federal public service
HEALTH, FOOD CHAIN SAFETY
AND ENVIRONMENT

PFAS AND PRECURSORS IN BELGIUM: CURRENT STATE AND DATA GATHERING – POLICY BRIEF

September 2022 version – CONFIDENTIAL (only intended for authorities - not for publication)

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Compilation of the information received: from FPS Environment.

This document is a short Policy Brief of the CCIEP PFAS report of 2022 and is compiled of the Summary, the Discussions & Perspectives and the Conclusion of the main report.

Summary

This report presents a non-exhaustive compilation and analysis of the available information and ongoing activities in Belgium about PFAS. The report considers available data on possible/recognized/expected exposures, quantifiable or expected but non-quantifiable risks, expected / possible/probable outcomes, as well as the balance of uncertainties, ambiguities and ignorance. Hazards are not specific to Belgium, so they are more briefly mentioned.

The PFAS regulatory landscape has evolved tremendously over the last years, with several legislations including PFAS norms in their text, up to the point that an EU-level general ban is being prepared. In consequence, this report is useful for recollecting the fragmented information available until now (Regions, Federal level, NEHAP) so BE positions at EU and international levels can be better prepared with up-to-date information, and federal/regional actions can be coordinated or serve as sources of inspiration. Moreover, as for example the water compartment shows, regions are interdependent in terms of PFAS pollution and PFAS measures to take at their level.

Since the developments in Zwijndrecht of 2021 many actions have been taken to increase the knowledge, clean-up and regulatory action on PFAS substances. The regional authorities of Belgium have been conducting many different studies and (bio)monitoring on PFAS, as well as a mapping exercise and risk management of polluted sites. It is of vital importance that this large amount of newly generated data will flow through to the EU-level decision-making under REACH and other PFAS-related regulations. Especially under the current and planned REACH restrictions on PFAS this data will prove to be valuable for the development of these risk management dossiers and to develop strong knowledge-based restriction proposals. This CCIEP working group plays an important role in this data sharing in the form of this report.

With the data and information collected and generated in this report we have identifies some main gaps in knowledge and understanding regarding the PFAS topic. This list can be consulted in the discussion and perspectives section of this report. Even though we list some main concerns, it is important to realize that the topic of PFAS is a large and complex one with many different aspects to be taken into account due to the large number of substances and their widespread uses, together with the specific concerning characteristics of PFAS as a group. Considering this complexity it is impossible to give an exhaustive overview of the challenges regarding these substances. It also clear that there is still a lot of work to be done to ensure that these substances are properly regulated and actions are taken to reduce the emissions and the exposure of these substances to humans and the environment. However, this report illustrates that many things are happening in Belgium to tackle the PFAS pollution.

Discussion and Perspectives

This report highlights the complexity of the PFAS topic due to the large number of substances this group encompasses, as well as the multitude of uses of these substances. It is clear there are still many uncertainties; especially regarding PFAS production, export, and use in Belgium and abroad, as well as knowledge on PFAS toxicology, emissions, and end of life. However, this report also highlights that many different projects are planned and ongoing to broaden the knowledge base regarding these substances. The same can be said for the regulatory landscape, on the one hand showing a lack of current regulation (only a few PFAS are regulated at this moment), while some major policy actions are underway (i.e. planned PFAS restrictions under REACH and the Stockholm convention, as well as limit values under several EU and regional legal initiatives).

To ensure that these planned regulatory actions will provide the best protection of human health and the environment it will remain important to generate the needed data to be able to conduct a realistic risk and socio-economic analysis. With the specific case of PFAS (with persistence in the environment as common adverse property), especially costs of clean-up and decontamination will be important to correctly take into account. Information should be generated and made available on unacceptable costs and effects that are likely if the use of PFAS continues. Water resources, soils, and human exposure are of particular concern. Even though this report shows that a lot is happening regarding PFAS research, it is clear that PFAS regulatory decisions (1) will involve decisions with irremediably incomplete scientific information due to the large amount substances (>6000) and uses, and (2) there are sufficient indications that the possible effects (without action) are inconsistent with the chosen level of protection of health and environment in the EU and Belgium.

PFAS policy in the EU is taking the direction of increased protection of health and the environment, within a circular economy with non-toxic material and product lifecycles. Synergies between regulations (e.g. REACH and water regulations, REACH and IED, REACH and environmental permits, etc.) are important. Upstream measures, grouping of substances when regulating, safe and sustainable by design and essential uses definition are being proposed because a substance-by-substance approach for risk assessment/management of PFAS is not feasible while regrettable substitutions are possible. Amongst the various measures being discussed, the following ones are likely to have the biggest effect on PFAS production, use, releases, exposure, and placing on the market:

- REACH restrictions;
- Socio-economic analysis and essential uses definitions;
- New CLP categories on persistence and mobility;
- Strict environmental permits;
- Enforcement (including developing new analytical methods);
- Innovation for substitution and safe and sustainable by design.

Particular attention is needed for PFAS in imported articles (i.e. development of analytical methods and enforcement activities) for ensuring a level playing field for the EU and BE industries. Building and sharing expertise, collaboration, and making investments in green chemistry (in the technical sense) and sustainable chemistry is a promising path for avoiding regrettable substitution of PFAS in many uses. It is helpful to use environmental, health, and sustainability criteria for orienting investments.

There is already a legacy of pollution to manage, for which monitoring will be needed for many years. Use conditions, best available techniques, and environmental permits have a role in emission reduction, and this is likely to be also the case for future accepted essential uses until substitutes are developed. Monitoring of the environmental compartments will also remain necessary for confirming that the upstream measures are working.

In the following paragraphs, we list some key topics that pose uncertainties and perspectives that might become important points of discussion in the PFAS regulatory landscape for the following months and years.

PFAS production and use in Belgium

PFAS are (possibly) produced at several industrial locations in Belgium. The 3M site of Zwijndrecht is known to have produced long-chain PFAS substances in the past, which have now been replaced by short-chain alternatives. However, specific information on PFAS production at this site and by other companies is scarce, while emissions data indicate that many PFAS substances are being either produced or used on multiple industrial sites. On top of this emission data showing which companies emit these PFAS, this report also includes a list of Belgian companies that have registered PFAS substances under REACH, which indicates these companies either produce or market these substances in Belgium. Further action by inspection authorities could be an additional tool to broaden the knowledge base in this regard.
Knowing at which sites these chemicals are produced and used is important to properly follow up on potential emissions (and thus exposure to the local population) of these substances. This could then be followed up with risk reduction measures like emission reductions and proper waste management. As the recent case in Zwijndrecht and many others around the world have shown it is important to act on these production and use sites to prevent emissions and increased exposure of populations living nearby production sites.

PFAS are imported to Belgium in large quantities due to their presence in a multitude of products, mainly concerning substances in textiles, coatings, firefighting foams, and food contact materials. The report also includes a SCIP database search which demonstrates the presence of SVHC-identified PFAS in a wide variety of products, although this search highlighted that the SCIP database is lacking in clarity regarding the specific product type in which these are present, making it impossible to clearly identify which products contain PFAS.

The above discussion clearly shows that only fragmented information is available on the production, use, and import of PFAS and that it was challenging to collect. This highlights one of the bigger challenges regarding PFAS substances which is knowing and tracking where PFAS are produced and used in materials and products throughout their life cycle. Knowing the limitations of the SCIP database (i.e. only SVHC-identified PFAS are included and only limited product information is available), it is more than likely that downstream users are many times not aware that PFAS are present in their products, which might become important information once the general restriction enters into force. Furthermore, considering the rising public awareness of the challenges and risks regarding PFAS, it would be favourable to have a clear indication of whether PFAS are present in a consumer product. This shows that there is a need for clear and transparent communication throughout the supply chain to ensure that downstream users and consumers know that PFAS are present in their products and materials.

Lesser known PFAS: F-gasses and Fluorinated polymers (i.e. fluoropolymers, side-chain fluorinated polymers, and fluorocarbons)

A large class of PFAS for which many uncertainties remain is the fluoropolymers. This group will most likely be getting increasingly more attention in the coming years due to their many uses and the different toxicological profile they seem to have compared to other PFAS. The industry has indicated that they consider in many cases fluoropolymers irreplaceable in specific applications due to their unique properties and have indicated that these chemicals are vital for the move to more green and energy-efficient technologies[1]. Furthermore, the current research seems to indicate that the fluoropolymers themselves seem to be of low risk during the use phase due to the (currently known) absence of hazardous properties.

Nevertheless, as these substances also are built out of the persistent C-F bond, it will be inevitable that these will pose similar risks compared to other PFAS, meaning they will barely break down and concentrations could increase irreversibly in the environment, acting as a sink for exposure to humans and ecosystems[2]. Another important point of discussion regarding these lesser-known PFAS will be their exposure throughout their life-cycle. For example for the production of fluoropolymers, there is often a need for non-polymeric PFAS as processing aids, which are known to have hazardous properties and therefore can pose a risk when emitted to the environment[3]. Also at the end-of-life stage, PFAS-containing products must be properly disposed of, recycled, or reused, to prevent their emissions to the environment. Another example is the recurrent removal/re-coating of fluoropolymers in bakeries' forms, with unknown releases (Lohmann & Cousins, 2020).

The industry has acknowledged this life-cycle challenge and these processing aids proposed to have voluntary agreements for responsible manufacturing, which have been shown in some sites to reduce emissions by up to 99%[4]. The significance of the 1% remaining in terms of risks is not known presently to the CCIEP PFAS working group. Moreover, the drawback of only having voluntary agreements could be that there would be a lack of legal tools to enforce these emission reductions, risking that only frontrunners in the industry will follow these agreements. It would therefore be preferable to also have legal requirements on these emission reductions to ensure best practices and minimal emissions across the industry. These kinds of emissions reductions could either be enshrined under the coming REACH restriction or the reformed IED. Regarding the end-of-life of these products, there would be a need for proper waste management and ways to separately treat PFAS-containing waste to ensure that emissions to the environment are prevented via this route.

Similar discussions and challenges are ongoing for other fluorinated polymers like fluorocarbons and side-chain fluorinated polymers. Regarding fluorocarbons, the industry indicates these are very inert compounds that do not have adverse characteristics, and therefore do not pose a risk to human health and the environment; although again here

[1] https://setac.onlinelibrary.wiley.com/doi/full/10.1002/ieam.4646
[2] https://pubs-acs-org.vdicp.health.fgov.be/doi/10.1021/acs.est.2c02765
[3] https://pubs.acs.org/doi/pdf/10.1021/acs.est.0c03244
[4] Verbally stated by Chemours

concerns regarding their production and disposal could arise, and toxic characteristics cannot be excluded[5]. For side-chain fluorinated polymers, a recently declassified report by the OECD summarized that more and more evidence is indicating these are important precursors to non-polymeric PFAS and therefore also act as an important source of non-polymeric PFAS emissions during production and end-of-life.

Considering the above concerns regarding fluorinated polymers, an important step to decrease the uncertainty on the risks of these substances will be for the registration of polymers under REACH, which could increase the knowledge base on fluoropolymers and in turn facilitate science-based risk analysis, as well as indicate whether these substances indeed pose less risk compared to other PFASs.

The unique properties of polymeric-PFAS, together with the types of uses in combination with uncertainties regarding hazards and risks will most likely drive the essential use discussions under REACH (even though essential use will not be used under the PFAS restriction). Nevertheless, for PFAS uses that might be deemed essential in the future, it will remain important to have the best available practices and proper waste management to prevent unwanted emissions as much as possible. Research and innovation into the hazards, as well as safe and sustainable alternatives, will be vital for this subclass of PFAS.

A similar yet different case entails the F-gasses, which also have their unique properties in the PFAS group, with differing toxicological profiles and according to industry some essential applications. The same challenges and perspectives as with fluorinated polymers could apply in this case, with again a need to look at the complete life-cycle of these substances, in combination with more toxicological insights and continuing research for alternatives.

Research on PFAS hazards, risks, and mixture effects

One large challenge that remains is defining the potential hazards of all PFAS substances. As this is a large and diverse group of substances it is difficult to do a traditional risk assessment by identifying the hazard of each substance. Initiatives like the PFAS-tox database and ongoing academic research ensure that the knowledge is increasing, but it is unlikely that all PFAS will have a complete toxicological profile in the near future.

Even though the current grouping under REACH for PFAS is focussing on the common characteristic of persistence, it remains vital to research other potential hazards of specific PFAS substances, as this will further strengthen the risk assessment of the oncoming restrictions. For many of the investigated PFAS, it has been shown they have endocrine disrupting properties[6,7,8]. Especially considering that for multiple PFAS it has been shown that they exhibit low-dose

[5] https://www.ecetoc.org/wp-content/uploads/2021/10/ECETOC-TR-103.pdf

[6] Hormoonverstoorders | Beswic

[7] NAPED

[8] See following papers for more detail:
Endocrine-disrupting activity of per- and polyfluoroalkyl substances: Exploring combined approaches of ligand and structure based modeling - PubMed (nih.gov)
Vagi et al. 2014
Zota et al., 2018

effects[9] and their dose-response curves do not follow the typical linear line, but more towards non-monotonic dose-response curves[10].

The scientific literature and REACH-related dossiers show that the main hazards related to PFAS are persistence and long-range transport. In Belgium, several studies have been conducted on PFAS presence in the environment, bio-monitoring, and possible hazards, of which this report gives an overview. Furthermore, the proposed actions under the CSS to include new hazard classes focussing on persistence and mobility might prove to be a valuable legal asset to classify more PFAS substances as hazardous substances, enabling more regulatory action.

The focus of toxicological research should not only be on human endpoints but should include ecotoxicological research as well. Some studies from Belgium universities for example have already shown the effects of higher PFAS concentrations on certain species, although these studies are still rare compared to the human end-point studies.

Apart from hazard assessment of individual substances, it will be important to also research the mixture effects of PFAS. This includes the combination effects of different PFAS, as well as effects of PFAS in combination with other substances. Research under the HBM4EU already indicated that co-exposure to higher levels of both Cd and certain PFAS was associated with a decrease in kidney function in adults, which suggests a combined mixture effect[11].

Even though there are still a lot of unknowns on these substances, it is positive to see a lot of projects in the pipeline to fill in the knowledge gaps. The work being done by the regional authorities on (bio)monitoring with projects like the PFAS-action plan, CARIBOUH, BIODIEN, and others, as well as the extensive mapping exercises of contaminated sites shows that Belgian is playing a pioneering role in regards to PFAS research. Federal projects like FLUOREX, NAPED, and PERFOOD add to this body of knowledge being generated by Belgium. It will be vital in the future to follow up on these projects and share their results with the bodies working on the banning of PFAS.

Innovation across the life-cycle

Belgian authorities are taking initiatives at various levels: in the Walloon and Brussels regions, environmental monitoring has been conducted for several years. The Flemish region has adopted a PFAS action plan, which encompasses bio-monitoring, environmental monitoring, and the development of new methods to detect and analyse lesser-known PFAS substances. This work has been expanded following the Zwijndrecht case, now including several new

[9] See following references:
Dixon et al. 2012 - Tucker et al. 2015 - White et al. 2011
[10] Relatie tussen dosis en effect | Beswic - Meng et al., 2018 - Kim et al. 2018
[11] Synergistic impact of co-exposures to toxic metals cadmium, lead, and mercury along with perfluoroalkyl substances on the healthy kidney function - ScienceDirect
Preston 2020 -- Prenatal exposure to per- and polyfluoroalkyl substances and maternal and neonatal thyroid function in the Project Viva Cohort: a mixtures approach - Environ. Int., 139
The role of maternal high fat diet on mouse pup metabolic endpoints following perinatal PFAS and PFAS mixture exposure, Marques, 2021
Combined effects and toxicological interactions of perfluoroalkyl and polyfluoroalkyl substances mixtures in human liver cells (HepG2, Ojo 2020)

studies, the construction of a PFAS map, and a report being prepared for giving policy advice regarding these substances.

Taking into account this available information, the most important variables that will drive possible evolutions in the future are research on the potential human and environmental hazards of the lesser known PFAS substances, to determine which substances require the most stringent regulatory action. Furthermore, new analytical methods to analyse the wide variety of PFAS substances, as well as methods to analyse PFAS more efficiently in different matrices (i.e. water, air, and soil) are essential to indicate the scale at which these substances are present in the environment. Lastly, as the emissions of these substances will most likely continue for several years, and due to their persistent nature, the development of remediation techniques from different environmental compartments will be vital as well.

Research and innovation initiatives focussing on methods to remediate and destroy PFAS remain important to reduce the environmental presence of these substances, but it is at least equally important to look more upstream and prevent further emissions by redesigning products and services and substituting PFAS uses as much as possible. Concepts like Safe and Sustainable by Design (SSbD) and substitution projects like Belgium Builds Back Circular (BBBC) are vital to helping the industry in moving to alternatives that are safe and sustainable. For specific uses that might need to continue due to essentiality considerations, it could be interesting to look into concepts like the Extended Producer Responsibility (EPR), where a producer of a substance stays responsible for that product throughout the life-cycle.

REACH revision and other regulatory actions

The recent developments at the 3M Zwijndrecht site have demonstrated that it is important to ensure that industrial production processes generate minimal emissions and exposure to the local population and workers. By having mandatory best practices it can be ensured that emissions are minimised and risks are limited. Concepts like responsible manufacturing are an important first step in this, however, they should be legally implemented and not limited to voluntary agreements, as not only frontrunners should by applying these principles. Actions under the IED and the REACH restrictions could ensure that site management is legally required for PFAS-producing industries.

Adding PMT and vPvM to CLP classification will be an important step to enlarge the range of research under CLP, which will aid in expanding the hazard profiles of PFAS substances, which in turn will ensure that other regulatory actions will be well founded in scientific information.

One of the most important and effective tools to prevent further exposure of humans and emissions of PFAS to the environment will be the restrictions underway under REACH. By banning these substances it can be ensured that further emissions are stopped and consequently levels will stop rising in the environment. However, it is also important to recognize that some uses are at the moment irreplaceable and essential for the functioning of society. Therefore it will be important to have a very thorough socio-economic analysis of these substances to identify the uses which might be needed to continue until alternatives are available. Therefore the concept of essential use could be a strong tool to ensure that this selection is made correctly. Even though the essential use concept will not be cemented in EU law yet when the restriction proposal will be published, it should be possible to already do a similar analysis of the different uses and correctly identify the costs and benefits, and essentiality of the different uses. This analysis should not be limited to monetary costs of stopping the production, but should certainly also include benefits like prevented disease burden, prevented effects on ecosystems, and prevented remediation costs, of which monetary estimations have already been made in several studies[12,13,14]. The extent of genuine systemic societal risks generated by a restriction should be considered as the marker of the essentiality of a substance for the functioning of society.

As PFAS are persistent and many have long-range transport potential, it will be important that these actions are not limited to the EU as emissions from outside of the EU could reach the EU (either via planetary processes, or the import of PFAS containing articles or waste). By including additional PFAS in the Stockholm Convention, or having international certification and labelling schemes, it can be ensured that this problem is tackled at a more international level, ensuring that the global emissions are minimized. Without actions on PFAS at the international level, we will partly delocalize PFAS industrial uses and receive the PFAS back through the environment even if the final products do not contain the restricted PFAS.

Conclusion

Despite the scarcity of information on production and import, the data collected on emissions indicate the wide use of many PFAS substances in Belgium, indicating there is more import and production than what we could find when collecting data for this report. Monitoring studies of water, soil, and biota in Belgium show that PFAS are widely present in the Belgium environment. The wide use of these substances in consumer articles also indicates exposure to many of these substances, which is reflected in biomonitoring studies, showing that several PFAS substances are found in the Belgium population.

Research on these substances will remain vital, as many uncertainties remain on lesser studied groups of PFAS substances. Especially in light of the oncoming regulatory actions on the whole of the PFAS group, it will remain essential to collect as much data as possible on the Belgium situation regarding these PFAS substances. (Bio)monitoring, (eco)toxicity research and the development of new analytical techniques and remediation techniques will remain vital to assure the right regulatory actions are taken to assure maximal efficient risk management of these substances. Due to a large amount of expertise, pioneering research, and extensive (bio)monitoring projects, Belgium can play an important role in providing data for these future regulatory actions.

Given the great number of substances and different uses under the PFAS group, it will be impossible to have a full-scale idea of the hazards and risks of these substances. Therefore, it will be vital to tackle these substances in a group approach. This unavoidably leads to a decision-making process based on limited data and information. Concepts like the precautionary principle, costs of inaction, and essential use will be important tools to use in order to ensure that all PFAS will be banned unless they prove to be essential for the functioning of society. And even then efforts should be continued to be made to find safe and sustainable alternatives to phase out these substances as much as possible.

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[12] https://pubs.acs.org/doi/10.1021/acs.est.2c02765

[13] Leveraging Systematic Reviews to Explore Disease Burden and Costs of Per- and Polyfluoroalkyl Substance Exposures in the United States | SpringerLink

[14] Ontwikkeling van gezondheidsindicatoren voor blootstelling aan hormoonverstorende stoffen in Vlaanderen en doorrekening van de maatschappelijke gezondheidskost | FRIS onderzoeksportaal (researchportal.be)