



# Toxic Plastic Chemical Exposures to Plastics Treaty Stakeholders

November 2024



*Plastics and their byproducts are made of chemicals that are seriously harmful to people and the environment. They are present in every ecosystem on the planet, accumulating in food chains, contaminating water, soil, and air, and releasing hazardous substances into the environment. Most plastics derive from fossil fuels and emit greenhouse gases throughout their life cycle, exacerbating the multiple planetary crises. Each stage of the plastics life cycle from extraction through disposal, adversely impacts human rights, including the rights to health and to a clean, healthy and sustainable environment.*

*The negotiation of a new treaty on plastic pollution is a unique opportunity to advance human rights and protect our planet. We must seize this moment and deploy human rights solutions to stop the senseless destruction caused by plastic pollution.*

**Volker Türk**

**United Nations High Commissioner for Human Rights**





It takes a certain level of ambition to cultivate a seemingly impossible future, and as knowledge increases so do expectations. Participation in this study not only brought to the fore the hidden chemicals and potential threats in plastics from routine exposure but more so underscored the urgent need to catalyze the development of a purposeful global Plastics Treaty that addresses plastic pollution and reflects our collective will to amplify action to protect human health and the environment, for those among us and the generations to come.

**Ms. Keima Gardiner**  
**Waste Management Specialist**  
**Republic of Trinidad & Tobago**

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## INTRODUCTION

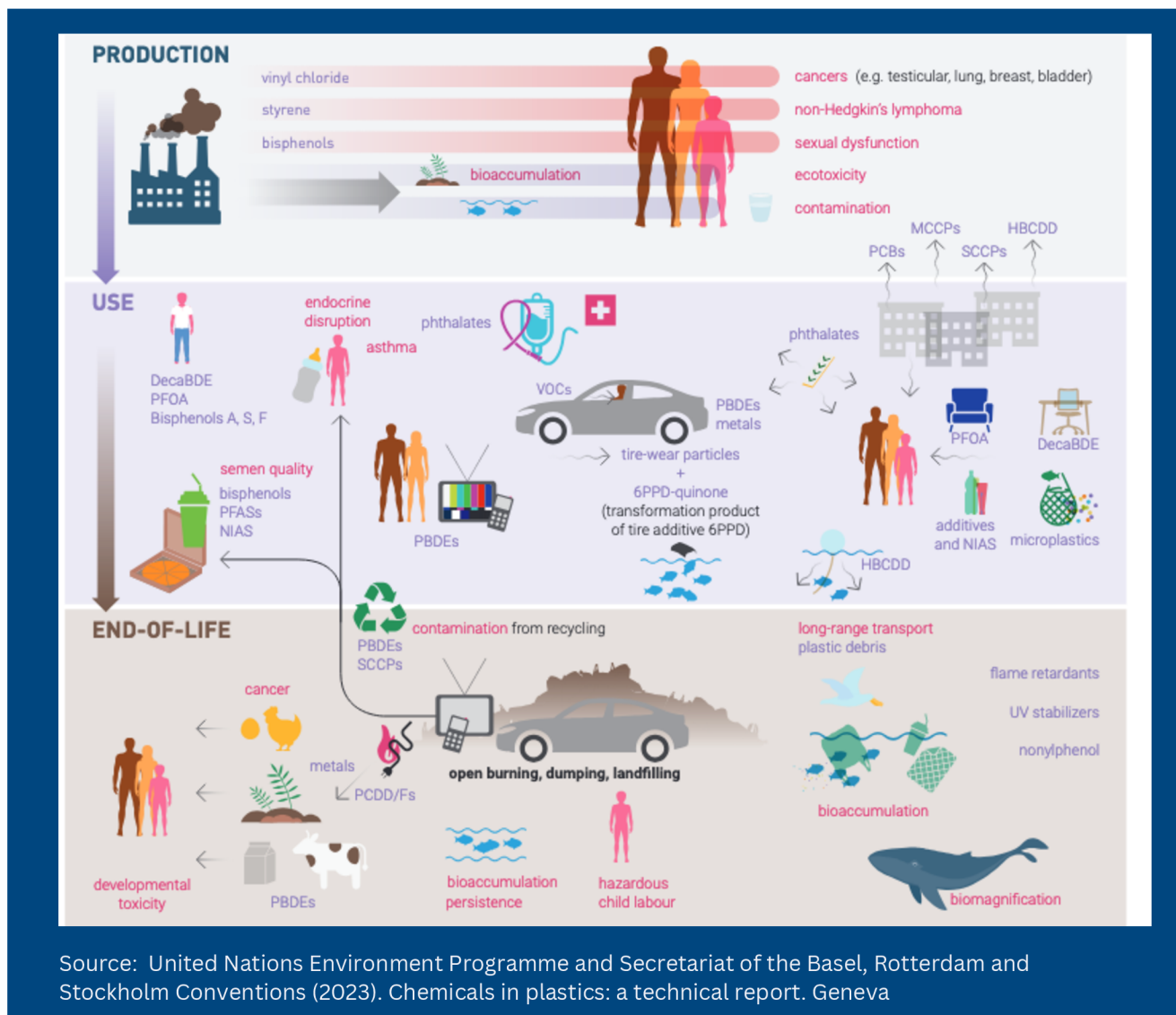
IPEN engaged UN officials and others connected to the Plastics Treaty talks to assess their exposures to toxic plastic chemicals, as a way to highlight the relevance of addressing plastic chemicals in the negotiations. All of these “global participants” work in settings without significant occupational exposure to plastics.

For five workdays, the global participants wore wristbands that capture exposure to certain hazardous environmental chemicals used in plastics. IPEN coordinated with an independent lab to test the wristbands for six types of chemical groups. **The results show that all global participants were exposed to toxic plastic chemicals from all six groups.** We also compare the results to findings from our study of plastic waste and recycling workers in Thailand.

## BACKGROUND

Plastics are mixtures of various types of chemicals, most of which are produced from fossil fuels (petrochemicals). Most plastic chemicals are not regulated, and little is publicly known about the health and environmental impacts of the majority of these chemicals. This is concerning, as it has been reported that more than 400 chemicals of concern can be present in each major plastic type, including PVC, polyurethanes, PET, polyethylene, and other types (Wagner et al., 2024). Many of these chemicals are known or suspected endocrine disrupting chemicals (EDCs) that are linked to a wide range of health impacts, even at low concentrations, including cancers, impaired brain development, metabolic disruption, and many reproductive toxic impacts leading to infertility (Gore et al., 2024).

Exposure to plastic chemicals is general, widespread, and occurs directly through many pathways including from extraction of fossil fuels, during production, use, recycling, and final disposal of plastics – in short, throughout the plastics life cycle (Hahladakis et al., 2018). We can be exposed to plastic chemicals both from direct contact with plastics and from air, food, water, dust, and other media that have been in contact with plastics.




Source: United Nations Environment Programme and Secretariat of the Basel, Rotterdam and Stockholm Conventions (2023). Chemicals in plastics: a technical report. Geneva

Some groups are especially impacted by plastic chemicals. These include communities living near fossil fuel extraction and processing sites and near areas of plastic production, recycling, and disposal. Workers in both the formal and informal sectors engaged in these activities are also at greater risk (ILO, 2023).

Some countries have started addressing certain plastic chemicals. However, the problems related to plastic chemicals are not national but global. Plastic materials, products, and wastes that enter a country have often been traded and shipped internationally, often through complex trade routes, with no transparency, traceability, or ability for consumers, waste workers, or their employers to know what plastic chemicals they contain. Therefore, new global controls are needed to protect human health and the environment from plastic chemicals. To date, less than 1% of the chemicals used in plastics are regulated under existing international multilateral environmental agreements.

Currently, governments are in a process negotiating a new international agreement on plastics. This provides a unique opportunity to address plastic chemicals, and safeguard the right to a clean, healthy, and sustainable environment, including a safe and healthy working environment.

A portrait of Ms. Elisa Morgera, a woman with dark, curly hair, wearing a black top. The background is a solid reddish-brown color. The text is overlaid on the left side of the image.

*The wristband study has been a wake-up call. I see now how much more I can do to eliminate plastic in my daily life, but I am also thinking about how much plastic is surrounding me that I didn't ask for or need.*

**Ms. Elisa Morgera**  
**Professor of Global**  
**Environmental Law, University of**  
**Strathclyde, Glasgow and United**  
**Nations Special Rapporteur on**  
**Climate Change and Human**  
**Rights**

## CHEMICAL EXPOSURES TO PLASTIC WASTE WORKERS IN THAILAND

In 2024, IPEN and its Thailand-based NGO partner EARTH conducted a study in Thailand of the exposure to plastic waste workers, plastic recyclers, and people with no occupational exposure to plastic chemicals. Each participant wore a silicone wristband that captures the semi-volatile organic compounds they were exposed to during the five days of the study. The wristbands were then analyzed in a lab to determine concentrations of six types of chemicals. The results showed that all participants were exposed to many types of chemicals, especially phthalates that are used to make plastics softer and more flexible. The study also showed that plastic waste and recycling workers were exposed to more chemicals than the office workers, with plastic recycling workers exposed to the highest number of chemicals.

## CHEMICAL EXPOSURES TO GLOBAL PARTICIPANTS

In addition to the study in Thailand, 12 individuals connected to the negotiations of a new international agreement on plastics wore wristbands during five days of their working week. This group includes UN officials and others who work in settings without significant occupational exposure to plastics and are referred to as “global participants” below. The intention is to highlight the relevance of addressing plastic chemicals in the negotiations. The individuals came from the UN groups of Asia-Pacific States, Latin America and Caribbean States, and Western European and other States.

Their wristbands were analyzed for the same six types of chemicals as in the study in Thailand.

73 chemicals belonging to six groups were included in the analysis:

- 12 phthalates: used as plasticizers in PVC plastic to make it soft and flexible and in personal care products.
- 2 other plasticizers: used as plasticizer alternatives to phthalates.
- 24 polycyclic aromatic hydrocarbons (PAHs): occur naturally in fossil fuels and are generated when coal, oil, gas, gasoline, wood, plastics, and tobacco are burned.
- 8 benzotriazole UV-stabilizers: prevents plastic from degrading when exposed to sunlight (UV light). Some may also be used in personal care products.
- 6 phenols and bisphenols: phenols occur naturally but are also manufactured for use in a wide range of applications, including in plastics production and as surfactants. Bisphenols are primarily used for producing polycarbonate plastics and in epoxy resin (a type of adhesive) production.
- 21 organophosphate flame retardants: used as replacements for brominated flame retardants, for example, in furniture, textiles, building materials, and electronics. These are also used as plasticizers.

These chemicals were selected due to their association with plastics, concerns about their health impacts, and the lack of global, legally binding instruments to address their impacts.

To facilitate readability and make the results easier to compare, rounded results are presented in the text.

## MAIN RESULTS

### 1. The global participants were exposed to a mixture of many chemicals

Each wristband of the global participants contained at least 29 chemicals, showing exposure to all six groups of chemicals. 24 out of the 73 chemicals were present in all of the wristbands, which is more than in the Thai study where 14 chemicals were present in all wristbands.

The maximum number detected in a wristband was 38 chemicals, and the median was 32.5 chemicals. This is higher than the results of the control group in Thailand, where participants worked in settings without significant occupational exposure to plastics. In the Thai control group, the median number was 26.5 chemicals per wristband.

The wristbands of the participants in Thailand who work with plastic waste and plastic recycling contained higher numbers of chemicals, with a median of 37 chemicals for the plastic recyclers, and 33.5 chemicals for the plastic waste workers.





The results reveal that my body, like those of all others in the study conducted by IPEN, contains chemicals such as phthalates. These chemicals have entered our bodies without our consent. However, every person has the right to physical integrity. Plastic polluters are invading that right by spreading chemicals that are now found everywhere on the planet. And some of these chemicals are hazardous to human and environmental health. Moreover, some people, because they live in the fencelines of plastic producing facilities or work with plastic wastes, suffer disproportionate chemical burdens on their bodies. Human rights standards offer each individual the guarantee that no one will interfere with their body without their consent. The increasing plastification of our planet by plastic polluters in each stage of the plastic cycle is setting this guarantee at naught.

**Dr. Marcos A. Orellana United Nations  
Special Rapporteur on Toxics and  
Human Rights**

## **2. Several phthalates were detected at the highest concentrations in all wristbands**

Among all the wristbands of the global participants, seven phthalates were detected (see Tab. 1), with five detected in every wristband: DEP, DiBP, DBP, BBP and DEHP. Four of these were also detected at the highest concentrations in all wristbands DEP, DiBP, DBP, and DEHP).

Compared to the concentrations detected in the wristbands of the Thai participants, the results were generally similar or lower in the global group of participants (see Table 1).

	Dimethyl phthalate (DMP)	Diethyl phthalate (DEP)	Di-isobutyl phthalate (DiBP)	Di- <i>n</i> -butyl phthalate (DBP)	Di- <i>n</i> -hexyl phthalate (DnHP)	Butyl benzyl phthalate (BBP)	Bis(2-ethylhexyl) phthalate (DEHP)
Global participants	14 (range: 6 – 190)	470 (range: 190 – 11,700)	1,900 (range: 380 – 3,300)	1,600 (range: 430 – 3,500)	29 (range: 17 – 29)	57 (range: 20 – 760)	12,300 (range: 1,100 – 61,400)
Control group	11 (range: 7 – 2,300)	1,800 (range: 140 – 9,200)	450 (range: 140 – 107,000)	2,200 (range: 750 – 24,000)	BLQ	69 (range: BLQ – 580)	8,400 (range: 3,500 – 65,000)
Plastic recyclers	30*	920 (range: 72 – 2,100)	370 (range: BLQ – 800)	2,300 (range: 460 – 8,000)	BLQ	41 (range: 7.8 – 1,547)	13,500 (range: 5,500 – 73,900)
Plastic waste workers	BLQ	1,600 (range: 79 – 10,200)	470 (range: 300 – 2,400)	3,300 (range: 1,200 – 16,000)	BLQ	110 (range: 72 – 2,200)	46,600 (range: 9,800 – 157,000)

Table 1. Median concentrations (ng/g, rounded numbers) of the seven phthalates detected in the wristbands of the global participants, compared to the concentrations of the wristbands of the participants in Thailand

BLQ = Below limit of quantification

\*only detected in one wristband

### 3. Overall, the levels of plastic chemicals were lower for global participants than Thai participants

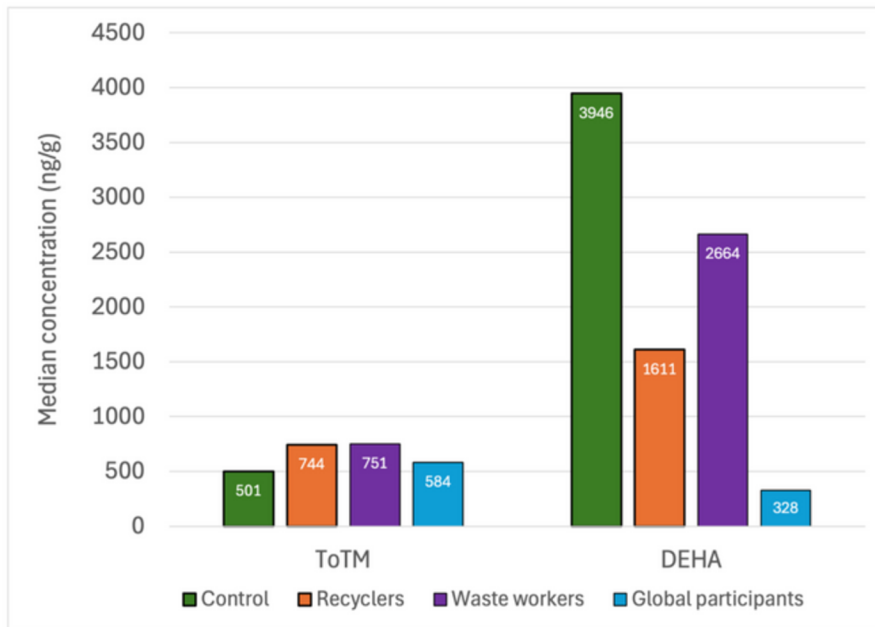
Comparing the median concentrations of the other plasticizers, total and individual PAHs concentrations, and bisphenols, the global participants had similar or lower concentrations than all the participants in Thailand (see Fig. 1 and Fig. 2).



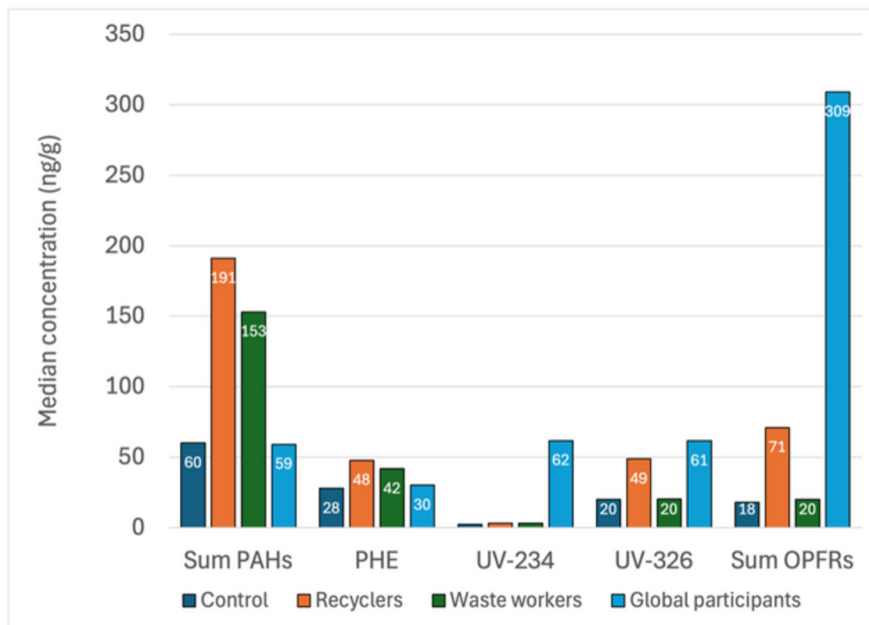
*Exposure to chemicals used in plastics that have long been regulated, like certain phthalates, is a public health concern. These chemicals are known to disrupt our bodies' natural hormones and demonstrate the urgent need for strong global protections for our health and the environment. The Plastics Treaty should be a key global agreement to protect human health and future generations.*

**Dr. Maria Neira**  
**Director, Environment, Climate Change and Health, World Health Organization**





**Figure 1.** Comparison of median concentrations of the phthalate alternative plasticizers for all participant groups.



**Figure 2.** Comparison between median concentrations for participant groups of selected other chemicals: the sum of PAHs, one individual PAH (Phenanthrene), two UV-stabilizers (UV-234 and UV-326), and the sum of organophosphate flame retardants (Sum OPFRs).

The median sum of organophosphate flame retardants (OPFRs) was higher in the global group than in Thailand. Academic studies assessing exposures to OPFRs using wristbands have shown that participants in countries where brominated flame retardants have largely been replaced instead have exposures to their replacements, the OPFRs. For example, the median level in this study was similar to levels in students in Italy (387 ng/g) and France (495 ng/g) (Wang et al., 2020).

Two chemicals from the group of benzotriazole UV-stabilizers were detected at higher concentrations for the global group than the Thai workers: UV-234 and UV-326. However, they are both used in sunscreen and skin cream, so that is a more likely source of exposure.

*All people have the right to access to information about the known and suspected health and environmental hazards, harms, and risks caused by chemicals, including additives, used in and released throughout the plastics lifecycle, but there is little transparency about these hazards and risks, so individuals are unable to make informed decisions. While we must acknowledge that the plastic crisis has disproportionate impacts on persons, groups, and Peoples in vulnerable situations, the true cost of plastic production and use is foisted on everyone.*



*In today's societies, no one can escape: plastic related chemicals are trespassing into our bodies without our knowledge or consent. Those are chemicals linked to health concerns, such as cancer and impacts on reproductive health. Increased oversight, transparency and accountability are imperative to ending efforts to suppress evidence of the harmful impacts of plastics.*

**Ms. Ana Paula Souza**  
**Human Rights Officer**  
**Office of the United Nations High Commissioner for Human Rights**

## CONCLUSION

The results from this study and the study in Thailand show that everyone was exposed to a wide range of plastic chemicals, some of which are regulated in some countries due to health concerns, such as endocrine disruption. However, no mechanism is in place today for globally controlling chemicals such as phthalates where exposure is widespread, making them an issue of global concern.

Plastic waste recyclers and plastic waste workers were exposed to a higher number and higher concentrations of some of the plastic chemicals included in the study and must be considered a group in an especially vulnerable situation.

Everyone has the right to a clean, healthy and sustainable environment, including a safe and healthy working environment. However, not even the wealthiest country has the capacity on its own to protect its people from hazardous plastic chemicals. Low and middle-income countries are the most impacted even though most are not major plastics or chemicals producers. This study shows that exposure to plastic chemicals is a global issue that requires global solutions.



I am grateful to participate in this study, as wearing the IPEN wristband confirmed that we are all exposed to toxic chemicals in plastics, even if invisible, and evidencing how marginalized groups are disproportionately affected. The results of the study are shocking and portray how recycling workers face the highest risks, exposed to chemicals linked to cancer and reproductive health issues. These chemicals invade our bodies, violating our right to a healthy environment. Industries must be held accountable for the harm caused by their products, and more robust frameworks are needed to stop and remediate this pollution. A robust Plastics Treaty is essential to ensure a clean, healthy, and sustainable environment. The cross-border nature of this pollution highlights the urgency of global action to uphold human rights everywhere.

**Ms. Astrid Puentes Riaño**  
**United Nations Special Rapporteur on the**  
**Human Right to a Clean, Healthy and**  
**Sustainable Environment**

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