting threshold of 100 ng/l per substance and, in analogy with return in groundwater, a group standard for PFAS of 500 ng/l apply here. When it can be demonstrated in individual cases that it is neither technically nor economically feasible to respect the basic principles, an additional risk assessment will have to be carried out during the permit procedure, considering the specific characteristics of a discharge of drainage water (in particular: temporary and non-intentional character) and possibly temporarily allowing higher discharge standards.

Policy framework for swimming and recreational water

There are **no (international) standards available for PFAS in bathing and recreational water**. For this reason, AZG has derived temporary health-based assessment values for swimming water for the sum of several PFAS compounds. The resulting health-based assessment values (rounded off) for PFAS in swimming water are presented below:

These assessment values indicate the maximal value for the sum of 4 PFAS compounds (PFOS, PFOA, PFNA and PFHxS) in surface water, in case people regularly swim in it:

- Children (3-6 years old): 200 ng/l
- Adults: 1,000 ng/l

If this value is exceeded, the advice is not to bath in this water and to evaluate the possibilities for recreation (kayaking, windsurfing, sailing, etc.), based on a specific risk analysis. After all, the use of open water for swimming and/or recreation implies a different usage profile.

Draft policy framework for air

A **temporary assessment framework (for chronic exposure)** has been derived for **particulate matter**, based on the health-based assessment value of EFSA 2020: for the sum of the EFSA-4 (PFNA+PFOA+PFHXS+PFOS) this means a threshold value of 0.4 to 2.2 ng/m^3 (annual average concentration), for an allocation of 20 and 100% respectively. These temporary assessment values are used in the permit conditions of the contractors of the Oosterweel project. The value of 0.4 ng/m^3 is used near residential areas and for the protection of the residents, while the 2.2 ng/m^3 is applied in the immediate vicinity of the site to protect the employees. If these values are exceeded, AZG recommends using risk-oriented *no regret* measures, considering vulnerable population groups.
No temporary assessment framework could be derived for **atmospheric deposition** because more complex exposure modelling is required. A first step in this investigation can be the development of a temporary assessment framework for atmospheric deposition for the EFSA-4 PFAS compounds (PFOS, PFNA, PFHxS, PFOA).

Next steps

The policy framework described above for the various environmental compartments is <u>temporary</u> due to factors such as:

- rapid evolution in scientific knowledge and health-based assessment values (EFSA 2020 or ATSDR 2021/draft EPA 2021). The development of a methodology for the assessment of mixture toxicity is still subject to scientific debate;
- uncertainty concerning the transfer of PFAS from soil to crops, vegetables, fruit, eggs and other animal products;
- uncertainty and limited knowledge about the behaviour and the presence of PFAS in groundwater, including leaching behaviour;
- evolving knowledge concerning the relative importance of different exposure routes (i.e. indoor environment) and their impact on policy advice;
- developments in regulation at the European level (drinking water, groundwater, air, food, etc.).

Further alignment between various regulatory frameworks is necessary to ensure smooth operation in practice. In doing so, efforts should be made to ensure consistency in approach and assumptions across the environmental compartments.

This policy framework shall be **closely monitored scientifically and adapted where necessary**. Currently there are various other initiatives that could support an update, such as: the human biomonitoring study near 3M (focussing on adolescents), the elaboration of the relative potency factor (RPF) -/ relative fate factor (RFF) method, measurements in the indoor environment and an update of the S-Risk model, followed by new scenario analyses.

The proposed policy framework above was formulated based on insights from experts from the task force under the leadership of the PFAS commissioner. Its implementation will depend on budgetary and policy considerations, as the financial impact of the proposed measures still needs to be clarified.

SOIL DISPLACEMENT

Free use and soil use in construction

Revision of the policy framework for soil and other compartments also leads to the need for revision of the policy framework for soil displacement. The recommendations for this were stated above in the paragraph 'Draft policy framework soil displacement'.

PFAS Suspected zones

By designating certain soils as "suspect soils", the obligation can be imposed to have **technical reports** drawn up, even if the volume of the excavation is less than 250 m^3. As soon as one wants to undertake in soil displacement, a technical report shall have to be drawn up. An approach is in development in collaboration with the Flanders RuimteModel that makes it possible to determine in a simple way where the **suspect zones** are located. This shall take place with input from the inventory of PFAS polluted soils and the PFAS explorer.

Quarries and excavations

For filling up **quarries and excavations**, the value "free use" is used as acceptance criterion, unless explicitly stated otherwise in the permit. Based on the precautionary principle, the recognised soil management organisations apply the guideline that for quarries and underwater applications, an additional statement is required from a recognised soil remediation expert, for soil materials that contain concentrations above the detection limit. Additional consultation between the sectors is planned to achieve greater legal certainty.

HEALTH

Many stages have to be passed and play a role in the development of health effects caused by environmental pollutants such as PFAS; furthermore, individual susceptibility and lifestyle factors are also very important.

Various studies, groups and agencies are trying to unravel different sub aspects, with various perspectives. For example, results of blood tests are, linked to eating habits, age, and place of residence. In the planned blood investigation, the results of blood tests will be **linked to the INTEGO database** of medical data, in order to obtain a clearer view of the medical history and possible medical effects of PFAS exposure.

The results of the blood test held at the end of 2021 (800 participants in the Zwijndrecht area) will be further investigated and linked with medical data. In the summer of 2022, the 5 km **population study** will start - whereby 40,000 samples will be taken in an area up to 5 km from 3M. At the same time, the Youth Study on Human Biomonitoring will start near 3M, in which more data on lifestyle, eating habits and health will be measured and monitored in a selected group of young people. All these studies should allow building new knowledge on the health risks of PFAS exposure. This knowledge can then be applied throughout Flanders to improve the policy.

The task force health under the PFAS commissioner seeks to facilitate the **information flow** between involved researchers and policy makers and to intensify the already existing **partnerships**. Many initiatives have been started or planned at short notice, because of the great complexity and rapidly changing scientific insights on the environmental and health impacts of PFAS. The insights and experiences can be discussed with colleagues at an early stage and the results can be placed in a broader perspective in order to achieve an accurate assessment of health impacts.

TACKLING PFAS POLLUTION IN THE MEDIUM TERM

While research provides new information and helps us understand and address the pollution, it is also necessary to view the PFAS problem in a **longer and broader time window**. In doing so, we are asking what preventive measures we can take to tackle the problem at the source and how we can change the system in which these products are widely used, so that we no longer need PFAS.

Already ongoing and newly established Initiatives put the necessary step 'from knowledge to action' in practice. Where necessary and possible, they were intensified, expanded, combined and accelerated.

Removing the risk of exposure and dispersion: stocktaking exercise

From the **stocktaking exercise** of fire-fighting related locations, which continues as planned, the current status (up to 16 March 2022) shows that pollution with PFOS, PFHxS, 6:2 FTS and PFPA is primarily identified in groundwater and the solid part of the soil. The groundwater also contains short chains (PFBA, PFBA, PFPeS) and the acid form of longer chains (PFOA, PFHpA, PFHxA); the soil also contains 8:2 FTS and 10:2 FTS. In general, a very low concentrations of long chains (in groundwater) and metabolites (in the soil and groundwater) were identified. The pollution is mainly located at **fire-fighting stations with training grounds** and less at sites of fires and training grounds without a station. More pollution is found on **unpaved grounds and sites that drain to non-surfaced areas**.

Prevention of PFAS in the environment through permits and enforcement

The discharge of PFAS in the environment from industrial processes that use PFAS can be addressed through the permitting policy. The environmental permits are based on the **BAT (best available technique) principle**,

which stipulates that both in the process and in the discharge the best available technique (BAT) must be used in order to limit the impact on the environment as a whole. What that technique is, is established in both Flemish and European BAT studies. By starting up new BAT studies in Flanders and contributing Flemish knowledge in the European BREFs (*BAT Reference documents*),[3] we ensure that industrial practice is adapted to the current level of knowledge and technique.

The Department of Environment and Spatial Development (Departement Omgeving) is working on tightening the sectoral discharge standards for PFAS and updating the special discharge standards for PFAS. This will ensure that the emissions (into water, soil, air) are reduced in all sectors where PFAS is discharged or emitted. By introducing a registry requirement for hazardous substances, the use of PFAS can be more accurately monitored. The feasibility of such a registry requirement is under investigation. An independent GIS-linked permit and environment quality tool provides data that supports policy decisions. **Opening up useful information**, both within the government and to the public can be done with a tool such as the PFAS explorer.

The Environment Inspectorate shall provide **increased supervision** on the PFAS emissions at both licensed and non-licensed companies in the environmental compartments of water, groundwater, waste and air. There is increased attention for companies in the paper and pulp sector and for companies with the duty of self-monitoring for PFAS. At fire-fighting sites, an inspection of PFOA foams is taking place providing the prohibition to store and use this substance by the middle of 2025.

Phasing out PFAS

At the **European level,** a procedure is ongoing to eventually ban or at least strictly limit the use of PFAS. The international approach is the most appropriate and effective. Belgium, with active input from Flanders, joins those countries that are taking a leading role in the intended phase-out. Several restrictions on PFAS have been implemented in the past, but more specifically on PFOS, PFOA and long-chain PFAS. Three **restriction processes** are currently under way. These focus on phasing out PFHxA, fire-fighting foam containing fluorine and the entire PFAS group.

The restriction process under REACH typically runs for several years since various public consultation periods and scientific advice must be undertaken. Thus, the general restriction on PFAS will most likely not be published until 2024 at the earliest and will probably enter into force even later. Also within the POP regulation, restrictions on the use of PFOS and PFOA has been put in place and other compounds have been nominated for addition; completion of that entry is expected in June 2022. It is proposed internationally to bring all long chain PFAS (>C8) under the Stockholm convention (and thus the POP Regulation) in this way.
In order to properly respond to the topicality and urgency of the problem, the Belgian coordination through the CCIM[4] has been optimised with the establishment of a specific coordination group on PFAS.

[3] VITO (2020): BBT/BREF and other publications
[4] Coordinating Committee for International Environmental Policy

The phasing out of PFAS is being tackled proactively and reactively. The key to the success of the proactive approach is the concept "**Safe and Sustainable by design**". Within the Chemical strategy for sustainability, there is mention of the "essential use" concept. This concept is still in a very early stage of development, but the PFAS issue already appears to be an interesting case study to develop this concept further. It shall still require considerable debate among the Member States and industry to define criteria for these applications.

A broader **screening** into potential substances of concern (during on the one hand design, production and emission of substances and on the other monitoring of the environmental pollution already present), the use of signalling values and sum parameters alongside standards for individual substances and more transparency from and collaboration with the industry regarding processing and risk assessment are also appropriate. Environmental monitoring, non-target screening, suspect screening and Effect Directed Analysis in various matrices and at various locations can expose whether new potential substances of concern are appearing in the environment and/or whether concentrations of specific substances are increase.

Knowledge acquisition and knowledge exchange, on various levels

Translating scientific knowledge into policy poses specific challenges. Knowledge must be accessible, available at the right time and be presented in a form that is usable by policy makers. Co-creation can help in this regard. In order to be able to set priorities for policy options, knowledge must also be of sufficient quality and sufficiently complete. Moreover, when applying the precautionary principle, transparent and unambiguous communication about scientific uncertainties, measures and action perspectives is needed.

Within the operation of the commissioner, tangible results have been achieved in this area or initiatives have been instigated. **Expert exchange, stakeholder involvement and open communication** are the guiding principle throughout here.

Internationally, the Flemish administrations and knowledge institutions are at the forefront of various **European projects and initiatives** on risk assessment and human biomonitoring of persistent chemicals such as HBM4EU, PARC, ETC CE, EmConSoil, etc. In this way, we are well informed about the status of knowledge within Europe and ensure that the knowledge we are rapidly accumulating is also spread internationally.

The **PFAS explorer** is a new type of data platform that fulfils the request of many stakeholders for a database for efficiently share and communicate data. Using the PFAS explorer, an interactive map was also developed for the PFAS website (https://www.vlaanderen.be/pfas-vervuiling, in Dutch). This gives all the information about polluted areas and the current *no regret* measures. In the meantime, considerable effort is going into adding new data and, in time, to expand the PFAS explorer to other pollutants so that there is always a global and up-to-date overview of all the available measurements and data.

The **PFAS action plan** (see also section 3 of the second interim report) brings together all initiatives for the further tackling of the PFAS problem from all acquired insights and can in turn also be used as case study for tackling and dealing with other "emerging contaminants".

THE PFAS ASSIGNMENT: LOOKING AHEAD

The next challenge is to embed the initiatives developed by the commissioner into the ongoing activities of the administrations and to ensure that the crisis approach results in a **structural improvement of tackling** pollution with PFAS and other persistent chemicals. The "storm" in which we found ourselves in June 2021 may perhaps have decreased, but we are still more in a state of crisis than a state of current policy.

In order to eventually make this transition, the following elements are needed:

- Stakeholder processes at Flemish and local level
- exchange of knowledge on soil and groundwater remediation
- exchange of knowledge on substitution of products containing PFAS
- research on risk and dispersion of PFAS
- reinforcing knowledge platforms
- permanent update of communication tools (website, PFAS explorer, mailbox)
- renewing the policy framework around PFAS and other substances of concern

The Flemish PFAS action plan must continue to offer a suitable framework to structure the actions and to provide the required coordination to the PFAS approach in the medium and long term after the conclusion of the commissioner's assignment.

All these initiatives are important but must be taken into account that the PFAS pollution is **just one of the environmental risks** that we in Flanders must respond to. Life in a densely populated industrialised region puts a lot of pressure on the environment and the health of the residents. In the meantime, climate change also forces us to face major challenges on a global scale. Addressing environmental problems can **never be done in isolation**. If we choose to focus on solving only one problem, that will inevitably lead to aggravating another problem, with possibly even more substantial consequences. We must continually evaluate whether the search for solutions to the PFAS pollution does not cause undesirable impacts on global warming, material use and circularity, energy use, emissions of particulate matter, etc. This is one of the major challenges of the systemic crisis in which we find ourselves. Only through continuous **collaboration** and persistent **exchange** of knowledge and information between all knowledge and policy domains can a sustainable solution be developed.

CONCLUSION– AFTER NINE MONTHS PFAS IN FLANDERS

From knowledge to action

Nine months after the start of the assignment to develop an approach to the PFAS problem, my activities have reached a turning point. In those months, the crisis expanded from a major problem around the 3M site in Zwijndrecht and the associated impact on the Oosterweel project, to a problem that is affecting the whole of Flanders. In recent months, we have worked together with experts from various policy areas, administrations and research centres to build up substantial knowledge. This collected knowledge must gradually enable us to shift towards a policy advisory role: which actions do we propose to policy makers to deal with this complex file in a thorough and vigorous way and to ensure that this problem will not repeat itself in the future?

This does not mean that we already have all the knowledge we need to provide an answer to all the challenges that the PFAS problem throws at us. Additional research is therefore still necessary and shall give us more clarity about exposure routes, impact on health or innovative remediation techniques.

Stricter values for soil and groundwater

Today the expert group is formulating a clear advice regarding a stricter policy framework for limiting PFAS exposure. This includes the (draft) soil remediation values used as assessment values in exploratory soil investigations. The combined evaluation of soil and groundwater pollution is decisive in developing the approach for polluted areas.

We recommend to make the provisional soil remediation values in exploratory soil investigations for PFOS for residential areas (category III) more stringent, to 3.8 µg/kg ds PFOS when locally grown food is (or may be) present. This value is the same as the value for agriculture and nature (category I/II). For residential areas without locally grown food, the value for PFOS of 18 µg/kg ds is retained. The assessment value for industry (category V) will be restricted to 110 µg/kg ds PFOS, equal to the value for recreation (category IV). The assessment values for PFOA are also strengthened according to similar principles.

For groundwater, the proposal for soil remediation is set at the European limit for drinking water, namely 0.1 µg/l for the sum of 20 PFAS from the Drinking Water Directive and 0.5 µg/l for the sum of all quantitative measurable PFAS.

In addition to the measured concentrations in soil and groundwater, the risk of spreading and exposure determines the need for further research. In hotspots, several sources or exposure pathways come together, vulnerable groups are present and there is a possible long-term exposure, necessitating a coordinated and integrated approach to reduce that exposure. Furthermore, local actors must be involved. In a non-hotspot, the approach focuses on integrated remediation (human exposure/eco-toxicity/spreading).

The expert advice about the target value for reduction of pollution and the values of free use for soil displacement are set at 3 µg/kg ds for PFOS, 3 µg/kg ds for PFOA and 8 µg/kg ds for the sum of PFAS. The experts advise that the values for soil use in construction of 70 µg/kg ds for PFOS should no longer be used. As an alternative, there will be a list of non-leachable applications.

For the water compartment, a renewed policy framework is proposed that closely matches the European frameworks. The use of the limit of quantification (0.1 µg/l for the sum of 20 PFAS and 0.5 µg/l for the sum of all PFAS) as a limit value is linked to specific guidelines for return or discharge of drainage water. When it can be shown in individual cases that this limit value is not feasible, an additional risk assessment must take place during the permit procedure, and a higher discharge standard may be temporary allowed. The policy framework for drinking water, surface water and bathing water has also been developed and proposed.

The expert group recommends the Government of Flanders to further assess this advice, which proposes more stringent assessment values, and to translate this into legislation and an enforceable policy framework.

Please note that this is a temporary policy framework, because more clarity is needed on several crucial factors: the transfer factor (soil to crops and eggs), the relative toxicity of the various PFAS molecules, and the contribution of leaching. Further research on these topics is planned this year. However, by making both the soil and groundwater standard more stringent and taking into account the threshold values based on eco-toxicity, this temporary policy framework provides a safe level of protection, aligned with the current knowledge.

It is also important to manage the presence of PFAS in compost and soil improvers. People do not come into direct contact with these products. In order to limit the dispersion, we propose a new assessment value of 15 µg/kg ds for the sum of 17 PFAS as a safe level. There is, however, a need for further investigation to clarify the transfer of PFAS via this route: how does PFAS end up in the compost and can the use of compost result in secondary poisoning of the soil or the vegetables (or does this generate no additional risk)?

Good insights into this are important for our entire circular and recycling thinking. We need to gain more in-depth knowledge about the behaviour of PFAS and persistent chemicals in recycled material streams. What are the mechanisms by which PFAS enter and concentrate in all these streams and what is the effect of the circularity of these streams on PFAS transport, concentration and exposure?

From there we need to give initiatives around circularity a 'chemicals' component, in such a way that this is taken into account from an exposure risk perspective. We must not evolve towards a 0-norm, because then the recycling chain will come to a standstill, and we will lose all the environmental benefits that recycling offers. Furthermore, we would then have to divert the streams to incineration. However, also there, studies are ongoing to determine whether PFAS, under standard process conditions, are sufficiently broken down in incinerators. Once these results are available, we will use them to adjust the policy framework.

Linking PFAS blood values with INTEGO for better insights

The elements above are further investigated and considered together with the human biomonitoring investigation and the measurements of the indoor environment. This must offer clarity on the exposure

pathways and whether we are assessing them correctly. The contribution of indoor dust may not be neglected, considering the products we all have in our homes that contain PFAS.

Eating eggs makes a significant contribution to the high PFAS levels in our blood, but certainly does not explain all the differences between individuals. There are thus contributions that we do not know enough about yet: indoor dust is one of these, but also products, which our skin is exposed to (e.g. cosmetics, lubricants, food packaging, etc.), and also general food products contribute. These elements are regulated at the federal or European level. Research is taking place at the Flemish level on all these routes and with the insights we gain from this, we can further influence the European processes and support and accelerate the phasing out of PFAS.

For the health aspect, the focus lies on the relation between source and effect and more specifically on the relation human exposure - effect. The starting point for this is the expansion of the blood testing around Zwijndrecht. We must now ensure that we can relate the results of the blood testing much better to exposure and so can therefore draw conclusions that can also apply to other places and groups. On the one hand, the 'Youth study on human biomonitoring in the 3M area' in which a group of 300 young people are being screened for their eating and living habits according to their blood values. On the other hand, the 800 samples from the first blood test (3 km) and 40,000 samples from a population study yet to be launched (5 km) will be linked to the INTEGO database of patient data. This will provide an exceptional number of insights into the links between blood values for PFAS and the people's medical history: do people with high PFAS blood values also fall ill more often? This must lead to a further integration of medical knowledge into ongoing work. By linking health-based measurements to environmental measurements, we can provide a better picture of the real effects and health risks of PFAS exposure.

Looking to the future

Finally, we stress the importance of remediation and decontamination. In Willebroek, a remediation operation was started in January 2022 and soils have already been removed for cleaning. In Zwijndrecht, the remediation approach for the residential area should become clear as the descriptive soil investigation (BBO) has been approved by the OVAM. In the meantime, a task force on remediation has been started, which made an inventory of the available and innovative remediation techniques for the entire polluted area. At the same time, Lantis and 3M are in consultation around the joint approach for remediation of the work site and the industrial site. In addition, we are looking at possible quick wins and measures that can contribute in the short term to the reduction of the spreading of the PFAS pollution.

After the completion of this report, it is time to focus even more on action. We have the necessary insights and tools that allow the Government of Flanders to complete the crisis management phase and to move on to a strong policy on PFAS and persistent chemicals. The guiding document for this must be the updated Flemish PFAS action plan. In this plan, the ongoing and recently started initiatives in the PFAS file will be followed up. The Flemish PFAS action plan must also pay attention to, among other things, the vision and strategy for the medium term, with clear performance indicators, a budgetary framework and an adequate governance structure.

Nevertheless, there is still a lot of work to be done to solve the PFAS problem. In Zwijndrecht, the first steps have been taken to initiate a constructive process. Elsewhere in Flanders, new polluted locations continue to emerge, as shown by the inventory campaign of the OVAM. Here too, targeted action is necessary: not only in terms of additional measurements, but also in terms of communication with local administrations and residents. Finally, remediation operations are also needed.

The major challenge for the coming months is bringing together all stakeholders in a common vision for the future, convinced that this PFAS file is being properly handled and that everything is being done to minimise the risks.

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