Climate Action Merri-bek
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15 November 2024

To: Select Committee on PFAS (per and polyfluoroalkyl substances)
Email: <**PFAS.sen@aph.gov.au**>

Re: Inquiry into PFAS

We are a grassroot Incorporated group of citizens in the municipality of Merri-bek in Melbourne's Northern suburbs active on climate advocacy since 2008. We bring our experience and knowledge of climate and environmental issues and the need for rapid decarbonisation to address the climate emergency, especially as it applies to our own municipality, but also generally for Australia as a whole.

We became aware of the risk and threat of PFAS chemicals through a 2020/2021 local Council proposal to convert a local multi-use grass sports field to a synthetic sports field. Our submission focuses on PFAS chemicals and synthetic turf. We think the Federal PFAS Taskforce has ignored the potential of synthetic turf as a source of PFAS contaminating the environment and human health.

We thank the Senate Select Committee for this opportunity to put in a submission on PFAS (per and polyfluoroalkyl substances) .

John Englart
Convenor, Climate Action Merri-bek
for and on behalf of Climate Action Merri-bek

Submission on PFAS

See our general and specific recommendations in the Conclusion.

Executive Summary

Our interest in PFAS started with a campaign in 2020-2021 to stop a grass multi-use sports field in Coburg North in Melbourne's northern suburbs being converted to a synthetic turf sports pitch. This was one of eight Council synthetic turf projects in a pipeline of projects.

We continued to investigate the scientific literature on artificial turf and discovered that PFAS chemicals are routinely used in the manufacturing of turf fibres and matting as a lubricant to prevent the extrusion machines from clogging up.[1] PFAS may also be added to plastic grass strands for UV protection and to prevent them from breaking.

Synthetic Turf is both manufactured here in Australia and also imported for sale.

PFAS can leach from artificial turf into local water supplies,[2] and aquatic ecosystems.

PFAS chemicals are not manufactured in Australia but imported subject to Federal Government regulation.

There appears to be no chemical testing of synthetic turf products in Australia.

There appears to be no regulation of chemicals in synthetic turf products in Australia.

NSW EPA and Victorian EPA have declined to test synthetic turf chemical content, despite evidence from USA and Europe, and being asked to do so.

Synthetic turf is not listed by the PFAS Taskforce as a potential source for PFAS in the Environment.

Synthetic turf as it wears and breaks down produces microplastics pollution which is both airborne and waterborne. Any Fluoropolymers/PFAS in synthetic turf will combine with microplastics pollution increasing its environmental and health impact.

Synthetic turf at end of life: Recycling synthetic turf with unknown chemical content risks furthering toxic contamination in the down-cycled products produced; or risks toxic leaching if disposed of in landfill; or causes PFAS in bottom ash and as airborne pollution if put through an industrial waste Incinerator.

Both microplastics and PFAS affect environmental ecosystems and human health, and when combined together, or with other toxic pollutants, may have both an additive and synergistic impact.

PFAS in the environment now has many sources. Scientists have tested and found PFAS chemicals widely on the earth and concluded that rainwater globally is contaminated often above all drinking water standards. Because of biopersistence, these chemicals are likely to continue to cycle in the hydrosphere. Global soils are now ubiquitously contaminated.

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[1] Toxic Forever Chemicals Infest Artificial Turf – PEER.org., 10 October 2019.
https://peer.org/toxic-forever-chemicals-infest-artificial-turf/
See also: Industry in a Dither about PFAS in Synthetic Turf – PEER.org, 24 October 2019.
https://peer.org/industry-in-a-dither-about-pfas-in-synthetic-turf/

[2] State Officials Warn Burrillville About Installing Turf Field Following PFAS Contamination in North Smithfield, ecoRI News. 21 August 2024.
https://ecori.org/state-officials-warn-burrillville-about-installing-turf-field-following-pfas-contamination-in-north-smithfield/

Contamination is poorly reversible. Planetary boundary for chemical pollution now being exceeded. Scientists recommend that “to avoid further escalation of the problem of large-scale and long-term environmental and human exposure to PFAS, rapidly restricting uses of PFAS wherever possible.”

Fluoropolymers and PFAS in Synthetic Turf

Recent scientific testing and research from the USA and Europe in the last 5 years strongly indicates that Fluoropolymers and PFAS may be in all synthetic turf products.

Initial report of PFAS used in Synthetic Turf came out of the US from the work of a former EPA USA official in an article in The Intercept October 2019 .

As PFAS chemicals are biopersistent and bioaccumulate, it poses questions of direct or indirect human and environmental impact. As PFAS is a forever chemical, when artificial turf is disposed of as landfill or recycled it poses an environmental contamination problem. Industrial waste incinerators also fail to substantially destroy PFAS chemicals producing toxic bottom ash and PFAS air pollution.

A Swedish peer reviewed study published in July 2022 by Melanie Lauria et al highlighted the issue of PFAS and its prevalence in multiple synthetic turf field samples. This study raised questions for us about whether PFAS class of chemicals is in synthetic turf in Australia and started our own enquiries for EPA Victoria to undertake testing of artificial turf.

This Swedish study highlights that fluorine signatures were found in all 17 fields sampled in all samples of the backing, filling and blades. While the fluorine appears stable, not enough is yet known of it’s fate when subject to weathering and degradation.

The researchers expressed concerns on the production and end of life of Artificial turf.

Artificial Turf analysed in the study contained 0.315–17.439 kg of Fluorine per field. Presence of Fluorine is an indicator for the presence of Fluoropolymers and PFAS.

Questions arise over PFAS contamination during disposal or recycling of synthetic turf backing, blades and infill.[3]

A very technical study by Rainer Lohmann et al from October 2020 discussed Fluoropolymers, questioning their use in industrial processes and manufacturing and highlighting the concern of fluoropolymers impact on environment and human health.

The study doesn’t specifically mention use of fluoropolymers in manufacture of artificial grass, but (Lauria et al 2022) makes that link. The study methodically documents use of Fluoropolymers and raises questions regarding impact including on:

[3] Lauria, Mélanie Z., Ayman Naim, Merle Plassmann, Jenny Fäldt, Roxana Sühring, and Jonathan P. Benskin, (July 2022) Widespread Occurrence of Non-Extractable Fluorine in Artificial Turfs from Stockholm, Sweden, Environmental Science & Technology Letters 2022 9 (8), 666-672
DOI: 10.1021/acs.estlett.2c00260

- Leaching of Low-molecular-weight PFAS from Fluropolymers during process and Use.
- Toxicity of Fluoropolymer processing aids, monomers, and Oligomers
- Penetration of cell membranes by Macromolecules
- Persistence and Disposal of Fluoropolymers
- Can Fluoropolymers be considered separately fromuse of PFAS as processing aids?
- Are Fluoropolymers Polymers of low or High Concern?

In the final point on whether we should be concerned with Fluoropolymers the researchers argue:

> "The concerns we present above suggest that there is no sufficient evidence to consider fluoropolymers as being of low concern for environmental and human health. The group of fluoropolymers is too diverse to warrant a blanket exemption from additional regulatory review. Their extreme persistence and the emissions associated with their production, use, and disposal result in a high likelihood for human exposure as long as uses are not restricted." [4]

Combined impact of Microplastics and PFAS

A study by Tayebeh Soltanighias et al in October 2024 highlighted the combined toxicity of perfluoroalkyl substances and microplastics in aquatic ecosystems. One of the potential sources for both microplastics and PFAS chemicals is synthetic turf.[5]

The study highlighted that PFAS and MP mixtures lead to developmental failures, delayed maturation, and reduced growth. Historical pollution exposure lowers tolerance to chemical mixtures. The combined effect of the persistent chemicals analyses was 59% additive and 41% synergistic.

The combination of microplastics and PFAS is an interesting one. Abad López et al (March 2023) explored Atmospheric microplastics: exposure, toxicity, and detrimental health effects.[6] This is a review article of airborne microplastics, including exposure, toxicity and health effects. Outdoor sources for microplastics include: "abrasion of synthetic textiles, incomplete incineration of plastic waste, municipal solid waste, dust storms, abrasion from synthetic rubber tires, scaffolding mesh on construction sites, and **synthetic turf** for ground cover are

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[4] Lohmann, Rainer., Ian T. Cousins, Jamie C. DeWitt, Juliane Glüge, Gretta Goldenman, Dorte Herzke, Andrew B. Lindstrom, Mark F. Miller, Carla A. Ng, Sharyle Patton, Martin Scheringer, Xenia Trier, and Zhanyun Wang, (Oct 2020) Are Fluoropolymers Really of Low Concern for Human and Environmental Health and Separate from Other PFAS?
Environmental Science & Technology 2020 54 (20), 12820-12828
DOI: 10.1021/acs.est.0c03244

[5] Tayebeh Soltanighias, Abubakar Umar, Muhammad Abdullahi, Mohamed Abou-Elwafa Abdallah, Luisa Orsini, (19 October 2024), Combined toxicity of perfluoroalkyl substances and microplastics on the sentinel species Daphnia magna: Implications for freshwater ecosystems, Environmental Pollution, Volume 363, Part 1, 2024, 125133, ISSN 0269-7491, https://doi.org/10.1016/j.envpol.2024.125133.

[6] Abad López, Angela Patricia, Trilleras, Jorge, Arana, Victoria A. , Garcia-Alzate, Luz Stella, Grande-Tovar, Carlos David., (March 2023) Atmospheric microplastics: exposure, toxicity, and detrimental health effects, RSC Adv., 2023, 13, 7468-7489
doi.org/10.1039/D2RA07098G

recognized as potential sources of MPs suspended in outdoor air." While it does not detail PFAS, microplastics provide a vector for PFAS and other toxic chemical transport and inhalation by humans and into the environment.

Toxicity of Synthetic turf and human health

Another very recent study by Kyle R. Siegel et al (September 2024) on the toxicity of synthetic turf, although it does not mention PFAS chemicals, highlighted In vitro endocrine and cardiometabolic toxicity associated with artificial turf materials.[7]

A study by Heather Leslie et al (2022) looked at Discovery and quantification of plastic particle pollution in human blood. It is an Important study highlighting that microplastics are now found in the human bloodstream, and are likely being ingested or inhaled. Long term health risks are still very much unknown. One of the issues is that microplastic particles often have a hacky structure that attract other toxic chemicals, so microplastics can be a vector into the body and bloodstream and to most organs of toxic chemicals such as Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), heavy metals, Volatile Organochlorine Compounds (VOCs).[8]

NSW Chief Scientist report on Synthetic Turf

The 2022 NSW Chief Scientist and Engineers report on Synthetic turf in public spaces identified multiple issues with synthetic turf, including with the chemical constituents of synthetic turf and whether it contains PFAS.[9]

> "9.1 Chemical constituents of synthetic turf
> Many of the commissioned experts, from diverse research areas, identified a singular major knowledge gap - that chemical constituents of synthetic turf components, and their associated human and environmental health impacts are not fully known. There is a need for laboratory and on-site studies conducted under Australian climatic and environmental conditions, and human health assessments across age and demographic categories. The development of a chemicals and materials library for synthetic turf components could inform leachate toxicant and pollutant identification and identify the impacts of synthetic surfaces on ecological and human health. Including chemicals and additives used during production, and materials such as SBR rubber that have a high Variability."

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[7] Kyle R. Siegel, Brooklynn R. Murray, Jeff Gearhart, Christopher D. Kassotis, (6 Sep 2024) In vitro endocrine and cardiometabolic toxicity associated with artificial turf materials, Environmental Toxicology and Pharmacology, https://www.sciencedirect.com/science/article/pii/S1382668924002023

[8] Leslie, Heather A., Martin J.M. van Velzen, Sicco H. Brandsma, A. Dick Vethaak, Juan J. Garcia-Vallejo, Marja H. Lamoree, (2022) Discovery and quantification of plastic particle pollution in human blood, Environment International, Volume 163, 2022, 107199, ISSN 0160-4120, https://doi.org/10.1016/j.envint.2022.107199

[9] NSW Chief Scientist and Engineer, 13 October 2022, Independent review into the design, use and impacts of synthetic turf in public open spaces, Final report, https://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0004/542263/CSE-Synthetic-Turf-Review-Final-Report.pdf

The main assessment on PFAS in synthetic Turf was a response provided by the NSW EPA. They did not do a literature review specific to the request. They acknowledged PFAS in test results from Sweden and USA. They argued health risks from PFAS are low, with greater concern for PAHs, VOCs, and heavy metals in synthetic turf. There was no assessment of cumulative risk.

They recommended that:

- testing for PFAS be considered in the context of testing for other more prevalent chemicals such as PAHs and some heavy metals.
- Suggested there would be a benefit in including PFAS in the suite of potential contaminants that are routinely investigated at synthetic field sites.

They note that:

> "Synthetic turf and potential PFAS contamination of synthetic turf are not currently regulated by the EPA. Additionally, there are currently no limits on PFAS levels for synthetic turf or recovered wastes applied to land. No data is held by the EPA regarding the potential contamination of synthetic turf, recovered wastes, and no literature reviews have been undertaken."

Given Victoria is financing the establishment of a synthetic turf recycling centre in the Albury area, there should be expert assessment on what the presence of PFAS and other toxic chemicals may imply for the mechanical recycling process and potential for downstream toxic contamination.

As we don't have any product life tracing for synthetic turf with unknown chemicals in each batch, this poses a problem for recycling in how to prevent spreading toxic contaminants further.

Request for EPA Victoria to test for Fluoropolymers/PFAS in Synthetic Turf

In September 2022 we asked the Victorian EPA to test synthetic turf for Fluoropolymers and PFAS here in Australia. They politely declined to do so, claiming it was not in their remit. They suggested we contact the Victorian Dept of Health, Sustainability Victoria, and the PFAS Taskforce. In due course we contacted all of these organisations and were equally politely rebuffed.[10]

EPA Victoria said ambiguously we should take a precautionary approach if we suspect PFAS is present, but refused to test for PFAS in synthetic turf, when research from the United

[10] Correspondence archived in Google Doc: EPA Victoria enquiry (expanded to Dept of Health, Sustainability Victoria, PFAS Taskforce) on PFAS in synthetic turf, Sep-Oct 2022, https://docs.google.com/document/d/1jNRsozHE2xl0cStPvVvEopsj0nSiiN5z4ZApVu_YSmY/edit?usp=sharing

States and Europe shows that it is present in synthetic turf, and also leaches out of synthetic turf fields into groundwater.

> "While scientific research continues to be undertaken, EPA, consistent with federal guidelines from the Environmental Health Standing Committee (enHealth), takes a precautionary approach and advises people to reduce their exposure to PFAS."

PFAS and Planetary boundaries

Our investigation of PFAS in synthetic turf led us to the broader global problem of PFAS contamination in the environment.

A scientific study on 4 PFAS chemicals by Ian Cousins et al published in August 2022 identified that for these chemicals we are now Outside the Safe Operating Space of a New Planetary Boundary for Per- and Polyfluoroalkyl Substances (PFAS).[11]

The study considered 4 PFAS related chemicals and concluded that rainwater globally is contaminated often above all drinking water standards. Because of biopersistence, these chemicals are likely to continue to cycle in the hydrosphere. Global soils are now ubiquitously contaminated. Contamination is poorly reversible. Planetary boundary for chemical pollution now being exceeded. Recommends that "In view of the impacts of humanity's chemical footprint on planetary health, it is of great importance to avoid further escalation of the problem of large-scale and long-term environmental and human exposure to PFAS by rapidly restricting uses of PFAS wherever possible.

An earlier study by Persson et al (January 2022) articulated that the safe guidelines limits for Plastics are reducing. It is now common that PFAS contamination on a wide scale is in excess of these guidelines. PFAS is now detectable in rain at most locations across the world. The authors propose a new planetary boundary for Per- and Polyfluoroalkyl Substances, as a subset of the Novel Entities Planetary Boundary, and that we are already exceeding that boundary.[12]

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[11] Cousins, Ian T., Jana H. Johansson, Matthew E. Salter, Bo Sha, and Martin Scheringer, (Aug 2022) Outside the Safe Operating Space of a New Planetary Boundary for Per- and Polyfluoroalkyl Substances (PFAS), Environmental Science & Technology 2022 56 (16), 11172-11179 DOI: 10.1021/acs.est.2c02765

[12] Persson, Linn., Bethanie M. Carney Almroth, Christopher D. Collins, Sarah Cornell, Cynthia A. de Wit, Miriam L. Diamond, Peter Fantke, Martin Hassellöv, Matthew MacLeod, Morten W. Ryberg, Peter Søgaard Jørgensen, Patricia Villarrubia-Gómez, Zhanyun Wang, and Michael Zwicky Hauschild (Jan 2022) Outside the Safe Operating Space of the Planetary Boundary for Novel Entities. Environmental Science & Technology 2022 56 (3), 1510-1521 DOI: 10.1021/acs.est.1c04158 https://pubs.acs.org/doi/10.1021/acs.est.1c04158

Conclusion and Recommendations

We are aware of the many sources of PFAS pollution including from clothes, carpets cosmetics, consumer products, in our water supply, and in takeaway food packaging.

Our submission has focussed on a niche use of PFAS chemicals, as part of artificial turf. This use has been substantially ignored by official agencies regulating PFAS chemicals.

We found wide use of artificial turf with poor regulation of its chemical content deeply concerning. PFAS is just one toxic aspect of this product that has multiple problems and we judge as a climate maladaptation.

General Recommendations:

1. PFAS chemicals should be regulated and addressed as a class
2. Use of PFAS in manufacturing in Australia should be tightly regulated, controlled and phased out.
3. During PFAS phase out all products using PFAS implement full product tracing.
4. Update Australian drinking water guidelines to reflect the US EPA standards and finding that there may be “no safe level of PFAS exposure.”
5. Given PFAS contamination is now part of the hydrosphere, improve water treatment to ensure best available technology (BAT) to limit PFAS contamination as close as possible to zero
6. Address wastewater treatment plants PFAS contamination of biosolids and their use for agriculture.
7. We have had a voluntary phaseout of PFAS in food packaging. We should now move to mandatory removal of PFAS from all food contact packaging
8. Fluorinated Refrigerants. Rapidly replace refrigerants with non-fluorinated options and raise this in international fora.
9. The Australian government should ratify the three chemicals PFOS, PFOA and PFHxS for inclusion in the listing on the Stockholm Convention on Persistent Organic Pollutants 2001. Australia should also support the proposed global ban on perfluorocarboxylic acids (PFCAs) as recommended by the Persistent Organic Pollutants Review Committee (POPRC)

Specific Recommendations for Artificial Turf:

10. Manufacturers should be compelled to disclose full chemical makeup of the product.
11. The chemical composition of Artificial turf should be tested.
12. Import of Artificial turf should be banned.
13. Use of Artificial Turf should be restricted to certified PFAS free products.
14. Given the global plastics pollution crisis and with a Global Plastics Treaty presently under negotiation, artificial turf is a non-essential use of plastics that contributes to greenhouse gas emissions, microplastics pollution and adds to urban heat. Stringent triple bottom line governance arrangements are needed to justify any artificial turf use, including implementing microplastic pollution mitigation measures.