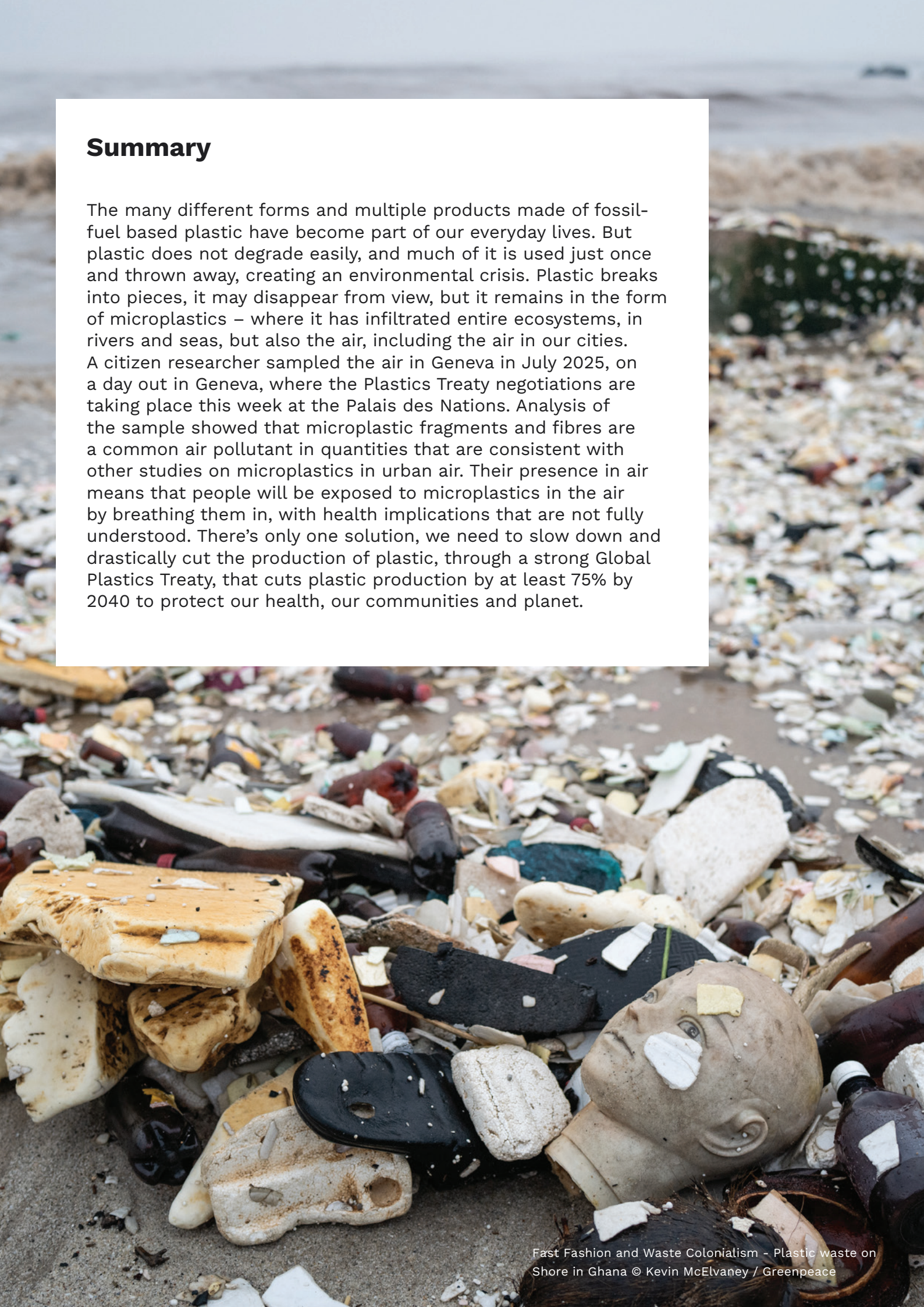
LIVING IN PLASTIC AIR

SAMPLING FOR MICROPLASTICS IN AIR IN GENEVA, SWITZERLAND

GREENPEACE

Summary

The many different forms and multiple products made of fossil-fuel based plastic have become part of our everyday lives. But plastic does not degrade easily, and much of it is used just once and thrown away, creating an environmental crisis. Plastic breaks into pieces, it may disappear from view, but it remains in the form of microplastics – where it has infiltrated entire ecosystems, in rivers and seas, but also the air, including the air in our cities. A citizen researcher sampled the air in Geneva in July 2025, on a day out in Geneva, where the Plastics Treaty negotiations are taking place this week at the Palais des Nations. Analysis of the sample showed that microplastic fragments and fibres are a common air pollutant in quantities that are consistent with other studies on microplastics in urban air. Their presence in air means that people will be exposed to microplastics in the air by breathing them in, with health implications that are not fully understood. There's only one solution, we need to slow down and drastically cut the production of plastic, through a strong Global Plastics Treaty, that cuts plastic production by at least 75% by 2040 to protect our health, our communities and planet.



Fast Fashion and Waste Colonialism - Plastic waste on Shore in Ghana © Kevin McElvaney / Greenpeace

1 Introduction - the plastics crisis and microplastics

More than seventy years since it was first made at an industrial scale,[1] fossil-fuel based plastic has infiltrated every aspect of our modern lives, and found its way into entire ecosystems. We're shocked by the floods of plastic waste overwhelming rivers and seas in the global South, but a big part of the plastic waste and pollution problem is not even visible. Since the first use of the term "microplastics" twenty years ago, these small fragments of plastic have been found everywhere, from the deep sea to the highest, pristine mountains, in 1300 species throughout the food web, with evidence of harm at multiple levels.[2] Microplastics are also infiltrating ecosystems on land and have recently been found in the faeces of land-based mammals in Switzerland.[3] They are in our food, water and the air that we breathe, and even in the organs and tissues of our bodies, where evidence is emerging of negative effects.[4]

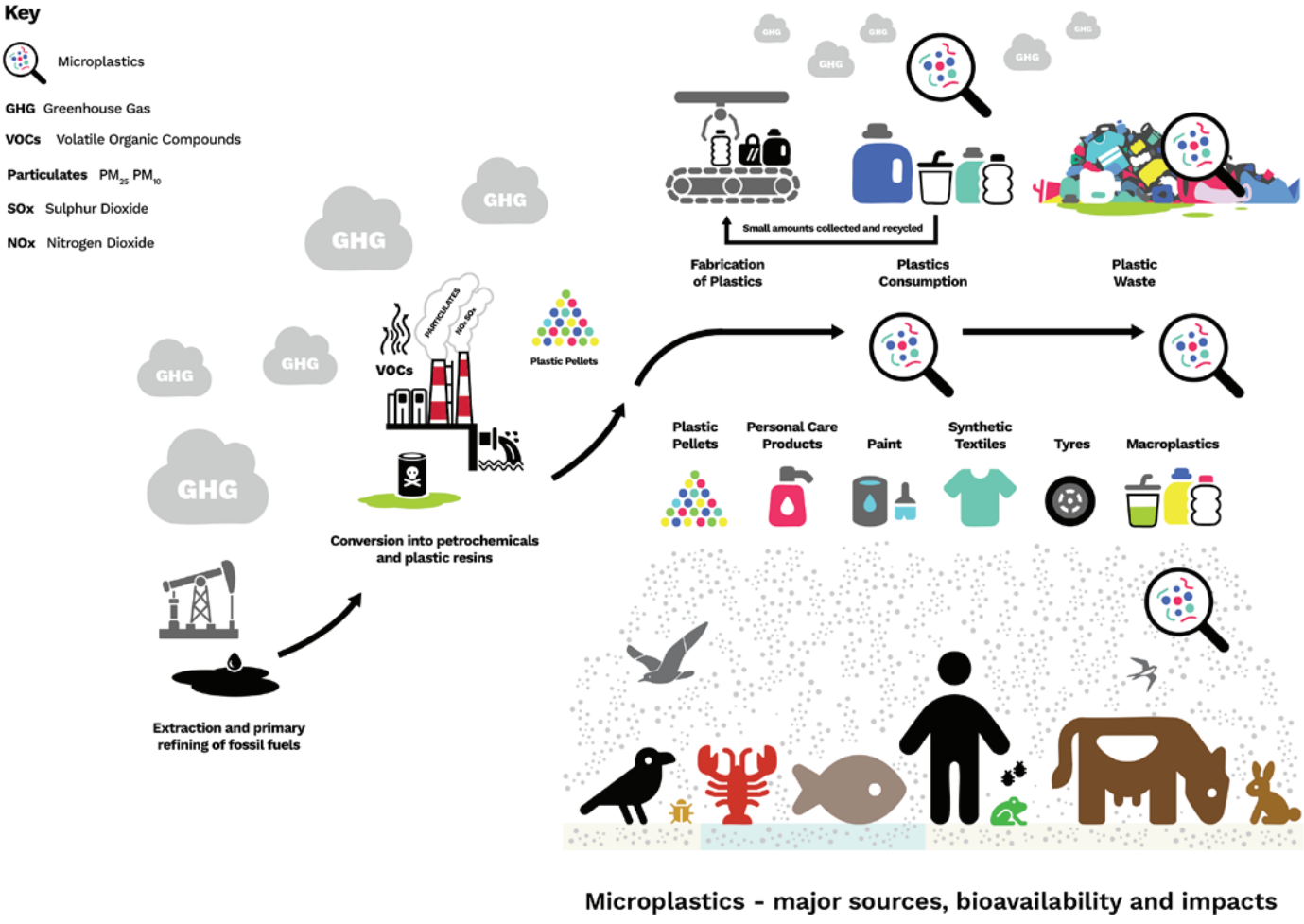
Collection of Wild Animals' Droppings with Microplastics in Switzerland. © Greenpeace

2 Microplastics in air

2.1 Sources in urban air

Most people are aware of the plastic and microplastic pollution of our rivers and seas, but may not know that we are also breathing in microplastics in the air. For this investigation, we focussed on microplastics in the air in urban environments, and indoor air in particular. Microplastics take the form of fragments, broken down from solid plastics, or fibres from textiles: they can be suspended in the air and transported over long distances by atmospheric currents.[5] Sources of microplastics in air can also be found throughout the urban environment, for example in consumer products and their packaging, in clothes, in textiles used in furnishings, in car tyres, as well as in urban architecture such as buildings and transport systems. The main source of airborne microplastics indoors is textiles, while sources of microplastic pollution of outdoor air are from traffic-related plastic particles, textiles, and agricultural and marine airborne microplastics.[6]

Figure 1: The plastics life cycle and microplastics [13]



As a product of the oil and petrochemical industry, plastic is a major source of environmental impacts including hazardous air pollution at the start of its life cycle (see Figure 1). The plastics themselves can also contain many chemicals,[7] some of which are known to be persistent, bioaccumulative, mobile, and/or toxic, with the majority not even assessed.[8] As microplastics and even smaller nanoplastics[9] they pose a serious global environmental challenge, due to low degradability, easy transportability and accumulation, and ecotoxicity, which also comes from their ability to absorb other pollutants and carry them throughout the environment.[10] Microplastics in air are easily breathed in, and have become a significant contributor to our intake of microplastics.[11] Studies into the health impacts of inhaling micro- and nanoparticles of plastics are at an early stage, but there are concerns about a range of health effects in particular respiratory diseases.[12]

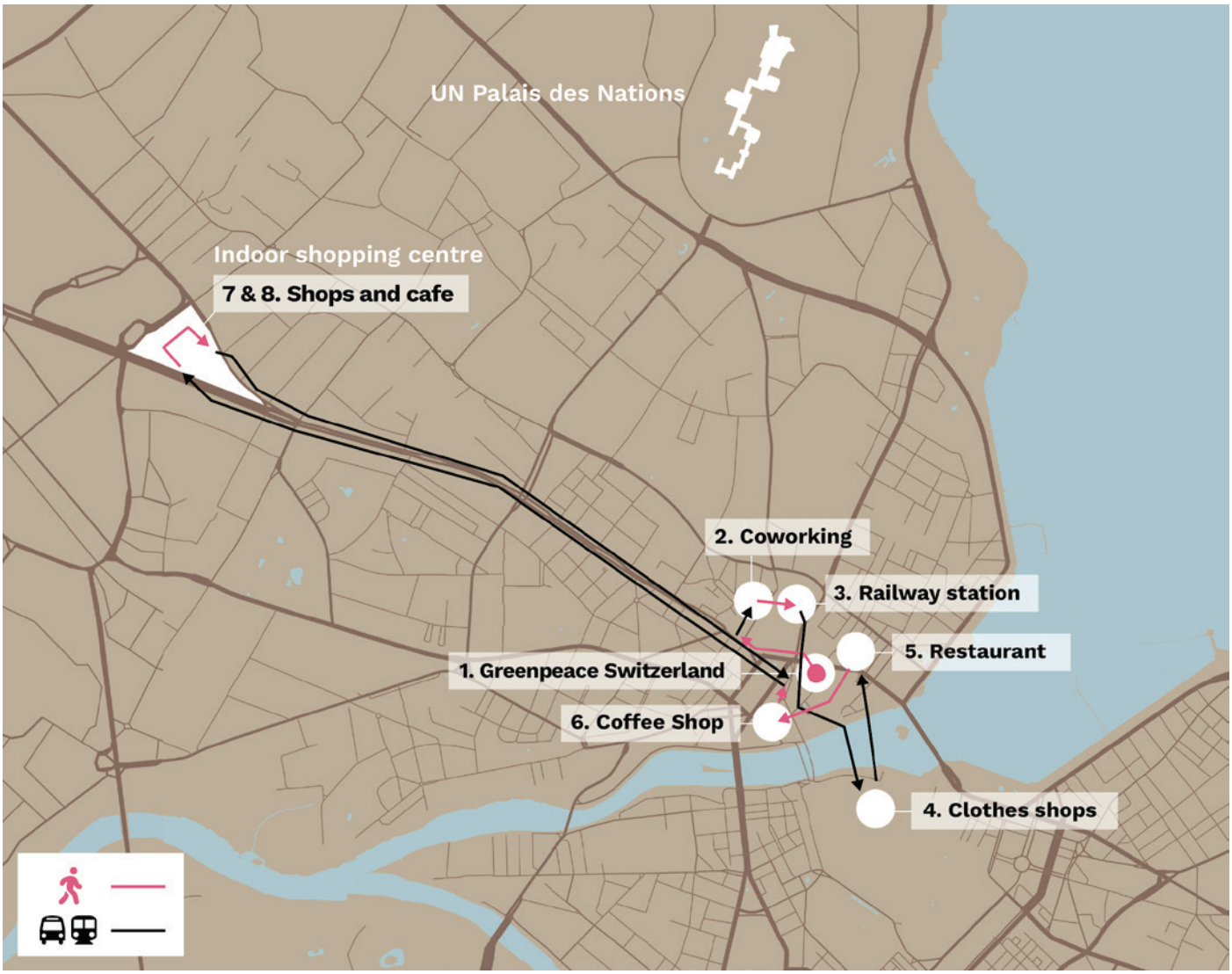
2.2 A "day in the life" - an investigation in Geneva

To investigate the extent of airborne microplastic pollution in Geneva, a Greenpeace researcher wore a PDR-1500 personal air quality monitor, modified for collecting airborne microplastics, during an 8-hour trip to Geneva on the 17th July 2025. The sampling method involved passing air at a known rate (3.5 litres per minute) through a silver filter so that airborne particles were collected.

The purpose of the sampling was to investigate the extent to which microplastic contamination is widespread, even in a city such as Geneva in Switzerland, which ranks 8th for waste management in the global Environment Performance Index,[14] and not to single out any one location as being atypical.

Sampling airborne microplastics. All Photos © Marc Meier

Figure 2. Locations in Geneva for sampling of microplastics in air.
Source map for illustration Open Street Map



The study does not aim to assess air quality at any of the locations. It illustrates the general presence of microplastics in the air.

The majority of the researcher's trip to Geneva was spent indoors, on public transport, in cafés or restaurants, shopping (supermarkets, clothes and electronics stores), and in co-working spaces (see Figure 2), where likely sources of microplastic contamination would include clothes and furnishings, packaging, plastic products, vehicle tyres and plastic infrastructure.

3 Key findings from the sample results

Following the sampling, the filters were removed from the device, and the sample was sent to the Greenpeace International Science Unit at the University of Exeter for analysis. After identifying the positions of fibres and fragments under the light microscope, individual fibres and fragments were examined using an infrared imaging system, and analysed to identify the polymers. Full details of the methodology used for checking the filters can be found in the Technical Report (Microplastic fibres and fragments in indoor and outdoor air, Geneva, Switzerland, July 2025)

The results for the numbers of synthetic fibres and fragments are shown in Figure 3, and the breakdown of the polymers found is in Table 1.

The sample shows that microplastics in the form of both fibres and fragments are present in urban air in Geneva, at quantities that are consistent with other studies, with six fragments (plus two tentative) and six fibres (plus one tentative) found in the filtered air (1.7m^3). The microplastics made up a small proportion of more than 150 particles in total, which were mainly of unidentified

Figure 3 . Quantification of synthetic fibres and fragments from the sample.

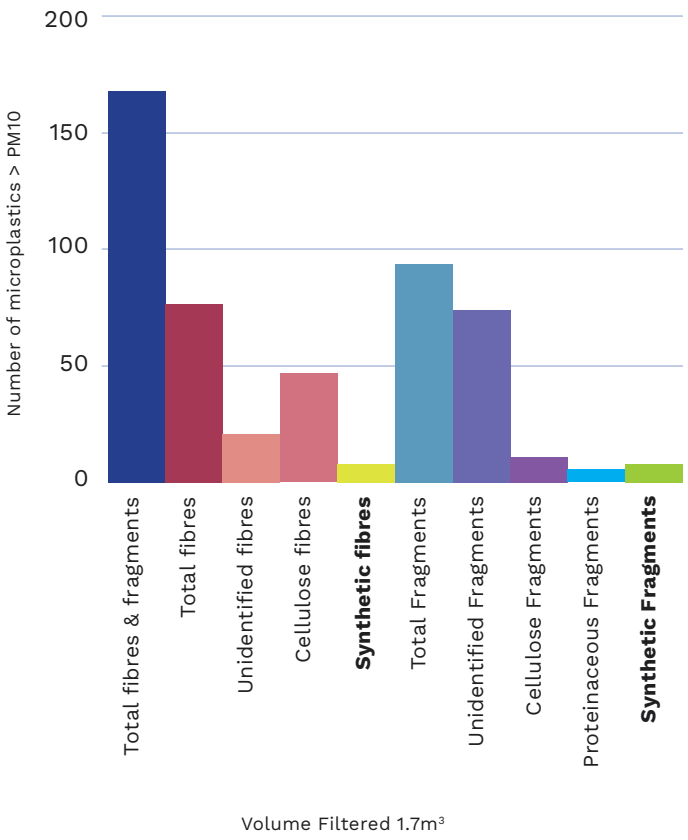
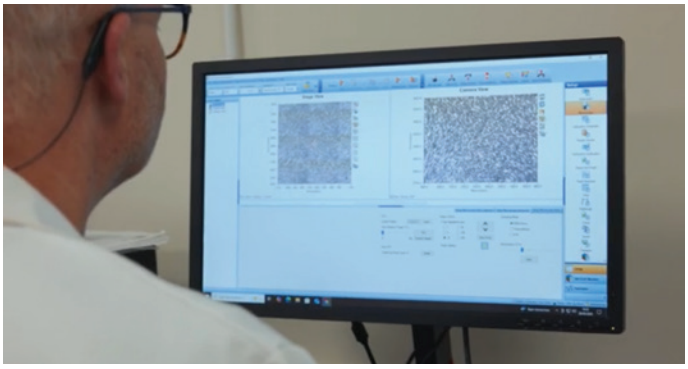


Table 1. Identification of polymer types in the synthetic fibres and fragments

Sample location
Locations throughout Geneva
Identities of synthetic fibres
4 x fibres of polyester (2 transparent, 1 blue, 1 black)
1 x pale brown fibre of nylon (PA)
1 x black fibre of another polyamide (PA)
Tentative
1 x brown fibre, methyl cellulose
Identities of synthetic fragments
1 x brown fragment of chlorosulphonated polyethylene
1 x black fragment of a vinyl ether copolymer
1 x orange fragment of chlorinated polyethylene
1 x black fragment of a vinyl acetate copolymer
1 x transparent fragment of cellulose acetate
1 x transparent fragment of polyethylene (PE)
Tentative
1 x pale blue, most likely polyacramide
1 x transparent poly vinyl alcohol

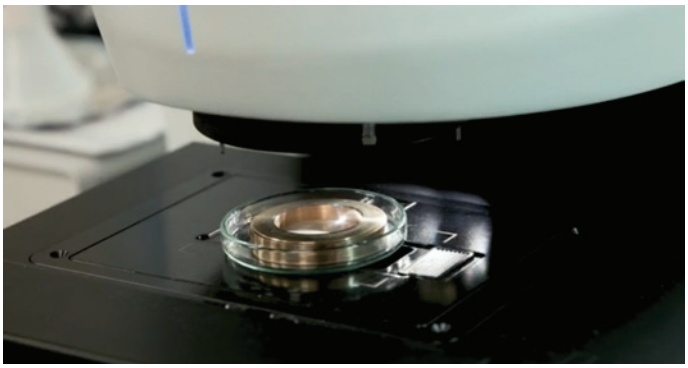
origin for the fragments, or cellulose based for the fibres (either of natural origin or modified through an industrial process). The types of polymers found in the microplastics were mainly polyester for the fibres, as well as nylon and another polyamide, all of which could have come from clothing or furnishings, while the fragments were made from a variety of polymers, with three types of polyethylene (one chlorosulphonated - a synthetic rubber, and one chlorinated, used in cables), vinyl ether copolymer, vinyl acetate copolymer and cellulose acetate. The amount of air that was sampled was 1.7 m^3. Although it varies from person to person, a typical at-rest breathing rate is 6 litres per minute.[15] Using this figure, the amount that a person breathes in during 8 hours is 2880 litres, so the total number of microplastics potentially present in that volume of air could be 1.7 times the number in our sample. However, it can't be assumed that all the microplastics in the samples would be breathed in, and some may also be breathed out. Nevertheless, this short study shows that microplastics are present in the air in Geneva at levels that are similar to other studies,[16] and that living beings including people could be breathing these in, posing a potential health risk.



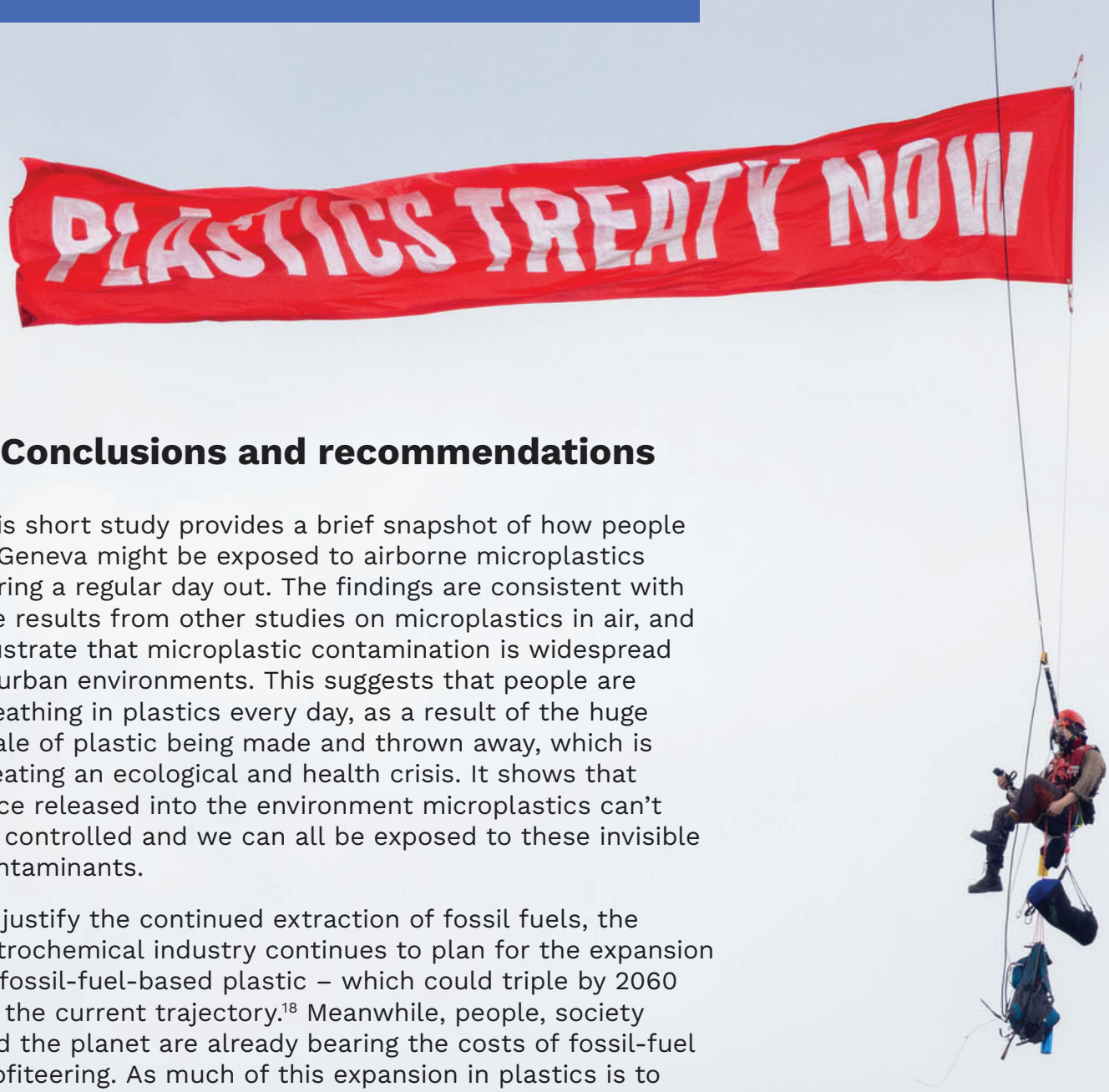
Greenpeace scientist Dr David Santillo using an infrared microscope system to locate and identify microplastics in air captured on the surface of a silver filter Photo ©Jack Taylor

In this study, we looked for microplastic fragments and fibres measuring 10 µm and above, however, it's likely that even smaller particles of microplastics and microplastic fibres could have been present in the air samples collected in Geneva. Recent studies have analysed much smaller microplastics in air of between 1 - 10 µm, and estimated that exposure could be 100-fold higher than previous estimates extrapolated from larger MP sizes, suggesting that the health implications of microplastic inhalation may be more substantial than previously thought.[17]

Greenpeace scientist Dr David Santillo examining the surface of a silver filter used to collect a sample of particles from the air, prior to analysis of the sample for the presence of microplastics using an infrared microscope system. Photo ©Jack Taylor



A silver filter, used to collect microplastics and other particles from the air, in its brass filter holder ready for analysis under the infrared microscope at the Greenpeace Research Laboratories. Photo ©Jack Taylor



Climbers Abseil from Forth Bridge in Scotland to Block INEOS Tanker in Plastics Protest © Luca Marino / Greenpeace

4 Conclusions and recommendations

This short study provides a brief snapshot of how people in Geneva might be exposed to airborne microplastics during a regular day out. The findings are consistent with the results from other studies on microplastics in air, and illustrate that microplastic contamination is widespread in urban environments. This suggests that people are breathing in plastics every day, as a result of the huge scale of plastic being made and thrown away, which is creating an ecological and health crisis. It shows that once released into the environment microplastics can't be controlled and we can all be exposed to these invisible contaminants.

To justify the continued extraction of fossil fuels, the petrochemical industry continues to plan for the expansion of fossil-fuel-based plastic – which could triple by 2060 on the current trajectory.[18] Meanwhile, people, society and the planet are already bearing the costs of fossil-fuel profiteering. As much of this expansion in plastics is to make short life items like single use plastic packaging or fast fashion, this will lead to increasing volumes of plastics and plastic waste well into the future - multiplying their devastating effects. This will be the case even with the best management plans for controlling plastic waste. And with this increase, the volume of airborne microplastic emissions will also continue to rise.

So there is no logic, justice or hope for the future in the fossil fuel lobby's goals for self-preservation. Although we may not yet know everything about the potential health impacts of breathing in plastic on a daily basis, the research so far shows that these could be serious. In contrast, the course of action to solve this problem is crystal clear: we need to slow down and drastically cut the production of plastic. This alone is more than enough to justify a strong Global Plastics Treaty, that cuts plastic production by at least 75% by 2040 to protect our health, our communities and planet.

Endnotes

1. Hannah Ritchie, Veronika Samborska, and Max Roser (2023) - "Plastic Pollution" Published online at OurWorldinData.org. Retrieved from:'https://ourworldindata.org/plastic-pollution [Online Resource]

2. Thompson Richard C. et al. (2024), Twenty years of microplastic pollution research—what have we learned?.Science386,eadl2746, 19th September 2024.https://www.science.org/doi/10.1126/science.adl2746

3. Greenpeace Switzerland (2025), Oh shit, microplastics! the presence of microplastics in the excrement of wild mammals in Switzerland; 10th June 2025; https://www.greenpeace.ch/de/publikation/120607/oh-shit-mikroplastik/

4. Thompson Richard C. et al. (2024), op.cit.

5. Jahandari, A (2023), Microplastics in the urban atmosphere: Sources, occurrences, distribution, and potential health implications, Journal of Hazardous Materials Advances, Volume 12, November 2023, 100346, ISSN 2772-4166; https://doi.org/10.1016/j.hazadv.2023.100346

6. Jahandari, A (2023), op.cit.

7. Depending on the type of plastic: the most widely used plastics are: Polypropylene (PP), Polyethylene (PE) (HIgh Density - HDPE & Low Density -LDPE), Polyethylene Terephthalate (PET), Polyvinyl Chloride (PVC), Polystyrene (PS), Polycarbonate (PC), Polyurethane (PU). See Table 2 in Greenpeace International (2025), Every Breath You Take; Air Pollution Risks from Petrochemicals Production for the Plastics Supply Chain, 22nd July 2025; http://bit.ly/3Jgx1qS

8. In addition to the bulk chemicals that make up the basic raw material for plastics, there are 16,325 known plastic chemicals, which can be persistent, bioaccumulative, mobile, and/or toxic. 3651 of these are known to be hazardous, while 10,345 have not even been assessed. Scientists Coalition for an effective Plastics Treaty, Article 3, Plastic Products: What are the benefits of regulating chemicals of concern?; https://linktr.ee/scientistscoalition

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10. Rafa N, et al., (2024), Microplastics as carriers of toxic pollutants: Source, transport, and toxicological effects, Environmental Pollution, Volume 343, February 2024, 123190, ISSN 0269-7491; https://doi.org/10.1016/j.envpol.2023.123190

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12. Facciolà, A., et. al. (2021). Newly Emerging Airborne Pollutants: Current Knowledge of Health Impact of Micro and Nanoplastics. International Journal of Environmental Research and Public Health, 18(6), 2997, 15th March 2021; https://doi.org/10.3390/ijerph18062997

13. Microplastics - major sources, bioavailability and impacts, adapted from a diagram in: Thompson Richard C. et al. (2024), op.cit.

14. Environmental Performance Index (2024), Switzerland; https://epi.yale.edu/country/2024/CHE

15. Pleil, J.D., Wallace, M.A.G., Davis, M.D. and Matty, C.M., 2021. The physics of human breathing: flow, timing, volume, and pressure parameters for normal, on-demand, and ventilator respiration. Journal of breath research, 15(4), p.042002.

16. See references in: Farrow A, Santillo D, (2025), Microplastic Fibres and Fragments in Air, Geneva, 2025, 11th August 2025, Greenpeace Research Laboratories Analytical Results 2025, https://www.greenpeace.to/greenpeace/?p=5056

17. Yakovenko N, et.al. (2025), Human exposure to PM10 microplastics in indoor air, 30th July 2025; https://doi.org/10.1371/journal.pone.0328011

18. OECD. Global Plastics Outlook: Policy Scenarios to 2060; Organisation for Economic Co-operation and Development: Paris, 2022. https://doi.org/10.1787/aa1edf33-en

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Cover picture:

A citizen researcher travels on a bus in the city of Geneva, Switzerland, wearing a sampling device measuring airborne microplastics. © Marc Meier / Greenpeace

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