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# Gender dimensions of plastic and POPs pollution in India

## Tracing impacts across the plastics value chain

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**Abstract**
This report investigates the gendered impacts of plastic and Persistent Organic Pollutants (POPs) pollution across the plastics lifecycle in India. It highlights how women, particularly those from marginalized communities, are disproportionately affected by plastic and chemical exposures due to both biological and socio-economic factors. From production to consumption and waste management, gendered labor roles and societal expectations result in unequal exposure to hazardous substances, including endocrine-disrupting chemicals and microplastics. The report synthesizes evidence on health risks such as reproductive disorders, cancer, and transgenerational impacts, and emphasizes the vulnerability of women during hormonally active life stages. It also examines policy gaps, noting the absence of gender-sensitive frameworks in India's plastic and chemical regulations. Drawing on international policy developments, the report advocates gender mainstreaming in environmental governance and offers actionable recommendations to improve occupational health, enhance data collection, and promote inclusive decision-making. By centering gender in the discourse on plastic and POPs pollution, the report aims to support equitable and effective responses to environmental health challenges in India.

**Keywords:** Plastic pollution, POPs pollution, India, gender, policies
**Emneord:** plastforurensning, POPs forurensning, India, kjønn, policier

[1] * The first two lead authors contributed equally to the report

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# Preface

The insights presented in this report are intended to inform policymakers, researchers, civil society actors, businesses, and all other stakeholders engaged in issues related to the plastics value chain in India.

We hope that this report, developed under the INOPOL project and funded by the Royal Norwegian Embassy in New Delhi (IND-3025, IND-22/0004), serves as a valuable resource for those committed to addressing plastic and POPs pollution and promoting a safe, inclusive, and sustainable plastics value chain in India.

Sara Noémie Plassnig from NIVA and Avanti Roy-Basu from Mu Gamma Consultants were primarily responsible for writing the report and contributed equally to its production. The other authors contributed to specific sections, revisions, and editorial support. Dr. Hans Adam is the main project leader of INOPOL at NIVA.

We would like to thank Rachel Karasik for her thorough review and constructive feedback, and Sissel Brit Ranneklev for her valuable comments on the POPs section.

Oslo, 30.09.2025

Norway

INOPOL

**Disclaimer**

This report examines how exposure of chemicals linked to plastics affects individuals with female and male bodies differently. When using “women” and “female”, we refer—unless otherwise specified—to individuals who are assigned female at birth (UW Medicine, 2025). Due to the current lack of data on transgender and intersex people in India, the primary focus of this report is on women. We acknowledge this research gap and emphasize that our use of terms like women, men, female, and male does not imply assumptions about individuals’ gender identities, nor does it impose normative views on bodies.

# Summary

This report explores how plastic and Persistent Organic Pollutants (POPs) pollution in India affects women and men differently, with a particular focus on the disproportionate impacts on women. It traces gendered risks across the entire plastics lifecycle—from production and consumption to waste management and recycling—and highlights how biological, social, and economic factors shape exposure and vulnerability.

Women are more likely to be exposed to harmful chemicals due to their roles in plastic manufacturing, informal waste work, and consumption of gender-targeted products such as cosmetics and cleaning agents. The report documents health risks including reproductive disorders, cancer and transgenerational impacts and emphasizes the lack of gender-sensitive protections in Indian policy frameworks.

It also reviews international efforts to mainstream gender in environmental governance, such as the Stockholm Convention and the Global Plastics Treaty negotiations. The report concludes with actionable recommendations for gender-sensitive policy development, occupational health standards, inclusive decision-making, and gender-segregated data collection.

We propose that, by integrating gender perspectives into plastic and POPs management, India can better protect vulnerable populations and contribute to global sustainability and equity goals.

# Sammendrag

Denne rapporten undersøker hvordan forurensning fra plast og persistente organiske miljøgifter (POPs) i India påvirker kvinner og menn ulikt, med særlig fokus på de uforholdsmessige konsekvensene for kvinner. Rapporten retter søkelyset mot kjønnsrelaterte risikoer gjennom hele plastens livssyklus – fra produksjon og forbruk til avfallshåndtering og gjenvinning – og belyser hvordan biologiske, sosiale og økonomiske faktorer påvirker eksponering og sårbarhet.

Kvinner er mer utsatt for skadelige kjemikalier på grunn av deres roller i plastproduksjon, uformelt avfallsarbeid og forbruk av kjønnsrettede produkter som kosmetikk og rengjøringsmidler. Rapporten dokumenterer kjente helserisikoer for kvinner i India, inkludert reproduksjonsforstyrrelser, kreft og konsekvenser på tvers av generasjoner, og understreker mangelen på kjønnssensitive beskyttelsestiltak i indiske politiske rammeverk.

I rapporten gjennomgås også tiltak for å integrere kjønnsperspektiver i internasjonale miljøavtaler, som Stockholmkonvensjonen og forhandlingene om den globale plastavtalen. Rapporten avsluttes med konkrete anbefalinger for kjønnssensitiv politikkutvikling, arbeidsmiljøstandarder, inkluderende beslutningstaking og kjønnssegregerte datainnsamlinger.

Vi foreslår at, ved å integrere kjønnsperspektivet i plast- og POPs-forvaltningen kan India bedre beskytte sårbare befolkningsgrupper og bidra til globale mål for bærekraft og rettferdighet.

# 1 Introduction

The current unsustainable trajectory of the plastic lifecycle (production-manufacturing-consumption-waste management-recycling) is a highly prioritized global environmental concern. This is largely due to the presence of intentionally and non-intentionally added chemicals (Food Packaging Forum, 2018), such as persistent organic pollutants (POPs) that adversely impact human and environmental health, as well as the inequitable distribution of these impacts on vulnerable groups in society. This report synthesizes gendered health impacts and risks associated with the plastic lifecycle in India, focusing particularly on the effects on women[2].

In less than 70 years, plastics production has increased 230-fold, from 2 million tonnes (Mt) in 1950 to 460 Mt in 2019 (OECD, 2022). Geographically, Asia has emerged as one of the largest plastic production and consumption areas of the world (Liu, 2018). China is by far the largest plastic producer and accounts for almost half of all global production. Asian plastic resin production is at about 82 Mt, more than half of it produced by China. At the same time, however, North America with 195 kg per year, followed by Europe with 187 kg, consumes most plastic products (Pottinger et al., 2024). India is the second largest regional resin producer in Asia, with a share of 14 Mt (Liang et al, 2021). While plastic was introduced in India in the 1950s, it was not before the 1990s that the material experienced a sharp increase in production, due to liberalization of the Indian market (Pathak & Nichter, 2021). As of today, India's plastic market comprises about 4 million employees and over 20,000 processing units (Jaganmohan, 2024). Though India's per capita consumption of plastic products is still among the lowest (Mehta et al., 2021a; Swarnakar, 2019), India counts as one of the biggest polluters of post-consumer plastics as of today, due to the country's large population combined with its poor waste management system (Cottom et al., 2024; Nøklebye et al., 2025).

The risks associated with the plastic value chain have gender-specific dimensions, for example when it comes to health impacts (Lynn et al., 2017). Women and men are affected differently by hazards due to biological and physiological differences including body size, fat distribution, reproductive systems, hormone levels, and cardiovascular function. These differences can influence how toxic substances are absorbed, processed, and eliminated by the body (Messing et al., 2003). In addition to biologically determined factors, women are exposed differently than men to these substances due to social and cultural contexts (Dixon et al, 2023; Lynn et al., 2017).

In a country that has been ranked 131st out of 148 countries evaluated in the Gender Gap Index in 2025, women face distinct challenges in society overall as well as their occupational life (The Hindu, 2025). For instance, as reported by the UN India Business Forum, over half of the work performed by women in India is unpaid domestic work and predominantly informal. Additionally, many women are excluded from the formal financial system—nearly 50% lack access to banking services or savings accounts, and 60% do not own any significant assets (Krishnan & Backer, 2019). The Indian plastic value chain is no exception to this trend, where occupational opportunities and associated risks are highly gendered.

The plastic manufacturing industry often features gender-segregated roles, each associated with distinct occupational hazards (Dixon et al., 2023). Women are typically employed in assembly line positions, where they may experience prolonged exposure to plastic additives and other chemicals. In contrast, men are

[2] *See disclaimer (page 4): This report examines how exposure of chemicals linked to plastics affects individuals with female and male bodies differently. When using "women," we refer—unless otherwise specified—to individuals who are assigned female at birth (UW Medicine, 2025). Due to the current lack of data on transgender and intersex people in India, the primary focus of this report is on women. We acknowledge this research gap and emphasize that our use of terms like women, men, female, and male does not imply assumptions about individuals' gender identities, nor does it impose normative views on bodies.*

more commonly assigned to roles involving heavy machinery operation, maintenance, and management, which expose them to different chemical risks and physical hazards (Lynn et al., 2017; Dixon et al., 2023). At the end of the plastic value chain, waste pickers face the highest health risks associated with emissions of hazardous substances within informal waste work, for example from the burning of plastic waste. They are collecting plastic from public areas, roadsides or from dumpsites without any safety measures in place. The majority of informal waste pickers globally and in India are women, while men tend to occupy more formalized and less precarious positions in the waste economy (Krishnan and Backer 2019). The deprived situation of female waste pickers also increases the risk of being exposed to harassment or sexual violence when picking or disposing waste in remote locations (Sinha & Chaturvedi, 2022). At home, women face additional risks from hazardous substances released during incineration of household waste that include plastics, as they are often responsible for domestic labor, such as disposing trash (Landrigan et al. 2023). Women living near industrial areas, contaminated sites, or sites with poor waste management are especially vulnerable to environmental pollutants due to their increased presence in these areas (Caterbow & Hausmann, 2016; Lynn et al., 2017). Studies have detected harmful substances in breast milk samples from breastfeeding women residing close to open dumping sites in Chennai and Kolkata, India (Someya et al., 2010). Women are further exposed to chemicals at home, as they are more likely to consume certain products that include POPs – such as cleaning supplies and cosmetics (Rumph et al., 2022) – to fulfill societal expectations linked to gendered occupational tasks, household chores and beauty standards (Dixon et al, 2023).

Despite evidence of disproportionate impacts of the plastic value chain on women, the Government of India has not introduced any recent revisions to protective measures for working women's health, raising concerns about the need for further action (Sahu & Behera, 2023). Understanding and being responsive to the intersecting issues of plastics and POPs affecting women is crucial for developing equitable and effective policies to address the environmental and health challenges posed by these materials. This report aims to foster a better understanding on how risks associated with the plastic lifecycle disproportionately affect women in India and concludes with recommendations for action towards a gender-sensitive management of plastics and POPs pollution.

# 2 Background: Impacts of plastic-additives, micropollutants and Persistent Organic Pollutants (POPs) pollution on women

As a result of rapid industrialization, a vast range of chemicals are produced and released into the environment every day, affecting people of all ages, gender, racial ethnicity, culture, and socioeconomic status. Exposure to environmental toxicants (Abbasi et al, 2022), including chemicals added to plastics products, persistent organic pollutants (POPs), and microplastics, negatively impacts human health, in particular women's and children's health (Tran & Miyake, 2019). On a daily basis, women encounter around 160 chemicals from cleaning supplies, cosmetics, menstrual hygiene products, and other products (Environmental Working Group, 2004). Women and men are affected differently by these hazards due to biological and physiological differences including body size, fat distribution, reproductive systems, hormone levels, and cardiovascular function. These differences can influence how toxic substances are absorbed, processed, and eliminated by the body (Messing et al., 2003). Since women typically have a higher percentage of body fat, lipophilic (fat-soluble) POPs are more likely to accumulate in their body. At the various development stages of women and girl's reproductive system, such as puberty, menstruation, pregnancy, nursing and menopause, they can also become more vulnerable to exposure and hazards of chemicals. Each stage has a direct relationship between hormones and how the body responds to

chemicals. Scientific evidence shows that hazardous chemicals that are hormone disruptors can put women at a higher risk of infertility, uterine fibroids, miscarriage, shortened lactation, and breast cancer (Lynn et al., 2017). This means that not only are women more likely to be exposed to some harmful chemicals at higher levels (than men) due to their work and products they use, but also that they experience different health effects from such exposure.

Socially determined factors such as education, income levels, connected life choices (e.g., food, lifestyle), and age as well as health conditions often dictate women's work and lifestyles. Women from disadvantaged backgrounds in India are more likely to take up unregulated work and are less involved in the decision making around work practices and their environments. As a result, they are exposed to toxic chemicals in the workplace, from products used daily, and through food, air, soil and water they get in contact with. Exposure to harmful substances, however, is not solely dependent on the socioeconomic background of women in India. Indeed, women from middle- and high-income families are also subjected to chemical exposure, mostly due to the lifestyle choices they make in terms of household and personal care products (Rumph et al., 2022). Despite disproportionate impacts of chemicals on women's lives, the fundamental health science research on the effects of chemicals, especially pertaining to women of all ages, remains inadequate (Lynn et al., 2017). This section describes environmental toxicants such as POPs and other plastic-additives as well as microplastics, focusing on what POPs are and how they can impact human health. The section further outlines how human exposure to these substances intersects with gender.

## 2.1 POPs: Sources, pathways and health impacts

Persistent Organic Pollutants (POPs) are toxic chemicals commonly added to plastic products, for instance to make them heat resistant, which can adversely affect the health of humans, animals, and the environment (Yadav, Devi, Li, & Zhang, 2019; Tran & Miyake, 2019). POPs are characterized by their resistance to degradation and persistence in the environment, potential for long-range transport and ability to bioaccumulate through the food web (Sharma, Kaur & Deep, 2023; Gaur & Narasimhulu, 2018). Due to these properties, POPs are commonly found in all environmental matrices, from air to water, soil and sediments, where they persist for long periods of time.

POPs encompass a wide variety of industrial chemicals, pesticides, and by-products. Examples of POPs include industrial chemicals like polychlorinated biphenyls (PCBs), a group of more than 200 related structures of chlorine substituents on biphenyl rings that are heat and fire resistance; organochlorine pesticides (OCPs) with long lasting effects on insect pests, such as hexachlorobenzene or dichlorodiphenyltrichloroethane (DDT); per- and polyfluoroalkyl substances (PFAS), including perfluorooctanoic acid (PFOA), or perfluorooctanesulfonic acid (PFOS); polycyclic aromatic hydrocarbons (PAHs) (Tran & Miyake, 2019; Miniero, R. & Iamiceli, A.L., 2008); polybrominated diphenyl ethers (PBDEs); endocrine disrupting chemicals (EDCs)[3] (Miyagawa et al, 2016) and Phthalates[4] (Liao et al. 2018). Several of these substances are prohibited by the Stockholm Convention, including PCBs, OCPs, and polybrominated diphenyl ethers (PBDEs) (Secretariat of the Stockholm Convention (SSC), 2023).

[3] *Some chemicals that are more harmful environmental contaminants are grouped into endocrine-disrupting chemicals (EDCs). EDCs are pollutants that are defined by the Environmental Protection Agency (EPA) as "Exogenous agents that interfere with the synthesis, secretion, transport, metabolism, binding action, or elimination of natural blood-borne hormones that are present in the body and are responsible for homeostasis, reproduction and developmental processes" (Colborn et al., 1993).*

[4] *Phthalates are chemicals often added to plastics to make them softer and more flexible. For example, di-2-ethylhexyl phthalate (DEHP) is used in medical equipment and toys, di-n-butyl phthalate (DnBP) in food packaging, and diethyl phthalates (DEP) in personal care products (Huang et al., 2015; Koch & Calafat, 2009).*

Several persistent organic pollutants (POPs) are commonly used in plastic products, including polychlorinated naphthalenes (PCNs), short-chain chlorinated paraffins (SCCPs), decabromodiphenyl ether (deca-BDE), and hexabromocyclododecane (HBCDD). PCNs have served as insulating coatings for electrical wires and as additives in rubber and plastics; although their intentional production is believed to have ceased, they can still be unintentionally generated during high-temperature industrial processes. SCCPs are used as plasticizers in rubber, paints, adhesives, and as flame retardants in plastics, but their global production has declined due to stricter regulations. Deca-BDE is widely used as an additive flame retardant in plastics, polymers, textiles, and is commonly found in products such as computer and TV housings, wires, cables, pipes, and carpets. HBCDD, a white solid substance, has been used as a flame-retardant additive in polystyrene materials since the 1980s, particularly for safety in articles, vehicles, and buildings. While there is no specific information on the use, production, or stockpiles of PCNs, SCCPs, and deca-BDE in India, PCNs are banned in printing inks for food packaging, and both Indian and EU regulations restrict the use of deca-BDE in new electrical and electronic equipment (INOPOL, 2021).

Elevated concentrations of POPs have been detected in soil, water, air and sediment samples from all around the world, not only in particularly polluted environments (Vasseghian et al, 2021). For example, PCBs, dioxins, and organochlorine pesticides were detected from low to alarming levels in surface water and groundwater worldwide, with India counting as one of the most polluted countries (Vasseghian et al, 2021). PFAs have been found in multiple Indian rivers, including the Ganges, Noyyal, and Cooum, and in groundwater that is used for drinking and agricultural irrigation (Roy-Basu et al, 2025). From these environmental sources, POPs accumulate in the food chain (Guo et al, 2019), and have been detected in human biological samples, such as blood and breast milk (Tran & Miyake, 2019).

Consumption of contaminated food is one of the most significant exposure pathways for POPs for humans, as they can build up in food chains (Gaur & Narasimhulu, 2018) due to their lipophilic characteristics (Barot & Kumar, 2021) and because they are resistant to being metabolized or excreted. Certain food products tend to be more contaminated by POPs because of their fat content, position in the food chain, exposure to contaminated environments, and the agricultural practices used. Foods rich in fat—such as fish, meat, eggs, and dairy products—tend to have higher levels of POPs (Shelke, 2024) compared to leaner foods like fruits, vegetables, and grains. This is particularly concerning for fish and shellfish species, as the aquatic environment can be a significant source of contamination. POP-contaminated water and sediments, as well as bioaccumulation[5] through the food chain will result in higher levels of contamination, especially in aquatic mammals (Barot & Kumar, 2021).

In addition to environmental contamination, microplastics represent an important vector for human POPs exposure. When plastic products degrade in the environment, they disintegrate into microplastics – particles ranging from 1µm to 5mm in size (Horton et al., 2017) – which can transport POPs into both ecosystems and human bodies (Bakir, Rowland & Thompson, 2014). These tiny plastic particles seem to have reached every corner of this planet: from the deepest point in sea (Peng et al., 2018), to the highest mountain peaks (Napper, 2020), and even the human placenta (Ragusa, 2021). Microplastics are increasingly recognized as a threat to human health, and they can enter the body through skin absorption, inhalation, and ingestion (Cox et al., 2019). Animal studies have shown that microbeads can pass from the gastrointestinal tract to the lymphatic and circulatory systems, and even cross from the placenta to a

[5] *Bioaccumulation is the process where harmful substances build up in the bodies of aquatic animals over time. This can happen when these animals absorb pollutants from the water, food, or tiny particles in their environment (Wang and Fisher, 1999) faster than they can get rid of them. As a result, the concentration of pollutants in their bodies becomes higher than in the surrounding environment (Markich et al., 2001). Understanding how bioaccumulation works is important because it helps us protect people and wildlife from the negative effects of pollution.*

fetus, causing a range of biological reactions that may be detrimental to human (and animal) health (Lynn et al, 2017).

Microplastics can also, either directly or indirectly, contaminate the food chain by leaking potentially hazardous chemicals, including POPs, into food products and enter the body through consumption. Microplastics enter the food chain during the different stages of food preparation, processing, and packaging. For example, plastic particles can be released from containers and utensils during food preparation or heating. Studies have shown that microwave or oven heating can cause plastic particles to detach from food container surfaces (Marazuela et al. 2022). Microplastics have so far been detected in drinking water (Vega-Herrera et al. 2022), tea (Foetisch et al. 2022), milk (Kutralam-Muniasamy et al. 2020), sugar, salt, and a variety of animal and plant-based foods. Animal products like fish, poultry, and other seafood are particularly prone to contamination, as these animals often ingest microplastics from their environment (Cox et al., 2019).

Human exposure to environmental toxicants, including chemicals added to plastic products such as POPs, and microplastics, have been linked to increased birth defects, immunological and reproductive dysfunction (Miyagawa et al, 2016) including infertility, as well as development issues such as brain and nervous system conditions (Tran & Miyake, 2019) such as autism, poor motor skills and aggression, especially in children (Landrigan et al. 2023). Exposure to these pollutants can further increase the risk for chronic diseases, such as cancer, diabetes, and obesity (Tran & Miyake, 2019). Studies have also shown a connection between inhalation of small particles and allergic reactions (including asthma), certain types of cancer, and cardiovascular disease (Caterbow & Hausmann, 2016 & Lynn et al., 2017).

Both POPs and microplastics pose risks to all populations, but pregnant women, infants, and children are particularly vulnerable, due to a combination of biological and societal factors. In women, ingestion of microplastics has been linked to increased risk of miscarriage, obesity, cardiovascular disease, and cancer (Caterbow & Hausmann, 2016 & Lynn et al., 2017). Infants and children are particularly vulnerable to microplastics due to their smaller body size, and increased exposure through products like baby food containers, bottles, and toys that are made from plastic materials and found to have POPs (Lynn et al., 2017). Given that infants consume a higher volume of liquids and food relative to their body weight, their exposure to microplastics and POPs from packaging or contaminated water may be proportionally higher than that of adults (Li et al., 2023; Mišľanová et al.; 2024, Sharma et al., 2023). The combined persistence, mobility, and bioaccumulative nature of POPs, coupled with the pervasive distribution of microplastics, underscores the urgency of addressing these pollutants as a public health priority.

## 2.2 Intersection of gender and POPs exposure

As briefly mentioned in the previous chapters, women and men are affected differently by health hazards due to biological and physiological differences including body size, fat distribution, reproductive systems, hormone levels, and cardiovascular function. These differences can influence how toxic substances are absorbed, processed, and eliminated by the body (Messing et al., 2003). Women are particularly vulnerable during hormonally active phases including puberty, menstruation, pregnancy, lactation, and menopause (Lynn et al., 2017). In addition to these biological determinants of health, women are more likely to consume certain products that might expose them to POPs such as cleaning supplies and cosmetics (Rumph et al., 2022) to fulfill societal expectations linked to gendered occupational tasks, household chores and beauty standards (Lynn et al., 2017). Vulnerable groups including women living in or near industrial zones, contaminated sites, or regions with poor waste management have a higher likelihood of getting exposed to these contaminants due to their higher prevalence in their surroundings (Caterbow & Hausmann, 2016; Lynn et al., 2017). Furans, dioxins, PCBs, and organochlorine insecticides

have been found in breast milk samples from nursing mothers living close to open dumping sites in Chennai and Kolkata, India (Someya et al, 2010).

Maternal transfer is a pathway of exposure wherein POPs can be passed from pregnant women to developing fetuses via the placenta, and from nursing mothers to their infants through breast milk (Tran & Miyake, 2019; Shelke, 2024). If POPs accumulate in the body of a pregnant woman, they can even reach the un- or newborn child (Tran & Miyake, 2019; Shelke, 2024). This is concerning as children have a lower body weight and are still under development (Smithers, 2023). POPs can bypass the placenta or pass through breast milk and have been detected in human biological samples, such as blood and breast milk (Tran & Miyake, 2019). In India, elevated PFAS levels have been found in the breast milk of women in Chidambaram and Chennai that exceeded the limit set at that time by the US national drinking water health advisory (Roy-Basu et al, 2025; Tao et al., 2008).

# 3 Gender dimensions within the plastics lifecycle in India

The entire value chain and lifecycle of plastics and persistent organic pollutants (POPs) intersect with gender issues in multiple and complex ways, from production to consumption and end-of-life management. The subsequent sections briefly describe gender dimensions in the plastic production, consumption and waste management phases.

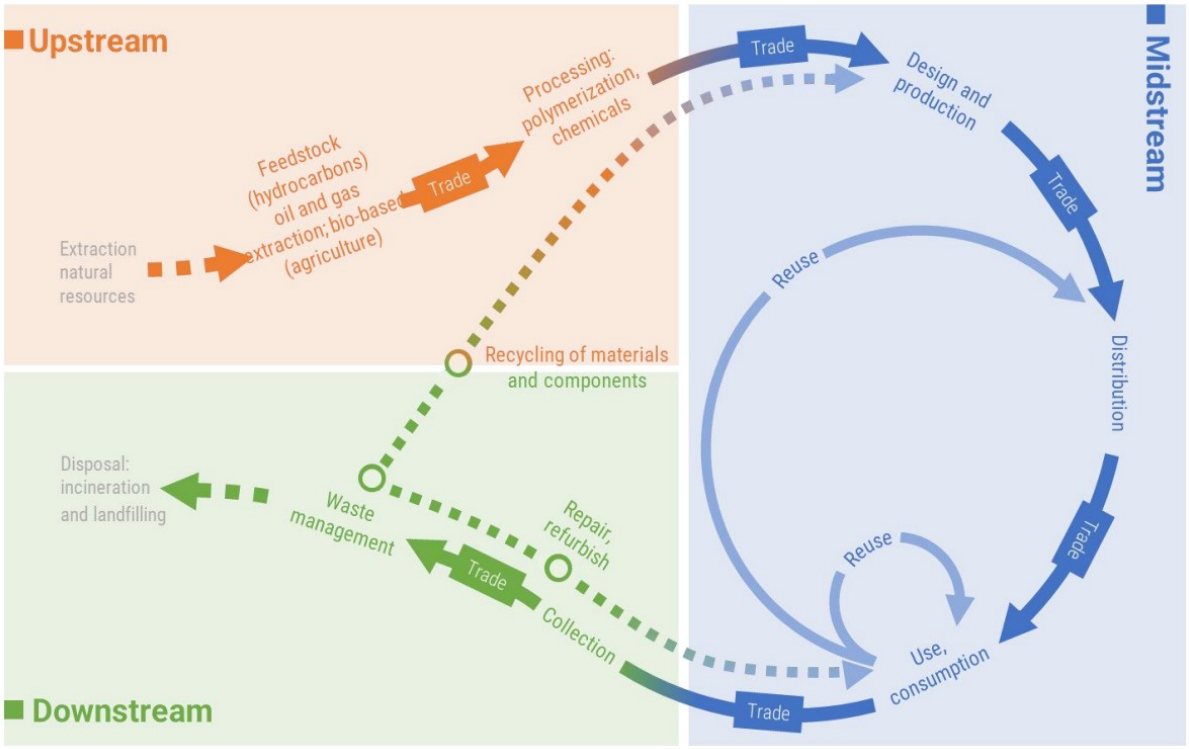


*Figure 1: Illustration of the life cycle of plastic (UNEP, 2022)*

Gender segregation in the labor market remains common, contributing significantly to inequalities in salary, working conditions, and the types of roles occupied by men and women. Across all sectors, power dynamics are shaped by socially determined factors such as gender, social status, education and occupational roles, which in turn influence both financial rewards and health outcomes. Historically,

women's responsibilities in taking care of children and the household have often led them into part-time, insecure, unregulated, low-paid and potentially hazardous employment, and they tend to be less involved when it comes to making decisions about practices at work (Lynn et al., 2017). India has a low female workforce participation rate, primarily due to women being expected to fulfill care giving activities at home and not getting the opportunity to pursue a higher education (Sahu & Behera, 2023). Meanwhile, traditional perceptions of male strength and masculinity frequently result in men being placed in more authoritative and managerial positions. Due to a lack of agency, women's health can be disproportionately affected by toxic exposure at work (Lynn et al., 2017).

Women who work in industries where plastics are manufactured, used, or handled, are at an increased risk of occupational exposure. These include women working at manufacturing facilities, waste management sites or e-waste dismantling facilities as well as informal waste pickers, sorters and handlers (Lynn et al., 2017). The health impacts of chemical additives being released throughout the plastic value chain have gender-specific dimensions. For example, chemicals used in plastics production, such as Bisphenol A (BPA) and phthalates, are known endocrine disruptors that can affect reproductive health (Lynn et al., 2017). Nonetheless, the Government of India has not taken significant measures to protect working women from these exposures (Sahu & Behera, 2023).

## 3.1 Occupational hazards in plastic production and their gendered impacts

India is the second largest resin producer on the Asian continent (Liang et al, 2021), counting over 4 million people working in more than 20,000 plastic processing units (Jaganmohan, 2024). While the number of female workers in the Indian plastic sector is unknown, the negative health effects of plastic-added chemicals on women are well documented, especially in countries situated in the Global North (Dixon et al., 2023).

The plastic manufacturing industry typically involves gender segregated jobs with differing occupational hazards (Dixon et al., 2023). Female workers are generally given roles in assembly line positions where they may face prolonged exposure to plastic additives and other chemicals; while men typically occupy roles in heavy machinery operation, maintenance and management, where they may encounter different types of chemical exposures and other occupational hazards (Lynn et al., 2017; Dixon et al., 2023).

However, gender disaggregated data on workers in the plastic industry, and their exposure to hazardous chemicals and resulting health effects is very limited. As such, there is no information on the proportion of women and men working in the plastic industry in India available (Federation, 2011). This lack of data makes it difficult to understand the full extent of chemical exposure and health impacts across various occupation activities in sectors ranging from plastic production to plastic waste management (i.e. recycling, incineration) (Lynn et al., 2017).

This is however what research so far has shown: During the production of plastics, workers are often exposed to hazardous chemicals and other additives that can be harmful, including known carcinogens as well as harmful airborne dust. These exposures are linked to serious health outcomes, including disease, traumatic injuries and premature death. According to the Minderoo-Monaco Commission (MMC), an estimated 32,000 premature deaths occurred in 2015 among the world's 107 million plastic production workers, resulting in welfare costs of approximately $40 million (Landrigan et al., 2023).

It is further documented that female workers' health and safety are significantly impacted by exposure to plastics at various stages of its lifecycle. Overall, research has identified 1,3-butadiene, acrylonitrile,

benzene, Bisphenol A (BPA), flame retardants, phthalates, styrene, and vinyl chloride as chemicals of concern for women working in the plastics industry (Engel & Rasanayagam 2015; Shen et al., 2022). These substances are known to disrupt endocrine systems, and cumulative long-term exposure to these harmful chemicals associated with plastics can lead to chronic health issues such as hormonal imbalances and cancer, including breast cancer (Lynn et al., 2017).

One major concern is related to the exposure to BPA, one of the most widely used and studied endocrine disrupting chemicals that are commonly found in everyday plastics. The female reproductive system, particularly the menstrual cycle and fertility, is highly sensitive to hormonal imbalances. Disruptions in endocrine function caused by BPA exposure—especially during critical life stages—can lead to adverse effects on female reproductive health, including menstrual irregularities, impaired fertility, Polycystic Ovary Syndrome (PCOS), recurrent miscarriages and endometriosis. Moreover, exposure early in life may not only affect adult health but could also have transgenerational impacts, potentially influencing the health of future generations (Kawa et al., 2021). Studies have also linked BPA to a range of other health issues, such as increased risks of diabetes, obesity, heart disease, birth defects, early puberty, and elevated liver enzyme levels (Caporossi and Papaleo, 2015).

However, health conditions associated with hazardous plastic additives are often only detected years after exposure, meaning they are frequently excluded from health statistics and global burden of disease estimates (Lynn et al., 2017). While some well-known chemical additives with harmful effects are regulated in certain high-income countries, thousands of substances with unknown toxicological profiles remain unregulated (Zimmermann et al., 2019). Moreover, most of the available data on plastics and human health comes from high-income countries, where the production, use, and disposal of plastics differ significantly from those in low-income regions. Addressing the plastics crisis also involves substantial economic costs, both along the plastics value chain and in implementing solutions and alternatives. For example, Trasande et al. (2024) estimated that diseases attributable to plastics costed the US $249 billion in 2018 alone.

## 3.2 Gendered consumption of plastic products

Since the 1990s, India has an increasing demand for plastics (Pathak & Nichter, 2021) that will most likely continue to rise rapidly due to economic growth and continued urbanization (Liang et al, 2021). However, India's share of global plastic consumption is currently still quite low (Mehta et al., 2021a; Swarnakar, 2019), with an annual consumption rate of 11 kg/capita (Ahluwalia & Patel, 2018). In comparison, the US consumes 195 kg plastics per year per person (Pottinger et al., 2024), about ten times as much as India, while China consumes about three times the amount of India (Ahluwalia & Patel, 2018).

The main plastic products that are purchased and used in India are bags, containers, clothes, toys, household applications, industrial products, engineering applications and building materials. Among them, the consumption of plastic packaging ranks highest (Liang et al, 2021), representing almost one fourth of the total plastic consumption (British Plastics Federation, 2011).

The consumption of many plastic products and products in plastic packaging is heavily influenced by gendered marketing and design. Many plastic products are targeting either women or men, following and reinforcing gender stereotypes. What follows are gendered consumption patterns that can lead to differential exposure to potentially harmful chemicals present in these products (Lynn et al, 2017). Due to societal expectations, men are more likely to buy expensive goods like cars, or electronic equipment; while women more often buy basic consumer goods related to health, food, clothing and household (Lynn et al, 2017; Križan, 2022). Those products include cleaning supplies, food packaging, non-stick cookware,

waterproofing products, personal care and cosmetic products, electrical apparatus and textiles, most of which have plastic and are packaged in plastic (Lynn et al, 2017).

However, women's societal roles also expose them disproportionately to potentially harmful plastic additives in different products such as household items. Higher levels of phthalates, often used as plasticizers or softeners, were found in women than in men. They are added to food packaging, medical equipment, toys and cosmetics as well as personal care products (Liao et al. 2018). Phtalates' higher prevalence in female bodies is a cause of concern since they act as endocrine disruptors and can affect the health of pregnant women and their infants (Ibid; Landrigan et al. 2023). They are linked to an increased risk of pregnancy loss (Liao et al. 2018), and changes in the brain development of the child as well as autism, poor motor skills and aggression (Landrigan et al. 2023).

The majority of personal care and cosmetic products users are women, who spend an average of $15,000 on makeup over their lifetime (Lynn et al, 2017). While not all chemicals found in cosmetic products pose a health risk, certain toxic substances have been associated with long-term health issues. Research has identified 88 harmful chemicals across more than 73,000 cosmetic items, which have been linked to symptoms such as headaches, dizziness, skin irritation, allergic reactions, and serious chronic health conditions including cancer, hormonal imbalances, and reproductive system disorders (Geiser, 2015; Nicolopoulou-Stamati et al, 2015; Alnuqaydan, 2024). Many cosmetic products, fragrances, and toiletries also contain phthalates (FDA, 2022) which can be absorbed through the skin or inhalation. Thus, women who use shampoos, deodorants, and perfumes, feminine hygiene products, sunscreen, disinfectants, scents, nutritional supplements and similar products are more likely to be exposed to this POPs type (Lynn et al., 2017; Liao et al. 2018). As already mentioned, phthalates have disproportionate health effects on women, especially during pregnancy (Liao et al. 2018; Landrigan et al. 2023). Over the past 50 years, plastic particles have been intentionally added to PCCPs. Conditioners, shower gels, lipsticks, hair dyes, sunscreen, bug repellent, nail polish, bubble baths, anti-wrinkle creams, moisturizers, foundation and eye makeup often include microplastics. Scholars, civil society, governments and more have called for an elimination of intentionally added microplastics in products such as cosmetics, paints and cleaning agents, arguing that harmless replacements for these substances can be easily found (Lynn et al., 2017).

Furthermore, about two dozen studies have detected environmental contaminants in menstrual products and have come to varied conclusions regarding exposure risks. Only a few human studies have directly examined the relationship between menstrual product use and concentrations of environmental chemicals in the body (Upson, K., Shearston, J. A. & Kioumourtzoglou, M. A., 2022). For example, feminine hygiene products can consist of bisphenol-S (BPS) or BPA, which are essentially organic compounds used to make hard plastic and synthetic fibers. It is estimated that women on average use menstruation products 11,000 times during their lifetime. Therefore, tampons (which contain 6% plastic) and pads (which contain 90% plastic) might affect female health as they contain residues of potentially harmful compounds (Lynn et al., 2017). A more recent study found that 12 out of 24 tested period products contained plastics in the form of synthetic polymers that are in direct contact with the vaginal wall during use. Many of these products shed fibers during laboratory tests and fragmented, releasing up to 17 billion nanoplastics per tampon. While the health effects of microfibers and nanoplastics inside the body remain unknown, the large quantity of nanoscale plastics raises health concerns due to the nanoplastics themselves, the potential release of contaminants attached to the nanoplastics, and the leaching of additives used in plastic production (Munoz et al., 2022). The widespread detection of chemicals in menstrual products, combined with limited data on their absorption through mucosal tissues, the scarcity of human-focused research, and the fact that menstrual bleeding is a common experience for a large portion of the population, highlights the urgent need for further investigation into potential health risks (Upson, K., Shearston, J. A. & Kioumourtzoglou, M. A., 2022).

## 3.3 Gender dimensions in plastic waste management and recycling

The waste management and recycling sector in India is profoundly shaped by gender dynamics and traditional gender norms that influence the distribution of labor and job opportunities. While women typically perform menial tasks, like waste picking, sweeping, and sorting, for instance, men tend to occupy higher-paid positions, such as managing recycling operations (Krishnan & Backer, 2019). These gendered divisions of labor not only limit women's access to secure and better-paid jobs and reduce their decision-making power in the sector but also exposes them disproportionately to hazardous waste materials. These dynamics result in differentiated health risks and socio-economic vulnerabilities for women and men. In this section, we will examine some of these key issues related to gender inequality and health and safety risks across the waste management and recycling phases of the plastic lifecycle in India.

Waste management in India, as elsewhere, is embedded in its socio-cultural context. Intersectionality – understood as how a person's social and political identities (such as gender, age, class or caste) combine to create different modes of discrimination and privilege (Crenshaw, 1991) – is central to understand why, despite their essential contributions to environmental sustainability and urban cleanliness, workers in the informal waste management sector – which largely consist of marginalized and disadvantaged groups, including women, children, migrants, and individuals from lower castes – face systemic discrimination, economic precarity, and social stigma (Krishnan & Backer, 2019).

As the urban informal waste management sector plays a crucial role in the recovery and recycling of plastic waste, one must also understand both the cultural and the economic meaning of waste in urban Inda. In urban India, women remain the main caretakers of the household, and most often the ones who are responsible for cleaning and separating waste into recyclable and non-recyclable categories, and for preparing it for collection or disposal (Luthra, 2020). Waste, however, is culturally regarded as polluting also in the ritual sense, so what women interact with household waste, depends on their status or position in society. Whilst higher castes and class women have less to do with waste, it is normally women from marginalized groups in the Indian society, such as Scheduled Castes being hired as the maids doing the most polluting tasks of a household – cleaning toilets, floors, and handling waste (Dickey, 2002; Frøystad, 2003). After the waste leaves a household, the trajectory continues to be a matter of intersectionality. According to Luthra (2020), household waste in India is generally discarded through two distinct pathways. The first, *kabaad*, refers to high-value recyclables and larger household items that are stored and sold periodically. The second, *kooda* (or *kachra*), includes general household waste and low-value recyclables, typically disposed of on a daily basis. Whilst the high-value *kabaad* tend to be collected directly by *kabadiwallas*, or scrap buyers, most often are men, low-value recyclables found in the general waste are often recovered by women (Krishnan & Backer, 2019; Luthra, 2020). In urban India, general household waste is often disposed directly into the streets to be collected by the informal workers (waste pickers). The waste pickers typically come from low-income households, live in urban slums or illegal settlements with limited access to basic services, and are predominantly female (Wittmer 2023). In Pune, for example, over 90% of the waste pickers in the city were female (Chikarmane et al. 2001). Waste pickers thus arguably occupy one of the lowest positions in the urban socio-economic hierarchy. As Misra and Tewari (2022: 1184–1185) note, "waste pickers are individuals who fall in the lowest hierarchy of power and economic structures in urban spaces." Similarly, Wittmer (2020: 1) emphasizes that they are "positioned at the bottom of these local urban waste economies and thus take on the most hazardous aspects of waste work, have the lowest incomes, and experience the highest exposures to various health threats and social stigmas."

Waste pickers are also exposed to a range of physical and mental health risks due to the hazardous nature of their work and lack of occupational protection. According to Mote (2016), the most commonly reported health problems among a sample of waste pickers in Mumbai included respiratory disorders, colds, coughs, fevers, skin conditions, and gastrointestinal infections. Cases of tuberculosis and hypertension were also

identified. The workers frequently experienced eye irritation, headaches, and muscular pain – particularly backaches – caused by static postures and heavy physical labor, and accidental injuries such as cuts and falls were reportedly common (Mote, 2016). Exposure to medical waste, including used needles, syringes, and other biologically contaminated items such as condoms, which can transmit infectious diseases, as well as animal bites and traffic accidents, posed an additional risk to the waste pickers, Mote (2016) reported. In addition to these challenges, waste pickers working at open dumpsites face dangers such as methane fires and landslides (Krishnan & Backer, 2019), and exposure to toxic substances released from the burning of plastic and other types of waste (Dixon et al, 2023).

Health risks disproportionately affect female waste pickers, especially in landfill and dumpsite environments where the nature of physical tasks coupled with a lack of personal protective equipment, healthcare, and safety training endanger women, who make up the majority of waste pickers (Krishnan & Backer, 2019). An investigative report published in 2022, found that 74% of waste pickers in New Delhi worked in unsheltered spaces, exposing them to extreme weather, traffic accidents, and animal attacks (Sinha & Chaturvedi, 2022). Safety concerns for women extend further to include threats of harassment: 75% of women surveyed identified physical harassment as a workplace risk, 70% reported fear of sexual harassment, and 58% cited harassment by officials as a concern (Sinha & Chaturvedi, 2022). According to Misra and Tewari (2022: 1189), several studies in Delhi show that "most women waste pickers have been harassed or detained by the police or the local public, once in their lifetime".

Along with physical health challenges and concerns, mental health issues among waste pickers are also prevalent, and show a gendered difference. Mote (2016) found that many waste pickers reported experiencing mild depression and anxiety, with female waste pickers showing higher levels of these conditions than males. These findings resonate with studies conducted by Misra and Tewari (2022) and Wittmer (2020), who also found that female waste pickers report feeling stressed, anxious and depressed.

Despite the prevalence of health challenges, Wittmer (2020) found that women waste pickers in Ahmedabad rarely took time off to access healthcare services due to financial constraints. As one of her respondents explained, if she did not pick waste, she would not have an income that day, and she could simply not afford any medical treatment. As a result, health issues often go untreated and become long-term or recurring problems (Wittmer, 2020).

Female waste pickers thereby face multiple and intersecting forms of precarity in their work. In addition to disproportionate health and safety concerns, they typically earn less than men, partly due to more limited access to high-value waste materials such as PET plastics, and partly due to gendered constraints that affect their mobility, negotiation power, and working conditions (Sinha & Chaturvedi, 2022). One study found that although 75% of waste pickers reported that plastics were their most profitable material, women had less access to high-value plastics than men. Specifically, 42% of women had access to PET, compared to 50% of men (Sinha & Chaturvedi, 2022). These disparities in access directly translate into income inequality: in the study, men were found to earn between INR 1000 and 2000 per week from selling plastic waste, while women earned between INR 500 and 1000 (Sinha & Chaturvedi, 2022). Compounding these challenges is the unequal burden of domestic work and caregiving responsibilities borne by women, which limits their time, flexibility, and capacity to engage more profitably in the waste economy (Sinha & Chaturvedi, 2022; Krishnan & Backer, 2019).

In the later stages of the plastic recycling/waste lifecycle—particularly in processing and recycling—men tend to occupy more formalized and better-paying roles. These positions often offer greater access to high-value recyclables, job security, and legal protections (Krishnan & Backer, 2019). In Dharavi, Mumbai, a 2015 study revealed that women working in the plastic recycling industry earned approximately INR 150 per day, while their male counterparts earned nearly twice as much: between INR 200 and 300 INR per day (Pandey, 2015). Men are also more likely to own and manage recycling businesses, giving them disproportionate control over decision-making and resources (Krishnan & Backer, 2019; DTE, 2024).

Tasks within the plastic recycling industry are also gendered. Men typically perform physically demanding jobs such as loading, unloading, and operating machinery, while women are often assigned repetitive and time-intensive tasks such as sorting and segregating materials (Krishnan & Backer, 2019). These roles expose women to specific health hazards. For example, in a study of self-reported health conditions among recycling factory workers in West Bengal's Malda district, 66.7% of female workers reported work-related injuries, compared to 31.7% of men. Similarly, 77.8% of women working in recycling experienced eye irritation, compared to 36.6% of their male counterparts (Hasan & Ghosal, 2023).

In addition to these gendered differences, both men and women in the recycling sector face several shared occupational hazards. Workers across the industry often lack health insurance, access to healthcare, and legal protections, leaving them vulnerable to toxic exposure, physical injury, and poor working conditions (Krishnan & Backer, 2019). Inadequate ventilation, insufficient sanitation facilities, and substandard housing further increase the health risks faced by these workers (Hasan & Ghosal, 2023). Commonly reported ailments include abdominal pain, asthma, eye irritation, headaches, muscular pain, skin allergies, and work-related injuries. In some cases, exposure to industrial toxins has led to serious neurological consequences. A case study by Verma et al. (2023) documented 10 workers at a PVC recycling facility in India who were hospitalized with toxic encephalopathy, a term used to describe various kinds of brain dysfunction, including symptoms such as memory loss, confusion, vertigo, and seizures. The authors warn of the acute risks posed by insufficient ventilation and toxic exposure in such industrial settings.

This highlights the need to recognize and address the health and safety risks faced by both women and men in the waste management sector, particularly within the informal economy. However, the risks are not equally distributed: women are disproportionately exposed to hazardous conditions while lacking access to protective equipment, healthcare, and decision-making power. Efforts to improve occupational health and safety must therefore adopt a gender-sensitive approach—one that acknowledges the specific vulnerabilities of women workers, addresses structural inequalities in access to resources and income, and promotes safer, more equitable working conditions across all stages of the plastic waste lifecycle.

# 4 Gender considerations in POPs- and plastic-related policies

As this report has shown, both men and women are negatively affected by Persistent Organic Pollutants (POPs) and plastic pollution, albeit in different ways. Addressing the gender dimensions of POPs and plastics throughout their lifecycle is crucial for developing effective and equitable solutions to the environmental and health challenges they pose. Incorporating scientific expertise into the development of clear gender mainstreamed policies will increase the effectiveness of mitigating the hazards associated with plastic and POPs on human health and the environment. In the context of POPs and plastic pollution, 'gender mainstreaming' (see text box 1) aims to ensure that gender-specific challenges related to the plastic lifecycle

**Text box 1. Gender mainstreaming**

The recognition and implementation of a gender perspective into the whole process of policymaking – from its preparation to implementation and evaluation, is called gender mainstreaming. Gender mainstreaming can be achieved through facilitating gender-sensitivity and gender-inclusiveness through education and awareness; ensuring local and gender diversified representation in policy-making bodies and stakeholder consultations or initiatives; implementing gender-responsive budgeting in environmental programs, promoting gender-differentiated and relevant research and data collection to inform policy design; and promoting equal access to resources and opportunities in the transition to sustainable practices (WHO, 2016; UNDP, 2016; UNDP, 2017; OECD, 2017; Dixon et al 2023).

are adequately addressed, and that both women and men benefit equally from policy-related measures (Dixon et al, 2023).

As per the time of writing, India has no overarching policy to addressing the risks and hazards faced by women from plastic and POPs pollution. For example, India's Plastic Waste Management (Amendment) Rules (2021) which aim to reduce plastic pollution and regulate microplastics, do not address gender-specific impacts (The Gazette of India, 2021).

At the global level, however, the importance of addressing the gendered challenges and risks posed by chemical pollution more broadly seems to be increasingly recognized. In 2013, the secretariat to the Basel, Rotterdam and Stockholm (BRS) Conventions developed their first Gender Action Plan (GAP), to ensure gender mainstreaming in its activities, projects and programs. The BRS-GAP has since been updated three times, in 2016, 2019 and 2023. The plan outlines the following areas of actions: "Develop a baseline on gender-related issues and measuring progress in achieving Gender Action Plan objectives and implementing activities; Ensure that the Secretariat's programmes and projects are planned and implemented from a gender equality perspective; Promote the consideration of gender issues in hazardous chemicals and wastes management at the national and regional levels; and Support staff in achieving a sustainable work-life balance."[6] When the Stockholm Convention on Persistent Organic Pollutants (POPs) was ratified by the UNs member countries, further commitments were made to enable gender mainstreaming and stakeholder participation in its implementation (BRS Gender Action Plan, 2023). In 2024, the UN Environment Assembly (UNEA) passed resolution V/4 in the global framework on Chemicals to address the gendered aspects of harmful exposure to chemicals and waste through a request to mainstream a gender perspective in policy, and to promote gender equality and empowerment of all women and girls in chemicals and waste management (UNEA, 2024).

In the effort to develop an international legally binding instrument on plastic pollution, advocacy groups are calling for strategies to promote gender equality, arguing for a Global Plastic Treaty (GPT) that addresses gender dimensions (WECF, 2023). During The fourth Intergovernmental Negotiating Committee (INC-4) in 2024, representatives from 175 countries, including several groups such as from governments, civil society, youth, industry, the financial sector, subnational governments, and Indigenous partners met in Ottawa to discuss how to mainstream gender into efforts for reducing plastic pollution (UNEP, 2024). In the discussions, the Office of the United Nations High Commissioner for Human Rights (OHCHR) brought attention to how human rights must be placed at the core of the legally binding global instrument on plastic pollution, with accountability, transparency, and prevention embedded across the entire plastic lifecycle—from production to disposal (OHCHR, 2024). Following the INC-4 and INC-5 sessions, OHCHR and participatory NGOs and CSOs like the Centre for Environment Justice and Development emphasized the disproportionate impacts of plastic pollution on marginalized groups, such as the marginalized and undervalued effort by waste pickers working within the informal sector (OHCHR, 2024). However, during INC-4, several member states actively sought to remove references to gender (Achakpa, 2025), leading to actors advocating repeatedly for the prioritization of gender considerations within the GPT agenda prior to INC-5.1, held in December 2024 in Busan (IPEN, 2024). After INC-5.2 had taken place in Geneva in August 2025, civil society criticized that despite strong advocacy, gender issues continue to be marginalized in the official documents related to GPT development. As of the time of this writing, the most recent GPT documents and drafts lack crucial provisions for the inclusion of women in decision-making, in the development of gender-disaggregated data, as well as mechanisms for a gender-responsive treaty implementation (Achakpa, 2025).

[6] Information about the Basel, Rotterdam and Stockholm Conventions Gender Action Plan, available at: https://www.brsmeas.org/Implementation/Gender/BRSGenderActionPlan/Overview/tabid/7998/language/en-US/Default.aspx (accessed 11.08.2025).

Besides plastics and POPs-related policies, gender considerations are also important in other sectoral policies that may have an influence on women as workers or consumers of plastic products. In many countries, pregnant women are protected by laws that shield them from working conditions that could pose risks during pregnancy due to exposure to hazardous chemicals or substances, for instance. Nearly every country worldwide has enacted some form of legislation for maternity protection (Lynn et al., 2017). These laws vary in scope and enforcement but generally aim to safeguard maternal and fetal health in the workplace. The International Labour Organization's Maternity Protection Convention, 2000 (No. 183), specifically addresses health protection in Article 3, mandating that pregnant or nursing women should not be obliged to perform work that is harmful to their health or that of their child (Maternity Protection Convention, 2000). As of now, 44 countries have ratified Convention No. 183, however, India has not ratified the convention so far (Ratifications of Maternity Protection Convention, 2002). Apart from the Maternity Benefits Act of 2017 and the Labour Code of 2020, the Government of India has not introduced any recent revisions to protective measures for working women's health, raising concerns about the need for further action (Sahu & Behera, 2023).

As such, in line with advice from the UN General Assembly (2024), this report recommends gender mainstreaming both in policy and decision-making processes on state and sectoral levels, with a particular emphasis on women and girls who are especially affected by toxic exposures, including informal workers, pregnant women, and girls in key stages of their reproductive cycle. Gender mainstreaming will also support India's contributions to UNs Sustainable Development Goal no.5, where member countries are committed to undertake reforms that provide gender equality, and grant women equal rights to economic and natural resources, and to adopt and strengthen sound policies and enforceable legislation that promote empowerment of all women and girls (UNDP, 2025). Below we offer key recommendations for developing gender-sensitive actions that protect the health of populations and the environment with a particular emphasis on gender mainstreaming and on reducing the exposure to harmful effects of POPs and plastic pollution for women.

# 5 Conclusion and Recommendations

Plastic and POPs pollution in India presents a complex and deeply gendered challenge. This report has shown that women—especially those from marginalized communities—face disproportionate exposure to hazardous chemicals throughout the plastics lifecycle. From occupational risks in plastic manufacturing and in particular informal waste work to negative health impacts linked to domestic roles and gendered consumption patterns, the evidence underscores the urgent need for gender-sensitive approaches in environmental governance.

Despite growing international recognition of gender dimensions in chemical and waste management, India's current policies lack adequate provisions to protect women from these risks. The absence of gender-disaggregated data, limited representation of women in decision-making, and insufficient occupational health standards contribute to ongoing inequities.

To address these gaps, the report calls for gender mainstreaming into national and sectoral policies, improved data collection, inclusive stakeholder engagement, and targeted support for women workers. Protecting women's health and rights in the context of plastic and POPs pollution is not only a matter of justice—it is essential for achieving sustainable development and environmental resilience.

Women are at the forefront of the battle against plastic pollution. Transitioning to a circular economy for plastics and moving toward a sustainable, green future must include creating a circular and safe plastics value chain that is both inclusive, socially just and gender sensitive.

## 5.1 Key recommendations

The following actions should be taken up to support women involved in and impacted by the plastics value chain.

**Knowledge and capacity building**

Increase awareness of the gendered aspects of plastic and POPs-related risks and hazards for policymakers, decision-makers, and for the Indian population in general.

- Establish or strengthen, and implement, national or regional platforms, network and fora for knowledge and policy development related to plastic and POPs-related risks and hazards
- Provide an inventory of tools, methods or guidelines for policymakers and stakeholders with practical examples on how to achieve gender mainstreaming in policy development
- Provide community-specific, accessible information and advice, including on stigmatized issues such as safe menstrual care and sexual violence within the informal waste sector
- Establish informal knowledge forums where women can exchange best practices and expertise about plastic product consumption and waste management

**Develop and enforce effective policies and regulations**

Ensure that the risk of harmful exposure to POPs and plastic pollution is reduced by developing and ensuring effective regulations and bans for industries, facilities and/or specific chemicals or products.

- Gender-specific risks, hazards and needs must be considered at every step of the plastic lifecycle when designing plastic and POPs management policies
- Include long-term health and financial impacts of preterm birth, low birthweight and other adverse birth outcomes in assessments of the danger posed by an industry, facility, chemical or product
- Ban chemicals and products that might be harmful
- Mandate or encourage labelling of products consisting of plastics and/or chemicals
- Set standards for information on the effect of products consisting of plastics and/or chemicals on reproductive health and other gendered impacts
- Prohibit import of chemicals from countries that ban it within their domestic policies
- Prohibit the production and export of chemicals that are banned or restricted from use in the import state
- Design GPT implementation frameworks that are responsive to gender dynamics
- Recognize and address the burden of unpaid care work exacerbated by chemicals that pose health risks through targeted information, advocacy and set safety-standards
- Integrate gender-disaggregated data into monitoring and evaluation systems

**Ensure gender-sensitive occupational health and safety standards**

Ensure that safe exposure levels for plastics are determined considering the varying sensitivity levels of men and women to toxic chemicals, and make sure that laws pertaining to occupational health and safety in the plastics industry are gender sensitive.

- Develop and enforce health and safety guidelines with special attention to women for the plastics and waste management industry
- Review current policies and regulations regarding POPs and plastic exposure to safeguard all workers
- Provide personal protection equipment (PPE) that is appropriate for women workers and raise their awareness of the importance for its usage
- Provide free gender-sensitive support services and routine health examinations for women who work in plastic manufacturing and waste management, including for informal sector workers
- Offer context-sensitive child- and healthcare for women working in the marginalized and unregulated plastics value chain such as waste pickers

**Increase participation of women stakeholders in decision-making processes within the plastic value chain**

Include female stakeholders across various levels across the plastic value chain when developing, implementing and assessing existing and future policies and action plans related to POPs, plastic pollution, waste, and more. Strive to ensure a representative diversity of female stakeholders by also considering socioeconomic (class) and sociocultural (caste, ethnicity) backgrounds.

- Provide capacity development training and courses tailored to encourage and ensure women's participation in decision making fora
- Provide grants, loans, and related training to women entrepreneurs in the recycling and waste management industries
- Ensure that men's and women's labor and time are valued equally by providing equal pay
- Guarantee employment opportunities based on skill and experience, not gender through actively inviting unions or organized labor groups to support negotiations
- Invest in women-led gender-responsive projects that aim to reduce health risks from plastics

**Research Priorities**

Endorse and fund knowledge and awareness raising by prioritizing research on gender-differentiated data generation, impact studies, and on the structural dynamics and norms which sustain existing gender disparities in society and in decision making processes. Encourage and enable research to be developed in collaboration with female stakeholders, especially from local minority groups and/or organizations and initiatives representing their interest. Research topics can include but are not limited to:

- Sex-disaggregated and gendered data generation on exposure pathways and health impacts from plastics, chemicals and POPs pollution
- Data collection on history of consumption habits (such as usage of food, care, hygiene, cleaning and household products) and other potential POPs exposure of individuals to assess and understand the accumulation of chemicals, in highly exposed women, and in what way they might be affecting future generations
- Data collection on population vulnerability, disease pathology, and occupational cohorts of highly exposed women (e.g., those employed in plastic manufacturing plants, waste management facilities, and as waste pickers)
- Societal barriers and enablers for achieving sound gender mainstreaming and/or reduction of gender disparity gaps
- Impact of climate change and plastic/POPs pollution on women's health, reproduction and wellbeing

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# 7 Appendix

## 7.1 Materials and sources for gender mainstreaming in India

**UN Women and the Green Climate Fund** have developed a toolkit to guide gender mainstreaming in all aspects of climate finance (UN Women and the Green Climate Fund 2017).

**UNICEF and Doordarshan** have developed Gender-Sensitive Programming Guidelines that promote gender equality in environmental policies and media representation (UNICEF 2024).

**NITI Aayog and UNDP** have published a 'Handbook on Sustainable Urban Plastic Waste Management' (2021). The handbook includes a checklist with a Gender Action Plan, with several steps towards gender mainstreaming such as preventing and responding to gender-based violence by implementing the 'The POSH Act Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) 2013', promoting gender sensitive trainings, involving women in management and leadership roles and ensuring gender-responsive health education, including nutrition, care and pregnancy prevention (NITI Aayog and UNDP 2021).

There are also several Indian civil sector initiatives working to support and empower women in waste management through raising wages and improving working conditions by formalizing the informal waste sector in the direction of more ethical recycling chains, such as the **Self-Employed Women's Association** (SEWA, 2025) and the social enterprise **Plastics for Change** (n.d.).

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