Regulatory options to prevent environmental harm and pollution across the tobacco product life cycle

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Abbreviations and Definitions

CSR – corporate social responsibility – generically refers to a company's voluntary commitment to operate in a way that considers the social and environmental impact of its business practices and to contribute to society through ethical and sustainable actions, philanthropy, employee wellbeing, and environmental protection. However, tobacco companies cannot reconcile their aim of maximizing profits from producing and selling a deadly product with CSR commitments *(1)*. More recently, the tobacco industry has categorized its CSR activities under the principles of environmental, social, and governance standards (ESG) *(2, 3)*.

ENDS – electronic nicotine delivery systems – these systems heat a liquid to create aerosols that are inhaled by the user, which contain nicotine and other toxic substances that are harmful to both users and non-users who are exposed to the aerosols secondhand; the liquid is often flavoured *(4)*. ENNDS are electronic non-nicotine delivery systems, which for the purpose of this report will be included as ENDS, since they have similar environmental impact.*(4)*

EPR – extended producer responsibility – generically refers to an environmental policy approach that integrates potential solutions to mitigate the environmental consequences of tobacco product waste by placing the burden on producers for the entire life cycle of the tobacco product, particularly through design, take back, recycling, and final disposal *(5)*. EPR is based on, but distinct from, polluter pays principle (PPP), defined below. To date, EPR for tobacco products has been mostly applied to post-consumption waste mitigation (e.g., clean-up of cigarette butts).

ESG – environment, social and governance – ESG refers to three non-financial perspectives on a company's societal impact, promoting respectability and investment potential *(6)*.

HTP – heated tobacco products – these tobacco products use devices to heat tobacco to produce an aerosol containing nicotine, other toxic chemicals, and particulates. These aerosols are inhaled by users from the device or from a "stick" resembling a cigarette. In addition, the aerosols contain non-tobacco additives and are often flavoured. The sticks that resemble a cigarette may have a plastic filter *(7)*.

SDGs – Sustainable Development Goals – the *2030 Agenda for Sustainable Development*, adopted by all United Nations Member States, includes 17 SDGs *(8)*.

SUP – Single-use plastic products – these are plastic items and that are intended to be used once and then discarded *(9)*.They are often made of

plastics derived from fossil fuels but also include biopolymers that are not petroleum based, such as cellulose acetate.

SHS – Secondhand tobacco smoke is a combination of the smoke exhaled by the smoker, and smoke emanating from a burning tobacco product.

THS – thirdhand smoke -- refers to the tobacco-related gases and particles that are embedded in materials, such as carpets, walls, furniture, blankets, clothes and other household objects *(10)*.

TPW – tobacco product waste – any discarded tobacco product, including cigarette butts, packaging, and related electronic devices.

Glossary

Bioaccumulation – refers to the accumulation of a substance (such as pesticides and other chemical toxins) in a living organism ingesting or otherwise exposed to these substances over time.

Cellulose acetate – is the plastic used in most commercial cigarette filters. It is a biopolymer, not derived from petroleum.

Circular economy – refers to the concept of keeping materials and products in circulation for as long as possible in order to maintain their highest value for as long as possible and reduce waste through better material, product, and system designs *(11)*.

Tobacco cultivation – is the process of growing tobacco plants. Tobacco cultivation is a labour-, fertilizer-, and pesticide-intensive process that requires cleared land for planting. This land clearance drives deforestation in tobacco-growing countries. Tobacco cultivation also diverts land and other agricultural resources from food production, often in some of the world's poorest and most food-insecure countries *(12)*.

Tobacco curing – this is the process of drying and aging the green tobacco leaf in the open air, in sunlight, or in heated structures (fire and flue curing), after it has been harvested *(13)*. The demand for wood fuel used in fire and flue curing, mainly in low-and-middle income countries, also impacts deforestation*(13, 14)*.

Ecosystem services – the benefits derived by humans from intact ecosystems such as food supplies, water and waste purification, medications, and cultural and aesthetic services such as tourism and recreation *(15)*.

Greenwashing – a marketing strategy used by companies to make their processes or products appear more environmentally friendly than they actually are. Tobacco industry CSR projects, such as clean-up campaigns, attempt to

detract attention away from the environmental harms its products cause along the entire product lifecycle *(16)*.

Hazardous waste – waste that poses a serious threat to human health and the environment. For example, in the EU's Waste Framework Directive, (Directive 2008/98/EC) on waste, this can mean explosive, oxidizing, flammable, irritant, organ toxicity, acute general toxicity, carcinogenic, corrosive, infectious, toxic for reproduction, mutagenic, acutely toxic as gas, sensitising, or ecotoxic threats *(17)*.

Leaching – a term used in environmental sciences referring to solids that are dissolved or otherwise incorporated into aquatic or other environmental settings *(18)*. Aquatic environmental contamination may result secondarily from terrestrial sources such as landfills and dump sites.

Nicotine product – refers in this report to any manufactured product containing nicotine (from any source), nicotine derivatives, or nicotine analogues, and intended for human consumption, but not a tobacco product (referred to separately in this report) or a product that has been approved as a tobacco or nicotine cessation product

Polluter pays principle (PPP) – is a commonly accepted principle requiring that those who produce pollution should bear the expenses of pollution prevention and control measures. These measures should be decided by public authorities and not polluting industries to ensure that the environment and human health are protected from pollution-caused damage *(19)*. PPP is often used interchangeably with EPR, although the PPP can involve broader applications and can be operationalized through EPR policies.

Product stewardship – an environmental management strategy for any entity that designs, produces, sells, or uses a product. The strategy should ensure responsibility to minimize the product's environmental impact throughout all stages of the products' life cycle, including end of life management *(20)*.

Tobacco product waste (TPW) disposal costs – result from costs of TPW receptacles, landfill disposal, or incineration of TPW; for jurisdictions that include electronic nicotine delivery systems (ENDS) as tobacco products; these costs include the hazardous waste management of ENDS components such as batteries, plastic cartridges and metals.

TPW downstream regulatory options – regulatory options that address the most visible parts of TPW after tobacco products are consumed and discarded.

TPW midstream regulatory options – regulatory options that address the use of tobacco products.

TPW upstream regulatory options – regulatory options address the sources of environmental harms and their prevention.

Executive summary

Decision FCTC/COP10(14): *Implementation of Article 18 of the WHO FCTC* was adopted at the 10th Session of the Conference of the Parties of the WHO Framework Convention on Tobacco Control (COP10) *(21)*. The Decision acknowledged the environmental harms caused by the life cycle of tobacco, highlighting that "plastic cigarette filters are unnecessary, avoidable and problematic, single-use plastics that are widely spread in the environment, killing microorganisms and marine life, as well as polluting oceans."

The Decision further acknowledged the role of the tobacco industry in causing environmental damage and invited Parties to hold the tobacco industry accountable for this damage under Article 19 of the WHO FCTC, including for the disposal and treatment of waste resulting from tobacco product manufacturing and consumption.

The Decision also acknowledged the links between the WHO FCTC and United Nations Framework Convention on Climate Change (UNFCCC), as well as with the ongoing United Nations Environment Programme's Intergovernmental Negotiating Committee on Plastic Pollution.

The Decision requested the Secretariat to examine regulatory options regarding the prevention and management of waste generated by the tobacco industry and its products, including a ban on plastic cigarette filters and the management of hazardous waste from cigarettes, based on scientific evidence. It further requested the Secretariat to identify several sources of tobacco-related environmental harm, with a focus on plastic waste, and to describe options that Parties may have to curb or prevent such harm.

This report was commissioned by the Secretariat to address the Parties' request and to present an overview, using available evidence, of the environmental harms caused by the tobacco lifecycle – from tobacco growing to post-consumption waste and the regulatory options to prevent these harms. This report sets out the substantial scale and broad range of harms to the environment caused by the tobacco industry and reviews regulatory options to prevent these harms.

The main conclusions of the report include:

- Strengthening the implementation of WHO FCTC measures to reduce the demand and supply of tobacco products will contribute to reducing the environmental damage of the tobacco product cycle, along with implementing the upstream regulatory options identified in this report. This could include measures that aim to reduce the availability of all commercial tobacco products through supply reduction approaches.
- Banning the manufacture (where relevant), import, distribution and sales of filtered cigarettes would eliminate trillions of pieces of plastic waste from the environment. This would also reduce the appeal of cigarette smoking and help to remove consumer misconceptions of the health benefits of filtered cigarettes. This conclusion is supported by the currently available scientific evidence and is aligned with the recommendations of the WHO Report of the twelfth meeting (Barcelona, Spain 2024) of the WHO Study Group on Tobacco Product Regulation, which was tabled at the Executive Board 157th session, and recommended “banning filters to reduce the palatability and appeal of cigarettes, remove consumer misconceptions about filters substantially reducing health harms and reduce a major source of toxic tobacco waste, including the microplastics deposited by cellulose acetate in filters.”
- The tobacco industry should be held accountable for the damage it causes to the environment through extended producer responsibility (EPR) for tobacco product waste (TPW). Litigation could also be used to hold the tobacco industry accountable for the environmental damage it causes across the tobacco product life cycle.
- These recommendations and others in this report would all contribute to the implementation of Article 18 of the WHO FCTC.

Other key findings of the report include:

- Extensive environmental harm exists along the whole supply chain of tobacco products. Tobacco cultivation and curing is the largest contributor to the supply chain’s environmental CO_2 pollution.

Manufacturing pollution, distribution and logistics (transport) pollution comprise approximately a third of tobacco's environmental CO_2 pollution.

- The tobacco product life cycle is also responsible for large-scale deforestation; loss of biodiversity, including wildlife; desertification, soil depletion and erosion; water depletion; microplastic pollution; emission of toxicants in the air via direct, secondhand, and thirdhand smoke pollution; and degradation of terrestrial and aquatic ecosystems.
- Commercial cigarette filters, which are made from cellulose acetate plastic, are a major source of toxic TPW. Trillions are discarded into the environment every year, leaching toxic chemicals and breaking down into microplastics.
- In addition to filters on cigarettes, plastics are used in both the manufacturing and packaging of tobacco products and are thus an additional source of plastic waste and microplastics.
- Research gaps identified include the need for more specific estimates of the costs associated with environmental damage along the entire tobacco product life cycle.

The report outlines specific regulatory options to address the environmental harms of tobacco. These are divided into upstream, midstream and downstream options:

- Upstream regulatory options address the sources of environmental harms and the primary prevention of them; these include:
    - Adopting a supply reduction approach to reduce the availability of all commercial tobacco products, including but not limited to: reducing the number of tobacco products available in the market, placing a birth-date based sales restriction on tobacco products to phase out their sale, and banning the sale of certain tobacco products.

- Banning the manufacturing (where relevant), import, distribution and sales of filtered cigarettes.
- Beyond cigarette filters, banning single-use plastics in all tobacco products (such as waterpipe, smokeless and heated tobacco products), as well as plastic packaging and plastic-containing accessories (such as plastic filters on small cigars or attached to roll-your-own cigarettes).
- Banning the sales of electronic nicotine delivery systems (ENDS) or banning the sales of single-use ENDS.

- Midstream regulatory options address TPW during the current use of tobacco products, these include:
  - Reducing retailer density to reduce the availability and location of tobacco retail outlets.
  - Creating a deposit/refund system whereupon a deposit is made with the purchase of a tobacco product, and a refund is issued upon return of the post-consumption waste. This option, however, is not recommended, as it is fraught with challenges, from the safe handling of TPW returns to the lack of utility and technology to safely recycle or dispose of this waste.
  - Introducing a TPW abatement fee on tobacco product sales, paid by the tobacco product manufacturer. These fees could offset some of the cost of managing post-consumption TPW, such as collecting and disposing of this waste. However, this option would not reduce the source of the waste or prevent the continued production of the waste.
  - Place-based restrictions on tobacco use, such as outdoor smoking bans in parks and beaches, would be expected to reduce TPW in the affected defined location. These are not a substitute for more comprehensive measures to address TPW.

- Downstream regulatory options address visible TPW, a small proportion of the total burden of discarded tobacco products. These options can raise public awareness about the quantity and harmfulness of TPW, but they do not address the source of the problem and only eliminate a small proportion of the discarded TPW. Such options are also at high-risk for being used as tobacco industry greenwashing initiatives. These include:
    - “Clean-up” campaigns and placement of waste receptacles for tobacco products. These options would still require disposal efforts for the collected wastes.
    - Requiring biodegradable filters. These would still be discarded into the environment and leach out toxic chemicals. They would not address the WHO Study Group on Tobacco Product Regulation recommendation of banning ALL filters to reduce the palatability and appeal of cigarettes. Nor would they remove consumer misconceptions about filters substantially reducing the health harms of smoking. In addition, they may inadvertently encourage people who smoke to continue to litter.

Other measures

The EPR framework is one measure that could be used to hold the tobacco industry accountable for the environmental consequences of TPW. Implementation of EPR measures would require fees to mitigate environmental harms across the entire tobacco product lifecycle. Any EPR system would have to ensure alignment with Article 5.3 of the WHO FCTC and its obligation on Parties to protect their public health policies with respect to tobacco control from commercial and other vested interests of the tobacco industry so as to avoid conflicts of interest and ensure that any such system is not identified as a partnership between the tobacco industry and the government.

Litigation is another option to hold the tobacco industry accountable and has been successfully used to assign economic accountability to the tobacco industry in other areas.

Classification of TPW as hazardous waste is another measure and could allow hazardous waste disposal models to be applied to TPW.

Supporting measures

An important component to support enforcement and compliance with any regulatory option is to develop and implement public educational campaigns and other initiatives that increase awareness among the public of tobacco-related environmental harms, in alignment with Article 12 of the WHO FCTC and its Guidelines for implementation. One strategy to promote public education of these harms is to include environmental harm labelling on tobacco product packaging, or even on the product itself, such as on individual cigarette sticks, in alignment with Article 11 of the WHO FCTC and its Guidelines for implementation.

Implementing tobacco industry reporting and disclosure requirements to appropriate government authorities is an additional important consideration, including information associated with the environmental harms of the tobacco product life cycle and information for monitoring compliance with regulations.

Most importantly, the report emphasizes that banning the manufacture (where relevant), import, distribution, and sale of filtered cigarettes would be a significant step in contributing to the implementation of Article 18 of the WHO FCTC. Trillions of cigarette butts are discarded into the environment every year, and banning filters would reduce the major source of toxic TPW, including the microplastics that result from the discarded cellulose acetate filters.

About this report

This report responds to the WHO Framework Convention on Tobacco Control (WHO FCTC) Decision FCTC/COP10(14) from the Tenth session of the Conference of the Parties to the WHO FCTC (COP10) on the *Implementation of Article 18 of the WHO FCTC (21)*. The Conference of the Parties (COP) is the governing body of the WHO FCTC and is comprised of all Parties to the Convention. Article 18 of the WHO FCTC explicitly states that: “In carrying out their obligations under this Convention, the Parties agree to have due regard to the protection of the environment and the health of persons in relation to the environment in respect of tobacco cultivation and manufacture within their respective territories” *(22)*.

The COP10 Decision

At the Tenth session of the Conference of the Parties (COP10) to the WHO FCTC, in February 2024, the Conference of the Parties (COP) adopted Decision FCTC/COP10(14): *Implementation of Article 18 of the WHO FCTC.* The Decision requests the Convention Secretariat to carry out work related to the implementation of Article 18 of the WHO FCTC (specifically Paragraphs 2.c. and 2.f. of the Decision) including:

1. To identify, in consultation with the WHO FCTC Knowledge Hub for Articles 17 and 18, and WHO:
    a. the various plastics used in the manufacture of tobacco products and their packaging, and how, as waste, they harm the environment;
    b. the extent to which protection of the environment from harm arising from TPW and packaging, such as plastics in tobacco products and their packaging, contributes to the implementation of Article 18 of the WHO FCTC;
    c. the options that Parties may have to curb or prevent such harm.
2. To examine regulatory options regarding the prevention and management of waste generated by the tobacco industry and its

products, including a ban on plastic cigarette filters and the management of hazardous waste from cigarettes.

3. To prepare a *Report* on the above matters based on scientific evidence to be submitted to the Eleventh session of the COP (COP11).

The Decision further requested the Convention Secretariat to:

- To continue to engage and support the Parties in the implementation of Article 18 of the WHO FCTC;
- To promote international cooperation and exchange of information on the implementation of Article 18 of the WHO FCTC, especially with the WHO FCTC Knowledge Hub for Articles 17 and 18;
- To call attention to the environmental damage caused by tobacco and its products throughout its life cycle.

This report sets out the substantial scale and broad range of harms to the environment caused by the tobacco industry. As some Parties regulate ENDS and nicotine products as tobacco products, this report additionally considers the environmental damage caused by these products. The report then presents the regulatory options that Parties can implement to curb, prevent, or manage the harms of TPW, such as plastics in tobacco products and their packaging, thereby contributing to the more effective implementation of Article 18 of the WHO FCTC.

Chapter 1 of this report summarizes the evidence on the environmental harms caused by tobacco cultivation, production, use and disposal across the entire tobacco product life cycle. The chapter also addresses the tobacco industry's interference with tobacco control through its expanding corporate social responsibility (CSR) (or environment, social, governance [ESG]) efforts related to the environmental harms of tobacco use *(1, 23, 24)*.

Chapter 2 of the report focuses on post-consumption TPW, especially the environmental harms from plastic and hazardous TPW, which contribute to environmental plastic pollution.

Chapter 3 of the report discusses regulatory options to prevent environmental harm and pollution across the tobacco product life cycle. The regulatory options are broadly characterized as *upstream, midstream*, and

downstream. Upstream regulatory options are those that address the source of environmental harms and prevent them prior to manufacturing or tobacco product use *(25)*. Midstream regulatory options address TPW during the current use of tobacco products. Downstream regulatory options address the most visible parts of TPW after the tobacco products are consumed.

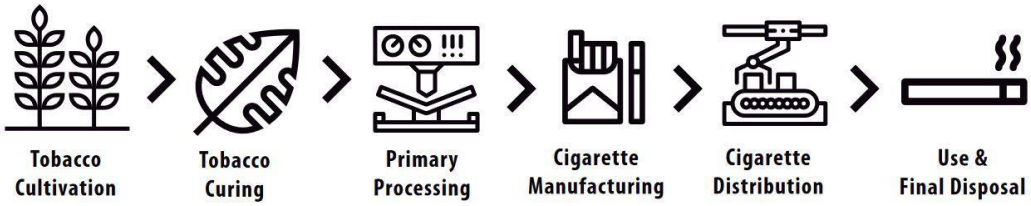
To promote international cooperation and exchange of information on the implementation of Article 18 of the WHO FCTC, the Convention Secretariat sent Parties an optional questionnaire on measures that may contribute to the implementation of Article 18. A summary of the results of this questionnaire is presented in the Annex.

Chapter 1. Overview of the tobacco product life cycle: environmental impacts

Introduction

The life cycle of tobacco products includes cultivation and curing of tobacco, primary processing and trading of tobacco leaf, the manufacture of tobacco products, their distribution, their use, and finally, their disposal (Fig.1) *(26)*.

Fig. 1. Tobacco (cigarette) life cycle



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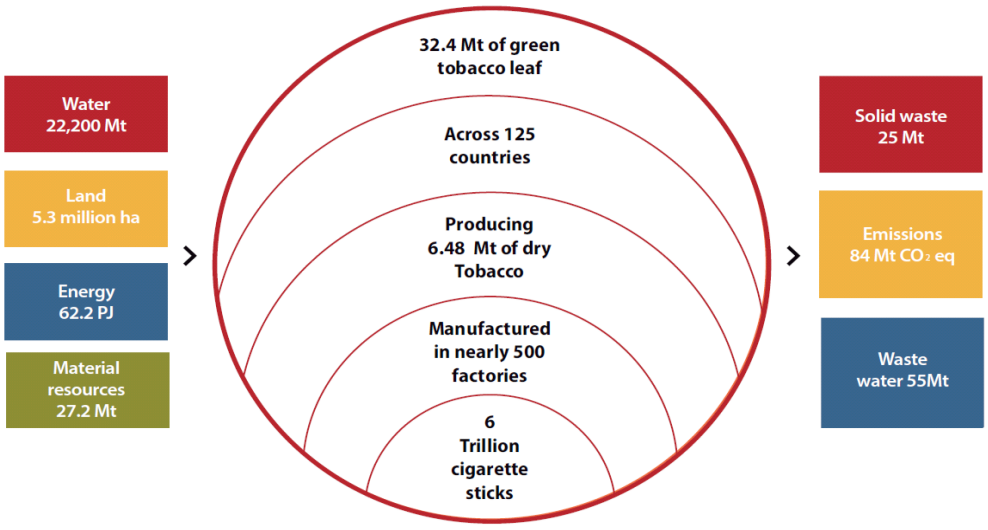
The enormous health harms of tobacco use are well established *(27)*. However, on a finite planet where many individuals struggle to achieve the basic human rights of access to adequate food, clean water, and clean air, tobacco products also place a substantial burden on ecosystem functions while diverting land, labour, financing and other agricultural resources away from food production *(12)*. As such, tobacco products and their production are a barrier to achieving the Sustainable Development Goals (SDGs) and the 2030 Agenda for Sustainable Development *(28)*. Preventing the environmental harms of the tobacco product cycle would contribute to achieving goals SDG 2 (Zero Hunger), SDG 3 (Good health and well-being), SDG 6 (Clean water and sanitation), SDG 8 (Decent work and economic growth), SDG 11 (Sustainable cities and communities), SDG 12 (Responsible consumption and production), SDG 13 (Climate action), SDG 14 (Life below water), SDG 15 (Life on land), and SDG 17 (Partnerships for the goals). The United Nations Development Programme (UNDP) has recognized the WHO FCTC as an accelerator for the SDGs *(28)*.

The Cape Town Declaration at the 2018 World Conference on Tobacco or Health stated that the “manufacture, marketing and sale of tobacco are incompatible with the human right to health” *(29)*. Further, the 2024 Decision FCTC/COP10(20) adopted at COP10 recognizes the interconnectedness between the WHO FCTC and human rights and requested the Convention Secretariat to foster coordination and collaboration with entities in the UN system pursuing human rights mandates in order to raise awareness of the importance of the WHO FCTC implementation in the fulfilment of human rights *(30)*.

As with the direct adverse health impacts of tobacco use and secondhand smoke exposure *(31)*, the direct adverse environmental impacts of tobacco cultivation and production are integrated across the entire tobacco supply chain *(25, 32)*. However, these direct effects also create indirect effects, such as loss of ecosystem services *(33, 34)* for which the tobacco industry is responsible. These indirect effects result from all stages of the tobacco life cycle and supply chain and are not restricted to tobacco-growing countries (See Fig. 2).

Fig. 2. Global cigarette life cycle environmental impacts (Mt = megatonnes)



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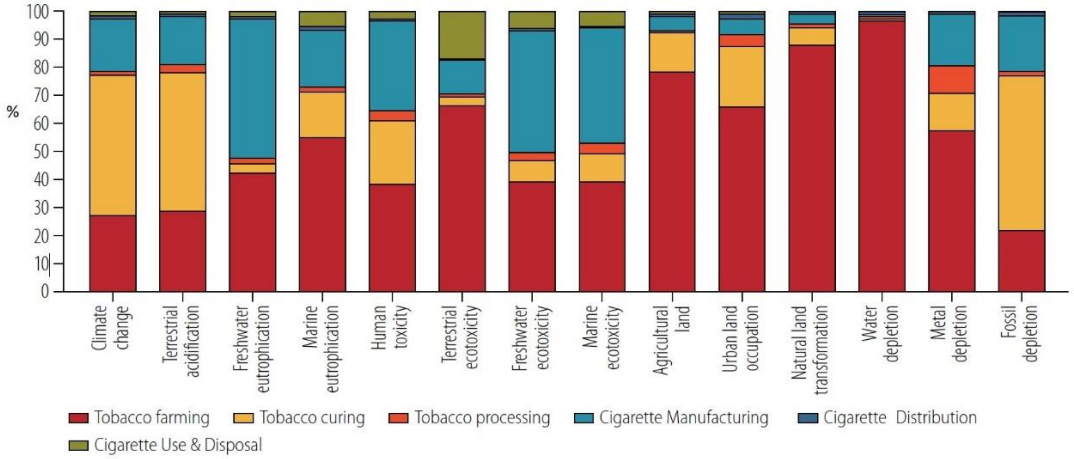
Note: Data in Fig. 2 are based on global cigarette sales in 2014 (5.79 trillion); recent global annual sales (2020) are an estimated 4.78 trillion, according to *The Tobacco Atlas* 2022 *(35)*.

The bulk of adverse environmental impacts related to cultivation and curing of tobacco occur in low- and middle-income countries *(36)*. Although more research is needed, including about products other than cigarettes, to precisely catalogue the local and global environmental impacts of tobacco cultivation, production, distribution, use, and discarding, there is no doubt that cigarette production contributes to a broad range of adverse environmental impacts globally (Fig. 3). Most of the known environmental burden results from tobacco cultivation and curing *(13, 26)*.

Fig. 3. Environmental impacts across the full life cycle of cigarette production and consumption, 2014; percentage contribution of tobacco life cycle components to total adverse environmental impacts by category



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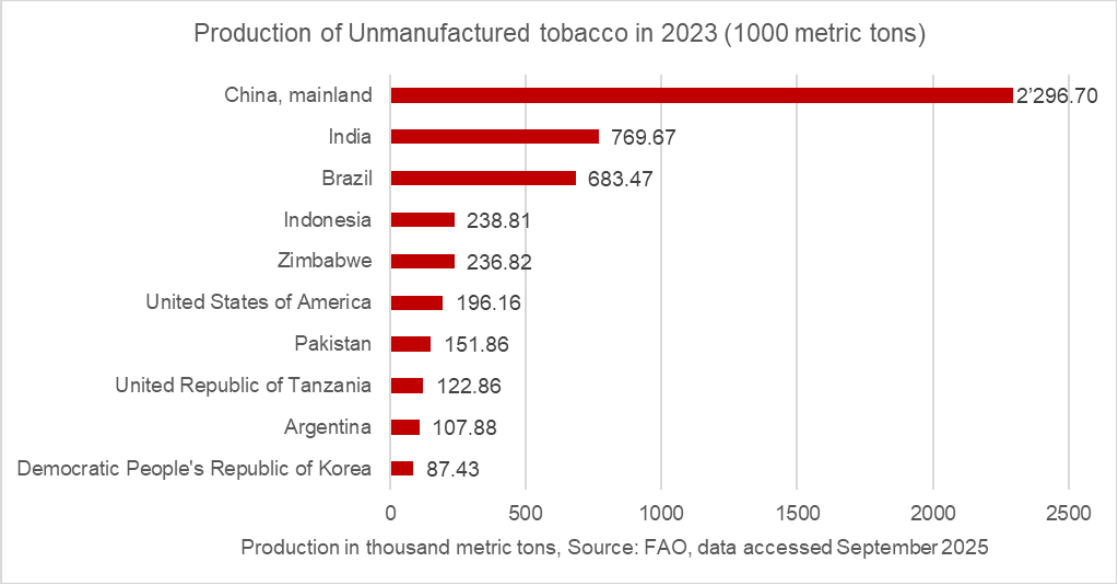
In contrast, the accumulation of profits and assets by tobacco transnationals, the four largest being Philip Morris International, British American Tobacco, Imperial Brands, and Japan Tobacco International, occurs mostly in high-income home countries *(37)*. The largest global grower, China National Tobacco Company, however, sells mainly to its domestic market (See Fig.4).

Fig. 4. Leading Unmanufactured Tobacco Producing Countries, 2023



Source: FAO (https://www.fao.org/faostat/en/#data/QCL).

Data regarding production of other tobacco products, or production of ENDS, are scarce, but there are increasing ethical and environmental concerns arising from the growing demand for lithium and other rare mineral mining activities, often used in related electronic devices *(38)*. Of concern is the competition for scarce water resources (an estimated 400 000 litres of water is required to produce one tonne of lithium) *(39)*. Water usage, allocation of mining revenues, and working conditions for people mining lithium are growing social justice challenges *(40)*. A report from Mexico on heated tobacco products (HTP) suggested that the supply chain for HTP devices depends significantly on the mineral extractive industry *(41)*. Thus, production of HTP, as well as production of ENDS, create additional environmental and human rights harms even as the use of cigarettes declines.

Environmental harms associated with tobacco cultivation and curing

Tobacco is grown in 124 countries, taking up 3.2 million hectares of fertile land and wasting resources that could be used to grow food instead *(12)*. The data in Fig. 3 demonstrate, among other harms, the significant annual global environmental impacts of tobacco cultivation, including the millions of hectares of land used to support production and curing, water use

for crop irrigation, fertiliser runoff causing eutrophication[1] of aquatic environments, and pesticide runoff that poisons ecosystems.

Tobacco cultivation's environmental impact is of more concern than for other crops, including food. The processes involved in tobacco cultivation - seedling production, soil management, irrigation, the use of agrochemicals (pesticides and fertilisers), harvesting, flue curing, and the burning of the crop residue – all have substantial environmental consequences *(14)*. Moreover, by comparison to other crops, tobacco is resource intensive, rapidly exhausting soil in which it is grown *(42)*. This means that new land needs to be cleared or that substantial inputs of fertiliser and pesticides are required to maintain tobacco cultivation in the same locations.

Approximately 200 000 hectares (ha) of land are cleared each year for tobacco cultivation and to obtain wood fuel for tobacco curing *(12)*. Flue curing of tobacco involves drying green tobacco leaf in closed barns with external furnaces, usually wood or coal-fired, to heat them. Fire curing involves direct hardwood fire heating the green leaves within the barns. The deforestation resulting from the demands for cropland and for wood used in these curing processes is approximately 5% of annual global deforestation *(12)*. Additionally, tobacco growing causes soil erosion, and desertification from tobacco cultivation has been observed in numerous countries *(13)*. Additional concerns include: resources needed to build and run agricultural machinery, plastics used in mulching soils, and plastic sheeting used to reduce soil erosion *(43)*.

Environmental harms associated with tobacco processing and manufacturing

Cured or uncured tobacco leaf is boxed and shipped to factories where it is manufactured into cigarettes and other tobacco products *(13, 44)*. Non-tobacco inputs to manufacturing include plastic filters, flavourings, other additives, and cigarette paper as well as boxes, cartons, cellophane, and other plastic packaging *(45)*. As with other manufacturing processes, the direct environmental impacts of tobacco production include emissions due to energy use from manufacturing and other services such as heating, lighting, and air conditioning. Disposal of wastewater and solid waste from

manufacturing also have environmental impacts *(44)*. Liquid waste includes tobacco slurries, solvents, oils, and greases that originate in the manufacturing processes, as well as liquid waste from building services and facilities that may need special treatment or disposal. Solid waste includes paper, wood, plastics, unusable tobacco, packaging materials, and dirt that originate in the manufacturing process *(46)*.

It is difficult to quantify the specific environmental impacts of tobacco manufacturing, given the lack of transparency about production practices by the tobacco industry. The tobacco industry's recent voluntary efforts to claim environmental improvements (ESG reporting), promoting respectability and investment potential in manufacturing and management have been criticized for lack of impact on farmers and support for tobacco industry "greenwashing" *(23)*. The tobacco industry incorrectly identifies manufacturing as the most environment-destroying step of tobacco production, when in fact extensive environmental harms exist along the whole supply chain *(44)*.

Environmental harms associated with transport and distribution of tobacco products

The transport and distribution of tobacco products from manufacturers to distributors produces CO_2 emissions *(13, 44)*. Although tobacco cultivation is the largest contributor to the supply chain's CO_2 emissions, about one third is attributable to manufacturing and logistics of distribution *(44)*. Because cigarettes and other tobacco-related products are fast-moving consumer goods *(47, 48)*, meaning products consumed and replaced frequently by consumers, the logistics needed to sustain tobacco consumption require multiple transportation systems and sales channels. These include land, sea, and air transport, and utilize supermarkets, convenience stores, specific tobacco retailers, online retailers, and more, all of which contribute to CO_2 emissions.

Environmental harms associated with marketing of tobacco products

Substantial resources are also devoted to advertising and promotional activities for tobacco products. These activities include, but are not limited to,

magazines, outdoor, point-of-sale, direct mail, promotional allowances and discounts, sampling, consumer engagement, public entertainment, sponsorships, coupons, website, internet and social media *(49)*. Decision FCTC/COP10(23) *(50)* recognized that tobacco companies and those working to further their interests increasingly use digital communication platforms for tobacco advertising, promotion and sponsorship *(50)*. Digital media-sharing platforms involve direct product promotions, influencer promotions, commercial promotion posts, event promotions, corporate and campaign promotions, embedded tobacco use and product integration, and sponsored news and infotainment as promotions *(51)*.

In 2022, cigarette companies spent US $8.01 billion on advertising and promotional expenditures in the United States of America (United States) alone *(52)*. The environmental impacts of marketing activities, including corporate social responsibility (CSR) processes, are unknown. They would derive from the utilization of resources such as paper, signage, and electrical energy for social media, artificial intelligence, and other web-based activities *(53)*. Marketing activities may also contribute indirectly to environmental harm by promoting greenwashing industry practices, shifting responsibility onto consumers, and delaying stronger environmental regulation. The objectives of the Guidelines for implementation of Article 12 of the WHO FCTC specifically mention identifying measures related to education, training and communication about the environmental consequences of tobacco production, including marketing *(54)*.

Environmental harms associated with use of tobacco products

Cigarette smoking, cigar smoking, waterpipe smoking, HTP use, and smokeless tobacco use cause adverse health effects that reduce individual economic productivity, well-being and human dignity; beyond these tobacco products, research on the impact of the adverse health effects of other tobacco products and secondhand smoke exposure on economic productivity is more limited *(55, 56)*. In addition, health care is responsible for almost 5% of global greenhouse gas emissions *(57)*, and smoking, a major cause of lung disease, heart disease and cancer, was estimated in a 2012 study to drive 5.7% of global health care spending *(58)*. This 2012 study reported smoking-

attributable economic costs in 152 countries with accessible data where 97% of global smokers reside *(58)*. The study also found direct and indirect economic costs of smoking are highest in North America and Europe, where the tobacco epidemic is most advanced and where health care and productivity losses are expected to be highest *(58)*. The total estimated economic costs of smoking (health expenditures and productivity losses) totalled over US $1.436 trillion, approximately 1.8% of the world's annual gross domestic product for that year. However, according to this same study, almost 40% of this cost occurred in developing countries *(58)*. It is clear therefore that the carbon footprint and other health system environmental impacts of treating tobacco-attributable diseases should also be considered an economic externality that should be added on to the direct financial costs of health care, indirect costs due to lost productivity, intergenerational harms, and the human misery caused by tobacco use *(59)*.

Secondhand smoke (SHS) is a recognized environmental health hazard *(31)*. Despite a gradual decline in global tobacco use over time *(60)*, exposure to SHS is harmful to health and has negative economic impacts *(61)*. The 2019 Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) estimated that 1.3 million (range 1.0–1.6) deaths were attributable to SHS globally in 2019, with the largest burden concentrated in low- and middle-income countries *(62)*. The environmental impact of health care due to multiple SHS-related diseases is unknown but likely to be substantial *(63)*.

The environmental and health impacts of exposure to *(64)* thirdhand smoke (THS) *(65, 66)* are of potential concern. THS persists in residential and commercial settings in the air, dust, and surfaces and cannot be eliminated through ventilation, vacuuming, or standard cleaning measures *(65)*. THS has also been shown to contaminate the skin of children exposed in homes where there has been smoking and to create risks for respiratory problems, developmental delays, hyperactivity, metabolic changes and DNA damage *(10)*.

Cigarettes are also a leading cause of deadly house fires and wildfires *(67, 68)*, with devastating environmental impacts, aside from the deaths and injuries due to these fires. Environmental harms of wildfires include the

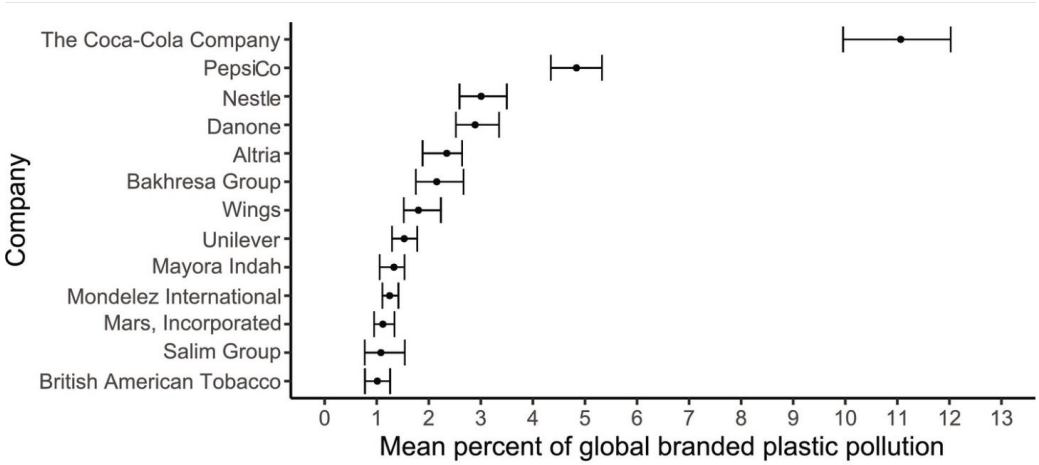
emission of greenhouse gases and particulates, and the destruction of ecosystems *(67)*.

Environmental harms associated with disposal of tobacco products

Cigarette butts

Trillions of cigarette butts are discarded every year, and these discards are a major source for plastic waste due to the cellulose acetate filter found on more than 90% of all commercial cigarettes *(69)*. To put the scale of this in context, some tobacco companies are among the top 10 companies whose brands were identified during global trash audit events in 2018—2022 (Fig.5) *(70)*. Each was responsible for producing more than 1% of global branded plastic pollution *(70)*. See Chapter 2 for further discussion of plastic waste concerns.

Fig.5. Top branded waste (2018—2022). Companies are shown only if their mean percentage exceeds 1% of the total branded plastic



Source: Used with permission, W. Cowger.

Environmental harms associated with heated tobacco products and electronic nicotine delivery systems

The production of and increasing use of HTPs and ENDS raises additional environmental waste concerns *(45, 71)*. These products are also a source of plastic, electronic, chemical and metal waste; of particular concern in the case of single-use ENDS. ENDS waste has been deemed hazardous by

environmental regulatory agencies, such as the US Environmental Protection Agency and the European Chemicals Agency, mainly owing to the residual nicotine, and other toxicants, in discarded ENDS products *(72-74)*. With the rise in sales of HTPs and single-use ENDS *(75-77)*, there is the potential for an increase in environmental hazards caused by the disposal of these products.

A study in San Francisco Bay Area, California *(78)* found that used ENDS cartridges are often discarded into the environment. ENDS cartridges contain endocrine-disrupting plastics (bisphenols and phthalates), electronic circuitry, and the residue of concentrated nicotine extracts *(44, 79)*. Lithium-ion batteries used in HTPs and ENDS are disposed of in ways that harm the environment and are a potential fire risk *(80)*. The batteries contain hazardous nickel, cobalt, and toxic organic solvents, which can leach out into waterways *(72)*.

Environmental harms associated with disposal of seized illicit tobacco products and illicit electronic nicotine delivery systems

It is estimated that 1 in 7 cigarette packages sold in low- and middle-income countries are illicit *(81)*; estimates from Latin America suggest rates of illicit trade are up to 12% of total cigarette consumption *(82)*. Governments seize illicitly traded (or manufactured) tobacco products, and then are faced with disposing of these hazardous, tobacco and nicotine-containing products (along with any plastics, metals, batteries and packaging materials) according to WHO FCTC Article 15, using environmentally-friendly methods where feasible, or disposed of in accordance with national law. Historically, seized goods (tobacco or non-tobacco) were auctioned off to dispose of them, but tobacco products are not ordinary goods; they harm health, and as waste, they harm the environment. Landfilling and incineration are the two disposal methods for disposal of confiscated products; however, both methods are costly and may pose human exposure risks from hazardous chemicals and fumes *(83)*. There is insufficient information about the environmental consequences of incinerating confiscated tobacco products, including HTP, or

ENDS; however, some countries have embraced Energy from Waste practices that may be used for disposal of the confiscated products as solid waste *(84)*.

Article 18 of the Protocol to Eliminate Illicit Trade in Tobacco Products states that: “all confiscated tobacco, tobacco products and manufacturing equipment shall be destroyed, using environmentally friendly methods to the greatest extent possible, or disposed of in accordance with national law” *(85)*. Twenty-eight Parties to the Protocol reported that all confiscated tobacco, tobacco products and manufacturing equipment had been destroyed in their jurisdictions, with 26 Protocol Parties reporting that they use environmentally friendly methods for destroying or disposing of the confiscated tobacco products *(86)*.

Tobacco industry response

For the past several decades, the tobacco industry has applied CSR strategies to avoid accountability for the environmental and other harms it causes *(2)*. The 2023 Global Tobacco Industry Interference Index report *(87)* found that tobacco companies involved several WHO FCTC Parties in industry-sponsored environmental campaigns *(87)*. Such industry-promoted “solutions” to the environmental harms of tobacco use can also be considered as “greenwashing”*(88)*. Clean-ups of cigarette butt litter and other public relations campaigns have a trivial impact on these harms and are not scalable to reduce the global environmental burden of TPW *(89)*. Further, greenwashing can interfere with implementation of effective regulations to address the causes of these harms along the entire supply chain *(16, 24, 90-92)*. Emerging and re-emerging tobacco products also do not address the environmental harms of tobacco and instead add to these harms with discarded plastic and electronic components *(33, 93, 94)*. Chapter 2 discusses the environmental burden of various tobacco and nicotine waste products.

It is also important to differentiate CSR from environmental, social, and governance (ESG) strategies. In short, CSR refers to internal corporate

frameworks, while ESG provides a non-financial assessment of societal impact, respectability, and investment potential as an external corporate assessment. CSR includes philanthropy, community engagement and ethical labour practices *(95)*, while ESG reporting allows tobacco companies to promote their CSR initiatives. Both these approaches seek to obscure the health, economic and environmental damage caused by tobacco products *(3)*. Tobacco industry CSR efforts that purport to address environmental justice issues, such as those related to tobacco cultivation, labour practices and TPW damage in communities most affected by tobacco use, do not do so to any meaningful extent *(88)*.

As will be addressed in Chapter 3 of this report, the WHO FCTC Parties need to remain vigilant to ensure that they are not embracing, supporting, or endorsing tobacco industry-led CSR or ESG strategies that have no meaningful impact on the prevention of tobacco-related environmental harms. These include, *inter alia*, supporting ineffective agricultural reforms, providing “organically grown” tobacco leaf, achieving carbon neutrality in manufacturing and distribution, supporting environmental clean-up campaigns and recycling schemes, developing and marketing biodegradable filters, placing and distributing bins and hand-held ashtrays, and financing EPR schemes that allow tobacco companies to buy-out costs for TPW clean-ups without taking full responsibility and accountability for the environmental damage caused by their products *(16, 96-99)*.

An additional concern is the other industries that operate in the tobacco supply chain *(45, 100, 101)*. For example, these include companies that provide pesticides and agricultural material specific to tobacco cultivation *(14)*, the companies that provide film and packaging material for tobacco products *(100)*, and the chemical companies that supply cellulose acetate for manufacturing filtered cigarettes *(102)*. One study found that companies involved in the tobacco supply-chain often reported their ESG efforts while being less transparent about their connections to tobacco manufacturing *(101)*.

Summary

Tobacco products are unlike other commercial products in that they create enormous human health, economic and environmental damage when used as intended. Eliminating the environmental harms caused by tobacco cultivation, manufacturing, distribution, use, and disposal means reducing production and use altogether. The entire life cycle of tobacco products creates substantial environmental damage, and the tobacco industry should be held accountable for those damage. Approximately 14 g of CO_2 are emitted per cigarette over its entire production chain *(26)*.

Cultivation and curing are reported to account for the bulk of tobacco's adverse environmental impacts through deforestation, land degradation, water depletion and pesticide use. Based on 2014 estimated levels of cigarette sales at 5.79 trillion (estimated global annual sales in 2020 4.78 trillion) *(35)*, the total annual contribution of the tobacco product life cycle to climate change is approximately 80 megatonnes CO_2 equivalent *(103)*. The vast majority of this is from cultivation (17.2 megatonnes) and curing of tobacco leaves (36.9 megatonnes) *(26)*. In addition, global tobacco production uses approximately 22 billion tonnes of water *(26)*. A single cigarette requires about 3.7 litres of water over its life cycle, from growing/cultivation, manufacturing, transportation, use and disposal *(26)*.

These activities take place in and impact some of the poorest countries in the world. However, given the increasing evidence about the environmental harms due to the manufacturing, distribution, use, and disposal of tobacco products, such as HTPs and nicotine products, including ENDS, as well as the environmental impacts of health care provided for tobacco-attributable diseases, concerns for the environmental harms of tobacco must extend beyond tobacco cultivation and curing.

It is important to protect tobacco-related environmental policies from the commercial and vested interests of the tobacco industry and those working to further its interests. This is particularly important with regard to environmental protection policies in which the tobacco industry has established opportunities to interfere with tobacco regulatory policies, to

engage in CSR activities that do not result in reduced environmental harms from tobacco production and use, and to avoid effective regulatory policies.

Chapter 2. Post-consumption tobacco product waste

Introduction

Tobacco product waste (TPW) and waste from nicotine products includes all discarded materials produced through tobacco and nicotine product consumption whether in a solid, semi-solid, liquid, or gaseous form *(104)*. TPW is post-consumption waste regardless of where this material ends up, including ashtrays, rubbish bins, sidewalks, parking lots, roadways, storm drains, wastewater facilities, landfills, beaches, and other habitats.

Most TPW attention has focused on discarded cigarette butts, but environmental concerns have arisen about toxic chemicals and waste from other tobacco products as well as tobacco products' packaging *(104)*. TPW thus includes discarded material from commercial cigarettes as well as roll-your-own cigarettes, HTPs, kreteks, cigars, little cigars, cigarillos, bidis, betel quid, pipe tobacco, waterpipe wastes, smokeless chewing tobacco, moist snus, dry snuff, and all other products that contain tobacco. Discarded ENDS and other nicotine products are also post-consumption waste.

Reports of human and domestic animal nicotine poisoning from cigarette butt waste consumption are uncommon, but accidental ingestion of cigarette butts by children and animals has been reported by poison control centres *(105)*. Poison centre reports also indicate a potential problem with child ingestion of discarded HTP sticks *(106)*.

This chapter mostly focuses on discarded cigarette butts, the single most collected global waste item *(107)* starting with a review of what has been referred to as "filter fraud" *(108)* one of the most successful tobacco industry marketing tools.

Cigarette filters do not reduce the risks of smoking

There is widespread agreement among health professionals and tobacco control experts that the cellulose acetate or any other type of filter has not diminished the overwhelming health risks of smoking. Filters may reduce the machine-measured tar and nicotine delivery of commercial cigarette,

achieved through cigarette design changes over the last several decades. However, machine measurements do not represent human smoking given the variability of inhalation and compensatory smoking by smokers and these laboratory-measured reductions, do not translate into a meaningful reduction in smokers' exposure to tobacco toxicants and the adverse outcomes of these exposures *(108-110)*.

With the publication of several cohort studies in the United States and the United Kingdom of Great Britain and Northern Ireland (United Kingdom) demonstrating the adverse health effects of smoking, by 1990, the demand for what were believed to be lower risk cigarettes grew, and thus nearly all cigarettes sold in the United States were filtered. While early epidemiological evidence from cohort studies suggested a health advantage of filtered cigarettes relative to unfiltered, these studies neglected to differentiate the amount of tobacco in filtered cigarettes (less tobacco) vs. unfiltered cigarettes (more tobacco) and cigarette design, among other confounding factors *(109, 111-115)*. In addition, since the 1990s, the predominant lung cancer cell-type has shifted to the more deadly adenocarcinoma, displacing squamous cell lung cancer, which predominated in the decades before filters became nearly universal *(109, 112)*. This shift was due to changes in cigarette design over previous decades *(112)* including widespread adoption of the cellulose acetate filter, the incorporation of filter ventilation, and changes in product formulation *(113-115)*.

Cigarette filters became a successful marketing tool for the tobacco industry in their attempt to counteract growing concerns in the 1950s and 1960s for the adverse health effects of smoking *(108, 116, 117)*. The word "filter" itself implies that all harmful substances are removed from the smoke that passes through the filter *(108).* While some particulates and chemicals are retained in the filter, filters have not prevented the adverse health effects of smoking *(89, 118, 119).*

Despite the evidence of filters' inability to eliminate toxic tobacco chemicals and particulates, or to reduce population risks for smoking-attributable diseases, there still are substantial misperceptions about their

potential health value *(120, 121)*. The intense, and misleading, marketing of the alleged health benefits of filters, ventilation, and other design features that do not decrease exposure risks, has led smokers to think that that filtered cigarettes are somehow safer *(122)*. Filters mainly make smoking more palatable and more appealing, and thus, they sustain misconceptions about their role in reducing the health risks of smoking while supporting commercial cigarette sales *(119)*.

Cigarette butts

The discarded butts from commercial cigarettes are the predominant type of TPW globally. Discarded butts typically include shredded tobacco leaf remnants along with chemical additives and other ingredients in processed tobacco, a filter (almost uniformly made of cellulose acetate plastic), plasticizers (such as diacetin and triacetin that make the cellulose acetate fibres flexible), burnt tobacco ash, and tipping paper *(107)*.

Of the 4.78 trillion cigarettes sold in 2020, more than 90% were filtered *(123)*. Although it is uncertain as to the total number of cigarette butts that are discarded into the environment each year, self-reported data from people who smoke commercial cigarettes suggest that most of them have discarded butts improperly during their lifetimes *(68, 124-128)*. Using the percentage estimates provided in research reports and other assessments of cigarette butt discarding behaviour *(68, 124-128)*, an estimated range of 33-75% of cigarette butts from filtered cigarettes smoked may be discarded into the environment. Based on 2020 global estimates of cigarette sales above, this would be equivalent to an estimated range of 1.58 to 3.59 trillion butts discarded every year.

A growing number of laboratory studies document the chemical toxicity of cigarette butt leachates, but there is a need for more research to document impacts on ecosystems, wildlife and human health that go beyond simply identifying exposure pathways in laboratory settings *(25, 67)*.

Plastic pollution from cigarette filters

Almost all cigarette filters are made of cellulose acetate *(89)*, which is a plant-based material derived by treating cellulose from cotton and wood pulp

with acetic anhydride and acetic acid *(102, 129)*. Cellulose acetate is also found in other products such as photographic film, rayon, eyeglasses, toothbrushes, and ink reservoirs *(130)*. Based on the range of global estimates of cigarette butt littering described above (at 0.31gm each butt), the estimated yearly total global weight of discarded butts in 2020 was between 489 800 and 1.129 000 tonnes. Of these totals, the plastic filter (average weight 0.14 g per butt) is attached to at least 90% of cigarettes sold. Therefore, the total weight of plastic waste discarded as cigarette butts annually is an estimated at 143 100 to 323 100 tonnes.

A cigarette filter has 12 000—15 000 cellulose acetate strands, and when butts are discarded into aquatic or terrestrial environments, the strands can detach and disperse, producing microplastic fibres, defined as a plastic piece sized from 1 nm to less than 5 mm, or a fibre with length from 3 mm to 15 mm *(131, 132)*. The filter itself is larger than 5 mm and is therefore a macroplastic *(133)*. Of concern for the environment, is what happens to the microplastics from the filters when they degrade and disperse under varying conditions, potentially adding significant amounts of microplastic fibres into the environment *(68, 134)*.

Cellulose acetate has been identified in urban water runoff; meaning water washed from streets and other urban landscapes, where discarded cigarette butts (rather than rayon or cotton clothing, eyeglasses, or other cellulose acetate products) have been discarded *(135)*. However, current methods of polymer identification do not distinguish between cellulose acetate fibres and other non-acetylated cellulosic fibres, such as cotton, found in these field studies.

Numerous laboratory studies provide evidence of potential harms caused by microplastic fibres derived from cigarette filters. One study assessed the ecotoxicity of microplastic fibres from smoked cigarette filters on water fleas and found that the breakdown of the filter into microfibres induced more toxicity than that from the filters that had not been degraded into microfibres *(134)*. The role of toxic chemicals produced by tobacco smoke that

then combine with discarded filter microplastics to contaminate the environment is also of concern *(25)*.

Evidence is emerging on the human health risks of exposure to micro- and nano-plastic fibres *(136)*. There is also growing concern about soil, water and food sources that may impact not only plant and animal health, but also human health *(131, 137)*. Microplastics have been found in human tissue and fluid samples (lungs, blood vessels, blood, brain, placenta, faeces) *(45, 138)*. The proportion of these micro- and nano-plastics that are sourced from plastic cigarette filters is unknown.

In addition to environmental concerns about microplastic fibres from cigarette filters, cellulose acetate fibres have also been shown to be present in the lungs of filtered cigarette smokers. Indeed, the tobacco industry became aware in the 1960s that all cigarette filters release fibres that can deposit directly into the lungs of people who smoke *(123)*. Subsequently, tobacco industry documents, patent applications, and other scientific reports have confirmed the problem of “filter fallout” from filtered cigarettes *(123)*. However, toxicological studies regarding filter particle inhalation and possible associated human health risks are scarce.

Chemical toxicity of cigarette butts

Cigarette smoke contains more than 7000 chemicals, of which 70 are known carcinogens *(139)*. Many of these chemicals are environmental pollutants that have been detected in leachates from discarded cigarette butts as well as from waterpipe water and smokeless tobacco wastes *(140-143)*. Numerous studies have found that nicotine rapidly leaches from cigarette butts, contaminating water at levels that are toxic to living organisms *(144)*. Cigarette butts might also be categorized as hazardous waste owing to the presence of nicotine and other toxic chemicals incompletely captured in them that are listed as hazardous chemicals by regulatory agencies *(145, 146)*.

There has been extensive laboratory research on the potential ecotoxicity of cigarette butt waste *(147-152)*. These studies have involved microorganisms, insects, aquatic invertebrates and vertebrates, terrestrial animals, birds, plants and *in vitro* human cells. Plant growth and development

may also suffer due to exposure to discarded cigarette butts *(153, 154)*. Field research has been more limited, but studies of urban runoff, wastewater, drinking water sources, beach environments, illuminate the filter's role as toxic, hazardous waste *(104)*.

Separately collected cigarettes butts such as from clean-up campaigns and other schemes *(99)* now provide a new hazardous waste stream that has been little studied to date. Cigarette butt waste is not yet entered into the European List of Waste *(146)*, but could be classified as hazardous if the waste material has one of 15 proscribed hazardous properties *(155)*. Rebischung et al. (2018) *(146)* reported on analyses of collected cigarette butt waste and found that cigarette butts and leachates were highly toxic to terrestrial and aquatic organisms, and the main toxic chemical in the waste was nicotine *(146)*. They concluded that cigarette butts should be classified as hazardous waste, meeting criteria for acute toxicity and ecotoxicity. Although more complete analyses of all compounds found in the cigarette butt waste stream should be conducted *(146)*, they recommended a relevant specific code for cigarette butt waste in the European List of Waste *(146, 156)*.

Bioaccumulation of tobacco chemicals from cigarette butts

One study identified approximately 800 chemical constituents in fresh and saltwater cigarette butt leachates; nicotine was the most abundant chemical, followed by diacetin and triacetin *(157)*. These chemicals were studied for the potential of bioaccumulation in rainbow trout and mussels (potential human food sources), and several were found to do so *(158, 159)*. In these studies, the leachates of cigarettes butts also produced genotoxicity and cytotoxicity responses in the test organisms, suggesting a potential risk to human health through consumption of aquatic organisms exposed to environmental tobacco toxins *(158, 159)*.

Biodegradability of discarded cigarette filters

Discarded cigarette filters may persist for variable time periods, from 18 months (in controlled compost environments) to more than five years (in controlled laboratory studies). In addition, smoked filters have been found to degrade less readily than unsmoked filters *(160-162)*. Although there is little research to date on the wider ecological impacts of cigarette butts on

organism populations, species diversity, or ecosystem functioning, the increasing evidence from laboratory studies suggest that they pose a potentially significant risk to the environment *(161)*.

The tobacco industry, and related entities, have worked to present biodegradable filters as a solution to the negative environmental impacts of the cellulose acetate filter *(163)*. The tobacco industry was aware of environmental concerns about the poor biodegradability of cellulose acetate filters for several decades *(164)*. Internal tobacco industry documents suggest that tobacco companies were aware of challenges with biodegradability, but their reports were not published in scientific journals *(164)*.

Although ultraviolet light (such as sunlight) may hasten degradation of cellulose acetate, full degradation of cigarette butts under “normal natural conditions” has not been shown *(129)*. Hence, they should be considered poorly degradable. Further, any cigarette filter biodegradability is dependent on the environmental conditions in which they are discarded, including pH, temperature, moisture, oxygen, sunlight, contaminants, microbial actions and location *(161)*.

Bonanomi, et al. (2015) published one of the few peer-reviewed multi-year scientific studies on the biodegradability of cigarette butts *(160)*. They measured the degradation of cigarette butts across various natural conditions in both laboratory and field conditions for five years (including sand dunes and grasslands) *(160)*. The researchers attributed the poor degradability of the cigarette butt to the cellulose acetate filter being resistant to microbial activity due to its high degree of acetylation *(160)*.

A study by Belzagui et al. (2021) reported results of a controlled laboratory study using pulverized smoked filters *(134)*. They did not observe chemical decomposition in the whole filters after a year and a half of variable freshwater and sunlight laboratory conditions *(134)*. After integrating the pulverized smoked filters into an active compost environment (an ideal setting with microbes, moisture, and oxygen available), the cellulose acetate mostly degraded by 151 days. However, such an active compost resource is not readily found in nature nor in municipal waste management systems *(134)*.

Despite the poor biodegradability of the cellulose acetate filter, biodegradable filters are not a solution to the enormous burden of cigarette butt waste *(108)*. The fundamental problem is that any filter is essentially a misleading marketing tool that does not prevent smoking attributable diseases. The problems with biodegradable filters are further discussed in Chapter 3.

Waterpipe tobacco

Waterpipe tobacco smoking is a global public health concern with a growing prevalence of use among young persons *(165)*. It also potentially leads to an increase in environmental pollution. For example, a US study reported that from each 10 g of freshly used tobacco for each waterpipe smoking session, about 71% remained as wastes and entered the environment through different pathways *(166)*. In waterpipe smoking, charcoal burns tobacco and flavourants in a clay or metal head, and thus waterpipe smoking wastes are the burnt or partially burnt tobacco residues and flavourants in the waterpipe head at the end of each use, including charcoal ash, used tobacco residue, aluminium foil and sometimes disposable mouthpieces.

Waterpipe tobacco residue and charcoal waste contain potentially harmful substances (such as, arsenic, cadmium, cobalt, chromium, nickel, lead, selenium, PAHs, acrolein, formaldehyde, volatile organic compounds such as benzene and isoprene, phenols, and tobacco-specific nitrosamines) *(167, 168)*. Of 38 chemicals in waterpipe wastewater, 20 are listed as harmful or potentially harmful constituents by the U.S. Food and Drug Administration; 15 are considered hazardous waste *(169)*.

Toxic chemicals accumulate in waterpipe water as well as being present in the unburnt tobacco remnants from waterpipe use *(143, 169)*. Post-consumption waste (burned and unburned tobacco and flavourants) from waterpipes has been shown in the laboratory to leach toxic chemicals *(170, 171)*. These toxins may accumulate in the soil and water systems through the disposal of waterpipe wastewater *(172)*. Microplastics have been detected in the tobacco used for waterpipe smoking (unsmoked and smoked), with higher

concentrations found in fruit flavoured waterpipe tobacco *(173)*. Aquatic systems and organisms may be the most vulnerable to waterpipe waste contamination, which may ultimately reach water bodies through rainwater or onsite drainage systems *(143)*. Wastewater treatment may curtail some of these contaminants, but the environmental impact of the discarded used and unused tobacco and the waterpipe water has not been sufficiently studied in field research *(143)*. Unlike cigarette litter, waterpipe water cannot be retrieved once it is released into the environment; estimating the environmental impact of waterpipe waste is challenging given the variability of use across regions and the current lack of specific regulations for disposal of waterpipe wastes *(169)*.

Smokeless tobacco

Although limited, the available evidence suggests that the chemical content of smokeless tobacco (SLT) products warrants consideration as toxic waste similarly to discarded cigarette butts *(174, 175)*. A 2022 observational study of transit routes in nine Indian cities identified 17 261 pieces of tobacco product litter with SLT packaging comprising 62% of all identified tobacco waste products *(176)*. Another study estimated the weight of tobacco waste products in India to total 170 331 (± 29 332) tonnes annually, of which two thirds of the overall TPW in India was from SLT *(177)*. The pouches used in some SLT products and nicotine products are an additional source of waste when discarded *(178)*, *(179)*. In Sweden, an estimated 1100 tonnes from 1.4 billion snus pouches, estimated at 4 million per day, were disposed of in toilet wastewater in 2016; concern was raised about this waste specifically as a source of cadmium exposure through the contamination of seafood by this wastewater *(180)*.

Heated tobacco products

Discarded heated tobacco products (HTPs) are both TPW and electronic waste. The components of discarded HTP devices include plastic, electronic and metal parts, and lithium-ion batteries *(181)*. HTPs contain tobacco that is heated in disposable tobacco sticks or pods and may have filters, and other polymers as waste products *(182)*. HTP waste from tobacco

sticks and capsules includes scorched tobacco, plastic filters and casings with tobacco residues *(183, 184)*. HTP waste also includes chargers with electronic components and packaging made of plastic and printed paper. HTP waste has been found to leach metals in laboratory studies and natural environments, and thus they can act as a source of metal contamination in the environment, just as with other tobacco products *(185)*. However, information is lacking about the specific composition of HTP devices and sticks and the toxicity levels of waste produced during HTP production and use, making it difficult to assess the associated risks *(182)*.

Electronic nicotine delivery systems

As noted above, some Parties regulate ENDS as tobacco products. Discarded ENDS, including refillable and single-use ENDS, are a growing waste problem *(186)*. Electronic waste includes ENDS electrical circuitry, including chargers in some cases, and lithium-ion batteries, which pose fire risks *(80)*. Additionally, discarded ENDS contain plastic, metals, rubber *(71)*, and e-liquid residues of chemicals, principally nicotine, propylene glycol, vegetable glycerine, and flavourings, some of which are suspected carcinogens *(187)*. Some discarded ENDS devices also have the potential to exceed US Environmental Protection Agency (EPA) hazardous waste thresholds for lead *(188, 189)*.

Total ENDS global sales are increasing *(76)*, suggesting that billions of these hazardous electronic, metal containing, and plastic waste products are being discarded into the environment globally each year each *(72, 190)*. The Government of the United Kingdom reported that an estimated 5 million single-use ENDS were discarded each week in 2023 in the United Kingdom, equivalent to two per second *(191, 192)*. The Government also reported that the number of ENDS discarded rose to an estimated 8.2 million per week in 2024, including single-use and “pod type” ENDS *(192, 193)*. To address the growing problems of this waste, the Government of the United Kingdom banned the sale of single-use ENDS, including ENNDS, in June 2025; other countries with sales bans are discussed in Chapter 3 *(193)*.

Packaging and plastic waste in tobacco products

Tobacco and nicotine product waste may also include packaging and accessories made of cellophane, plastic, foil, metals, glue, wood, and paper *(103)*. It is difficult to fully quantify the diverse tobacco packaging waste stream. In 2021, one estimate suggested that cartons and boxes used for distribution and packing of tobacco products produced at least 2 million tonnes of waste *(103)*.

Economic costs of tobacco product waste

Tobacco product waste (TPW) causes a negative economic externality caused by the tobacco industry and is borne by governments, communities, voluntary groups and businesses *(34, 194, 195)*. Assessing the costs of TPW to local, state, provincial, and national governments can justify economic and legal interventions against TPW waste.

Estimating the costs of cigarette butt waste

The total costs of TPW can be estimated by modelling prevention costs, surface abatement costs, system costs, disposal costs and secondary costs *(34)*.

- **Prevention costs** involve public health and voluntary environmental programmes against public smoking and littering, including costs associated with direct government administration and enforcement of laws and regulations regarding waste disposal, smoking in public outdoor spaces, signage and public information campaigns.
- **Surface abatement costs** result from collecting litter from streets, sidewalks, parking lots, beaches, parks, etc. and may be proportionately estimated from existing data sources (based on TPW collection data such as reported in the International Coastal Cleanup events or other area-specific TPW clean-ups) *(194)*.
- **System costs** result from waste management, sewage disposal, and drinking water treatment costs due to TPW, including operations, maintenance and repair costs.

- **Disposal costs** result from costs of TPW waste receptacles, landfill disposal of TPW, recycling schemes and hazardous waste management of TPW (if designated as hazardous waste).
- **Secondary costs** may result from environmental degradation due to TPW, including wildfires caused by cigarette butts, potential long-term impacts of plastic and chemical contamination from TPW (including butts without filters) on the environment and on human health *(136)*, and adverse quality-of-life impacts due to TPW contamination of recreational and natural environments.

To date, there have been few studies of the economic costs of TPW mitigation *(196)*. In 2009, the city of San Francisco commissioned the first economic study that estimated only surface abatement costs to the city of cigarette butt waste (US $0.22 per pack of cigarettes), which then encouraged the city to assess a fee of US $0.20 per pack to recover clean-up costs, fund information campaigns, and administer the fee collection scheme *(197)*. See Chapter 3 for more information and examples of economic cost estimates for TPW under the section on TPW abatement fees.

Summary

Post consumption TPW is a significant environmental concern, with evidence of toxic waste contaminating water, soil, and potentially harming human health. Currently, the costs of mitigating the environmental impact of TPW falls on governments, communities, and voluntary groups, with the tobacco industry often taking advantage of these efforts as part of greenwashing campaigns. While most evidence focused on cigarette butts, there is growing evidence of the environmental harms of smokeless tobacco products, waterpipe, HTPs and ENDS.

Trillions of cigarette filters are discarded into the environment every year. Cigarette filters are one of the most commonly found items of plastic waste globally; they have no proven health benefit and have been shown to be a misleading marketing tool used by the tobacco industry for decades to deceive people who smoke into believing that filtered cigarettes reduce the

adverse health effects of smoking. Regulatory options to prevent the environmental harms of TPW are discussed in Chapter 3.

Chapter 3. Regulatory options to prevent and mitigate tobacco product waste

A range of existing measures can address some of the environmental damage caused across the tobacco product life cycle. This relates to deforestation, water conservation, pesticides and other chemicals used in agriculture, and CO_2 emissions, among others. Although such regulations might be outside the scope of conventional tobacco control policies, multisectoral coordination within governments is needed to ensure that existing environmental measures are applied to the tobacco production supply chain *(13, 44, 98)*. The increasing recognition that the entire tobacco production chain impedes sustainable development, highlights the need for an increased focus on supply side policies *(198)*.

This chapter reviews various regulatory options that have been proposed and/or implemented to address the environmental impacts of tobacco, sometimes drawing on non-tobacco sectors. All demand and supply reduction measures of the WHO FCTC would address environmental harms by preventing or curbing the potential causes of the environmental harms prior to production or use of tobacco *(199)*, including forward-looking tobacco control measures *(200-202)*. However, the scale of the environmental problems previously described suggests the need for policies that can address current environmental harms caused by tobacco production and use. Implementing Article 18 of the WHO FCTC through an environmental lens will expand tobacco control practices to include environmental advocacy and regulatory interventions; the recommendations discussed in this chapter could all contribute to the implementation of Article 18 of the WHO FCTC.

Regulatory options and measures for tobacco product waste

TPW can be mitigated through a range of approaches, broadly characterized as **upstream**, **midstream**, and **downstream** regulatory options, along with other supporting measures. These regulatory options and measures are described below.

Upstream regulatory options

Upstream regulatory options are those focused on addressing the source of environmental harms and their prevention prior to manufacturing or tobacco product use. These should be prioritized as they address the *source* of tobacco's environmental harms.

Product Regulation—banning sales of cigarette filters

A straightforward way to eliminate the most common type of TPW would be to ban the manufacturing (where relevant), import, distribution and sales of cigarettes with filters. There is currently enough scientific evidence to support such measure. Banning filters was called for by the WHO in 2022 *(103)*, and was a main recommendation of the WHO Report of the twelfth meeting of the WHO Study Group on Tobacco Product Regulation, Barcelona, Spain, which was tabled at the WHO Executive Board meeting 157th session *(119)*. Specifically, the WHO Study Group recommended: "Banning filters to reduce the palatability and appeal of cigarettes, remove consumer misconceptions about filters substantially reducing health harms and reduce a major source of toxic tobacco waste, including the microplastics deposited by cellulose acetate in filters"*(119)*. This option is also listed in the report by the Expert Group on forward-looking tobacco control measures (in relation to Article 2.1 of the WHO FCTC) *(200-202)*. There are parallels to such an intervention in bans or restrictions on single-use plastics (for example, plastic bags, utensils, straws and food containers) across over 100 countries around the world *(203, 204)*.

As of May 2025, only one jurisdiction has banned the sale of filtered cigarettes — Santa Cruz County, California, United States, taking effect in January 2027 *(205)*.

Banning cigarette filters is expected to have a positive effect by reducing the appeal of smoking cigarettes and eliminating misconceptions that filtered cigarettes reduce the adverse health effects of smoking *(108, 119, 123)*. Recent research on public knowledge, opinions, and behaviour regarding a filter ban, generally reports higher levels of support among non-smokers compared to smokers *(206, 207)*. Importantly, a consumer survey

conducted in the Netherlands found that 12% of the smoking respondents indicated that a filter ban would be a direct reason to quit smoking and to smoke less; support for a filter ban was higher among non-smokers (63%) than among smokers (35%) *(69, 208)*. In a four-country 2022 survey of the International Tobacco Control Smoking and Vaping Survey, respondents were asked about support for a ban on cigarette filters *(121)*. Across all four countries, three quarters of adults who smoke erroneously believed that removing filters would make cigarettes more harmful and believing that doing so would make cigarettes much more harmful was the strongest predictor of opposing a filter ban *(121)*. Additional research to understand beliefs, attitudes and behaviour change regarding filtered cigarettes is needed to inform educational efforts in support of a filter ban.

Implementation of a ban on the sale of filtered cigarettes should be monitored to understand the impacts on any changes in toxicant exposure among people who smoke and switching to or uptake of other nicotine products *(209-212)*.

Report by the Belgian Superior Health Council (SHC)

The Federal Minister of Climate, Environment, and Sustainable Development, with consideration of the European Green Deal *(213)*, requested information in 2023 from the Belgian Superior Health Council (SHC) concerning the use of plastic filters in cigarettes. The SHC addressed the following questions: (1) Is there a health benefit of cigarette filters for smokers? (2) Is it possible to ban cigarette filters? (3) Are there plastic-free alternatives to cellulose acetate filters *(214)*?

The SHC concluded that, from a public health perspective, “cigarette filters have no proven benefits in preventing adverse health effects of smoking” *(214)*. On the second question, the SHC concluded that cigarette filters also “cause large environmental pressure” and should therefore be banned *(214)*. On the third question, the SHC “sees no solution in advocating ‘green’ biodegradable filters” *(214)*. The SHC has recommended a general ban on cigarette filters, both at national and international, levels, while continuing to be committed to the prevention of smoking and smoking

cessation *(214)*. The report additionally concluded that a filter ban was recommended due to the "expected reduction in the number of smokers" *(214)*.

Product regulation—banning the use of single-use plastics in tobacco products

Banning the manufacture (where relevant), import, distribution, and sales of other single-use plastic-containing tobacco products, and plastic accessories (such as plastic filters used in non-cigarette tobacco products, for example, little cigars and roll-your-own tobacco) is an additional regulatory option. Beyond filters, banning single use plastic in all tobacco products (such as waterpipe, smokeless, heated tobacco products) as well as plastics included in the packaging is also a regulatory option that would significantly contribute to the implementation of Article 18 of the WHO FCTC. India banned plastic material in *smokeless* tobacco packaging in 2016 and imposed levies after testing packaging and finding that plastic content remained *(215-217)*.

Product regulation—Reporting

Starting in September 2025, Canada will require reporting on plastics, specifically on the manufacture, import, and market placement of products such as tobacco products containing filters, ENDS devices, and ENDS cartridges *(218)*. Reporting requirements, under Canada's Federal Plastics Registry, will then expand from 2026 *(219)*.

Data on reporting and disclosure and monitoring on plastic packaging bans would remain critical to monitor compliance with such interventions.

Supply reduction of commercial tobacco products

Supply reduction refers to a series of policies that aim to reduce the availability of all commercial tobacco products. These include but are not limited to, reducing the number of products available in the market, placing a birth-date based sales restriction on tobacco products to phase out their sale, and/or banning certain tobacco products. These are regulatory options that would reduce TPW *(220)*. Cigarette filters do not eliminate the risks of smoking, and the cigarette itself, to which the filter is attached, has been described as, "the deadliest artefact in the history of human civilization" *(221)*.

The concept of reducing the supply of tobacco products is listed in the report by the Expert Group on forward-looking tobacco control measures (in relation to Article 2.1 of the WHO FCTC) *(201, 202)*.

Banning the sale of electronic nicotine delivery systems

Banning the sales of ENDS or banning the sales of single-use ENDS are other measures that could be considered and could reduce toxic chemical, metal, plastic, and electronic waste *(222-224)*. More than 40 countries and jurisdictions have banned the sale of some or all ENDS *(76)*. Several other countries have focused on banning the sale of single-use ENDS *(193, 225-230)*, citing both environmental and youth protection arguments.

Midstream regulatory options

Midstream regulatory options address TPW during the current use of tobacco products.

Retailer density

One midstream approach to mitigating TPW is through licensing retail outlets that sell tobacco products. Such licensing interventions aim to reduce the availability of tobacco products and include: decrease retailer density and opening hours; restrict point of sales promotion and advertising; and reduce overall exposure among youth to tobacco products marketing *(231-233)*. Such interventions will also impact environmental justice, as tobacco outlet density tends to be higher in economically deprived areas *(234-241)*. Available geographical analyses suggest that TPW is more concentrated around tobacco retail outlets *(242)*. Several jurisdictions have adopted retail licensing policies with the goal of reducing retail density. Implementation and enforcement of these policies may support a reduction in TPW, especially if integrated with other comprehensive intervention programmes *(238)*. This option is also listed in the report by the Expert Group on forward-looking tobacco control measures (in relation to Article 2.1 of the WHO FCTC) *(200)*.

Deposit/refund systems

Many jurisdictions have deposit/refund systems to reduce waste from recyclable or returnable consumer products *(243, 244)*. While these circular economy schemes do reduce environmental waste from larger objects such

as bottles and cans *(11)*, such deposit/return schemes for cigarette butts are not feasible. With trillions of discarded cigarette butts every year worldwide, any deposit/refund system would likely only remove a tiny fraction of these from the environment. Additionally, the infrastructure required to implement an effective deposit/refund system would likely not be feasible given the toxicity and unpleasantness of the collected butts, the difficulties in enforcing such a scheme, and the lack of any scalable market for recycled cigarette butt-based products. Although multiple studies have reported on the processing of cigarette butts such that they may be used in various consumer products, implementing these recycling schemes are unlikely to be feasible outside of the laboratory setting. Marinello et al. (2020) *(163)* highlight the fact that collection of cigarette butts for commercial recycling purposes will require large-scale logistical systems for collection and transportation *(163)*. A more important consideration is the toxicity of both the cigarette butt substrate and the potential toxicity of the output products and/or by-products of manufacturing. Smoked cigarette butts contain toxic compounds and recycling them will not necessarily remove toxicity. Additional safe handling measures would be needed to minimize risks to those handling these returns. Above all, any policies focusing on a deposit/refund system needs to be legally enforceable and not rely on voluntary tobacco industry "greenwashing" initiatives, as observed in several countries *(16, 245)*.

The State of Maine (USA) proposed such a system in 2001 with a $1/cigarette pack deposit and $0.05/cigarette refund on return. The state projected returns of US $50 million per year with the deposit. There were health concerns in handling discarded butts and managing the logistics of the return programme, and the bill was not enacted into law *(246)*. The city of Barcelona, Spain, similarly attempted to pass such a policy with a 20 cent/cigarette tax, but this measure failed to pass in the local election *(247)*.

Tobacco product waste abatement fees

TPW abatement fees are levied on tobacco products to recover the costs of tobacco waste prevention, clean-up, disposal and environmental damage *(248)*. These can be levied on the producer or on the product itself to

mitigate the cost of managing TPW downstream as well as other environmental harms caused during tobacco product lifecycle. Several countries have implemented environmental taxes on cigarette packages sold *(103)*.

TPW abatement costs are mostly borne by local governments, thus some cities have sought to have the tobacco product manufacturers reimburse the cost of TPW abatement by directly measuring TPW collection costs or modelling TPW costs based on a proportional assessment of overall waste management costs (Table 1) *(34)*.

Table 1. Studies of tobacco product waste surface abatement costs

Country	Year	Approach (method)	Annual tobacco product waste cost estimate (US $ millions)
France	2021	Direct measurement	93
United Kingdom	2021	Direct measurement	55
United States (30 largest cities)	2020	Proportional measurement	265
United States - San Francisco	2011	Proportional measurement	6

Source: http://dx.doi.org/10.2471/BLT.22.288344

It is important that such polices detail the structure of these abatement fees, including how the funds will be collected and used by the government to ensure they are used for addressing TPW. Fees might be more publicly accepted if framed as necessary for environmental protection *(34)*. San Francisco, California, USA, implemented such a fee ($0.20/pack) in 2009 *(248)*. Although this fee was defended against industry lawsuits in that city, a state-wide voter initiative, spearheaded by the tobacco and alcohol industries, established a constitutional amendment that restricted other local applications of litter fees without a supermajority vote of the affected jurisdiction, labelling them as “just another tax increase” *(249)*.

Although abatement fees would reimburse some costs associated with collecting and disposing TPW, they do not address the source of environmental harm, which can only be addressed by upstream policy

options, in addition to implementation of WHO FCTC supply and demand measures.

Place-based use restrictions

This intervention targets tobacco use behaviours, in particular the locations where tobacco use is not permitted. For example, in the past 25 years, hundreds of jurisdictions have banned smoking in public parks or on public beaches *(76, 250-253)*. The success of these policies relied on ample public information and enforcement policies. Public support for such policies is generally high, in one study ranging from 50% regarding outdoor dining areas to 69% regarding parks and beaches *(250)*. Such outdoor smoking bans, when enforced, would be expected to reduce TPW by reducing tobacco product use in the affected location and by de-normalizing tobacco use in general.

Downstream regulatory options

Downstream regulatory options address the most visible parts of TPW after the tobacco products are consumed. Downstream regulatory options have limited impact as they do not address the source and causes of tobacco-related environmental harms. While they may be useful to raise awareness of the environmental impact of tobacco, specially TPW, these efforts should be part of more comprehensive regulatory measures that can reduce the source of tobacco products' environmental harm. Additionally, some of these measures are readily embraced by the tobacco industry in its greenwashing efforts *(16)*. According to Article 5.3 of the WHO FCTC and its Guidelines for implementation, Parties should not partner with the tobacco industry in these initiatives.

Clean-up campaigns

As emphasized throughout this report, due to the sheer volume (trillions per year) of cigarette butts and other TPW discarded into the environment, clean-up campaigns are ineffective in reducing the global burden of TPW. These campaigns are also heavily promoted by the tobacco industry's greenwashing and other corporate responsibility efforts *(16, 254-256)*. Such volunteer-based programmes also focus attention on littering by individuals

rather than on accountability for the tobacco industry *(257)*. Further, these efforts, though helpful in demonstrating the quantity and persistence of TPW in some settings, are labour intensive, costly, and time consuming.

A related clean-up approach focuses on distribution and or installation of waste receptacles dedicated to cigarette butts *(258)*. These most commonly are either individual receptacles, for example, small portable pouches in which to discard butts until they can be disposed of in bins, or receptacles placed on public areas. The challenge remains that this waste will eventually have to be properly collected, transferred, and disposed of in landfill. These actions also only cover a limited geographic area, must be serviced regularly by some agency, rely on motivated people to use them, and likely only remove a small amount of TPW from the defined area. One study found that waste receptacles at beaches can reduce the volume of litter by 10 - 12% and at highway rest stops by 5% *(259)*. The tobacco industry also uses the installation of such receptacles in their 'greenwashing' initiatives *(90)*. Removal of ashtrays or cigarette butt bins also serves to support smoking bans, including in outdoor areas.

Biodegradable filters

Tobacco industry affiliates responded to the evidence that filters are poorly degradable *(89, 260)* with research and development of biodegradable filters.*(16, 96)* Biodegradable filters do not provide a solution, as they would still be discarded into the environment and leach contaminants into the environment. Biodegradable filters would also not address the WHO Study Group on Tobacco Product Regulation recommendation of banning filters to reduce the palatability and appeal of cigarettes; nor would they remove consumer misconceptions about filters substantially reducing health harms. Widespread implementation of biodegradable filters could in fact have negative outcomes, including further normalizing greenwashed cigarettes (sustaining misleading misconceptions of safety), creating a permissive scenario for littering *(164)* and potentially resulting in more tobacco toxicant release into the environment. There are no reports evaluating the ecotoxicity of biodegradable filters, but it is likely that any biodegradable filter material will leach out the same chemicals as detected in leachates of cellulose acetate

filters. There are also no published evaluations of biodegradable filters regarding human health protective effects. Biodegradable filters would not reduce the risk of fire from improperly discarded butts, which pose an increasing risk as global temperatures increase. Eliminating the sale of *all cigarette filters* should remain the goal of reducing environmental harm from TPW, as also concluded by the Belgian Superior Health Council and the WHO Study Group on Tobacco Product Regulation *(119, 214)*.

Importantly, the tobacco industry may use biodegradable filters as part of its CSR, which in turn may encourage people who smoke to consider "biodegradable" products as providing "the ability to litter without guilt" *(164)*.

Collecting and recycling cigarette butts

In the last decade the idea of collecting and recycling used cigarette butts into new materials, including building materials, road paving, and other uses has emerged *(83, 261-267)*. This ostensibly suggests a circular economy approach to discarded cigarette butts as a mitigation strategy for TPW. However, the concept of recycling cigarette butts presents numerous logistical challenges in gathering and delivering cigarette butts for recycling and raises additional concerns about corporate greenwashing, as described above.

Discarding and recycling of heated tobacco products and electronic nicotine delivery systems

HTPs manufacturers have promoted HTP recycling programs *(182, 268)* as part of their greenwashing initiatives; these have no known positive impact on HTP waste.

Recycling programmes for ENDS exist in several countries, such as the United Kingdom *(269)*, Ireland *(270)*, Canada *(271)*, and Malta *(272)*. Recycling programmes for all types of ENDS are challenging given their multiple components, including chemicals, and their design, which leads to technical difficulties in disassembly and recovery of recyclable materials *(193, 273, 274)*. The waste management of discarded ENDS also poses fire risks due to the lithium-ion batteries *(80, 193)*.

Groups linked to ENDS manufacturers have also promoted recycling programmes, for example, at a music festival in New Zealand *(275)*. Thus,

while ENDS recycling programmes exist in several countries, these programmes come with challenges, do not address the source of the waste, and may be used by ENDS manufacturers to help greenwash their image.

Other measures

Accountability measures

In Decision FCTC/COP10(14), the COP invited Parties, "under Article 19 of the WHO FCTC, to hold the tobacco industry accountable for the damage it causes to the environment and the adverse health effects on workers involved in the cultivation and manufacture of tobacco products, and the disposal and treatment of waste resulting from their manufacture and consumption" *(21)*.

Parties could consider using the information on tobacco products' harm, and the legal obligations under the WHO FCTC, to strengthen existing environmental laws to eliminate tobacco-related environmental harms, including imposing sanctions to mitigate those harms. It could also bring these problems to the attention of environmental tribunals, where available, or use international instruments to bring cases against the tobacco industry for its environmental damage *(276)*.

Extended producer responsibility

The framework of extended producer responsibility (EPR) is an option to mitigate the environmental consequences of tobacco products waste *(5)*. EPR falls within the Polluter Pays Principle (PPP), which seeks to address protection of the environment such that the polluter should bear the expenses of carrying out pollution prevention and control measures decided by public authorities to ensure that the environment is in an acceptable state *(277)*. In current EPR systems, industry producers set up the collective eco-organism Producer Responsibility Organization (PRO) to manage the waste from consumer products *(278)*. Producers and distributors pay fees to the PRO based on product weight or units. These fees, in most EPR systems, are supposed to cover downstream waste management costs, including collection, transport, sorting, and recycling, as well as administrative expenses and awareness campaigns.

However, in the context of tobacco control, there is a need to be cautious about how EPR-related policies could also be perceived as an incentive to redesign tobacco products (currently EPR fees provide little incentive for producers to make upstream, waste-preventing design changes). For example, in the case of cigarette filters, a simple redesign would not solve the problem of cigarette butt waste; the elimination of all cigarette filters is needed to materially reduce the impact of discarded cigarette butts. As previously discussed, biodegradable filters and recycling systems should not be considered as part of EPR for tobacco products.

It is also important that EPR schemes do not become part of the tobacco industry's greenwashing initiatives, referring to in the Guidelines for implementation of WHO FCTC Articles 13 and 5.3 regarding CSR *(279)*. Additionally, traditional approaches to EPR involve the manufacturer in the policy development process. This must then be modified when applied to tobacco-related environmental and human harms, as including the industry, directly or indirectly, in policy development would not be aligned with the obligation in Article 5.3 of the WHO FCTC. There are examples of the tobacco industry taking advantage of these initiatives to have access to policy-makers and to use these efforts in their marketing campaigns *(3, 24, 255, 280)*.

For tobacco products, most current EPR schemes aim to generate funds for the collection, sorting, and recycling or final disposal of TPW, thus limiting the EPR interventions to a measure that does not solve the source of the problem *(255, 281, 282)*. EPR policies, which often require industry to report production and sales data, may support surveillance and data collection functions, provide information on production, product sales, waste generation, and waste disposition *(278, 283)*; however, EPR policies would have negligible impact on the sheer scale of the TPW problem. Jurisdictions may use these data to establish costs of the product waste stream leading to assignment of fiscal and or legal accountability for tobacco producers and distributors.

Example of an EPR scheme

The EU Single use Plastics Directive (SUP) *(284)* introduced an EPR scheme. Specifically, Article 8(1) of the SUP Directive describes general terms

for EPR schemes for single-use plastics listed in Annex E of the directive; this includes cigarette butts. Article 8(3) and Article 8(4) define EPR for tobacco products with filters and filters marketed for use in combination with other tobacco products, including loose tobacco *(284)*. According to SUP Directive Article 10, Member States must ensure that tobacco manufacturers cover costs of awareness-raising measures; clean-up, transport and processing of littered plastic tobacco products; and they must report on these activities. However, these requirements only apply to designated tobacco products discarded in or collected by public collection systems, not by private systems such as clean-ups done by voluntary groups. Costs for tobacco waste disposal are determined proportionately for each tobacco company based on market share. The EU passed an Implementing Decision that set out a format for reporting data and information on post-consumption waste collected (tobacco products with filters and filters marketed for use in combination with tobacco products) through public waste collection systems. However, at the time of this writing, no reports have been filed due to delayed implementation of the decision *(283)*.

Considerations for EPR implementation

If EPR is to be pursued to address tobacco-related environmental harms, the following conditions must at a minimum be met:

- Exclusion of direct or indirect involvement of the tobacco industry and those working to further its interests from the EPR decision-making body, in accordance with Article 5.3 of the WHO FCTC.
- Exclusion of direct or indirect involvement of the tobacco industry and those working to further its interests from implementation and enforcement.
- The tobacco industry engagement should be limited to paying fees to the government.
- Inclusion of stakeholders from tobacco control and environmental civil society organizations not affiliated with the tobacco industry in the EPR decision-making body.
- Implementation of reporting and transparent disclosures of industry activities in the EPR scheme that considers additional caveats related

to working with the industry, including not encouraging product redesign that do not address the source of environmental harm.

Therefore, EPR is an option to mitigate the environmental damage of the tobacco product life cycle only if implemented correctly.

Litigation

Litigation has been successfully used to assign economic accountability to the tobacco industry through numerous and continuing cases globally*(285)*. Such approaches could also be considered for recovering costs of tobacco product abatement and preventing future environmental harms. These cases can be pursued under legal regimes governing public nuisance, product liability, as well as violations of hazardous materials or environmental protection laws *(286)*. The report by the expert group on Liability (Article 19 of the WHO FCTC) outlines developments regarding the environmental liability of the tobacco industry *(217)*.

In 2022, the city of Baltimore, Maryland, filed the first environmental lawsuit against six major tobacco companies to seek recovery of damage due to cigarette butt waste in the city. The damage claimed arose from economic losses due to environmental degradation, clean-up costs, waterway pollution, and the unmitigated harms caused by cigarette butt waste as chemical pollution and microplastics. Baltimore's legal claims are based on violations of dumping and littering laws, defective filter designs, public nuisance of cigarette butt litter, and failure to warn of these defects and harms. The lawsuit is still in its early stages, but it is being watched closely by other jurisdictions given the ubiquity of cigarette butt waste and the growing recognition of its environmental hazards *(287)*.

Supporting measures

Education measures

An important primary component of any environmental regulatory option is to develop and implement education campaigns and other initiatives that increase public awareness of tobacco products' environmental harms. Public awareness of these harms will contribute to compliance and enforcement of any type of regulation.

Labelling

One example of a possible educational intervention is the inclusion of messaging on environmental harm on tobacco product packaging or even on the product itself, similar to the health warnings printed on the filters of individual cigarette sticks in Canada and Australia *(288, 289)*. SUPs, such as cigarette filters, HTP sticks, and filtered cigarettes, require a standardised marking in the EU. Responding to concerns about plastic pollution, particularly marine litter, the EU proposed rules in 2018 targeting the 10 plastic products most often found on European beaches, including cigarette butts *(284)*. The SUP Directive subsequently required tobacco package marking to inform consumers about appropriate plastic waste management options and which disposal methods to avoid. In addition, the standardized marking should indicate the plastic filter in tobacco products and the plastic in filters marketed for use in combination with tobacco products. The environmental warning must not obstruct the health warnings *(290)*. The markings were adopted in 2020 and were applicable from July 3, 2021*(291)*.

Fig. 6. Marking addressing environmental concern of cigarette butts

Source: EUR-Lex (https://eur-lex.europa.eu/eli/reg_impl/2020/2151/oj/eng).

While some manufacturers have voluntarily included package messages to consumers to encourage individual-based action (for example, "Please Don't Litter" messages on packs), there is no evidence to suggest that these are any different than other ineffective voluntary industry initiatives (greenwashing).

Hazardous waste disposal models

As data continue to emerge on the toxicity of TPW, including hazardous chemicals such as nicotine, metals, and TSNAs *(292)*, governments may wish to classify TPW as hazardous waste *(107, 293)*.

Hazardous waste disposal models would then be applicable to these products and could support several of the mitigation options discussed above, including the banning of filters. Hazardous waste is generally collected in dedicated systems based on their contents and/or likely harms. Some examples of consumer goods that end up as hazardous waste include used oil and tires from automobiles *(294)* and household items such as paints, batteries (particularly lithium-ion batteries), and electronics *(295)*. These waste streams in most countries are diverted from general landfills and disposed of in other ways *(296)*. There are some examples where recommendations for ENDS disposal have been made *(74, 297)*, however, disposal may still pose risks, depending on the circumstances and enforcement of safe disposal regulations *(298, 299)*. This measure could be implemented in conjunction with EPR framework and other measures that put the economic burden of TPW management on the tobacco industry.

While additional data on the toxicity of tobacco waste is needed, the *precautionary principle* would suggest that toxic waste handling measures could be applied to TPW *(107)*. The precautionary principle provides that in the context of regulated industries, any uncertainty about potential impacts of environmental regulations should be resolved in favour of prevention *(300)*. Additionally, existing and new laws associated with electronic waste should be applied to HTPs, as previously discussed *(71, 181, 186, 301)*.

Summary

The environmental harms of tobacco can be mitigated through a range of approaches, broadly characterized as **upstream**, **midstream** and **downstream** regulatory options.

The most straightforward way to eliminate harmful TPW, based on currently available scientific evidence, is to ban the manufacture (where relevant), distribution, import, and sale of all cigarette filters. Banning the sales of ENDS or at least banning the sales of single-use ENDS is an additional option.

Another option is to adopt a supply reduction approach to reduce the availability of all commercial tobacco products.

Midstream regulatory options include limiting retailer density and place-based smoking bans. Additional options include TPW abatement fees.

Downstream interventions focusing on addressing TPW through clean-ups or litter collection can never do more than demonstrate the visibility and enormity of this waste stream, while calling out the need for more effective upstream regulatory options.

EPR as a cost recovery option to mitigate the environmental damage of the tobacco product life cycle is another option if implemented correctly, as is holding tobacco companies accountable for the harms caused to the environment through litigation. All regulatory options would need educational support for successful implementation.

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Annex

Survey of Parties experience regarding Article 18 implementation

Background and methodology

The WHO FCTC Secretariat sent an email and attached questionnaire in July 2024 to WHO FCTC technical focal points in each Party inviting them to participate in an optional survey regarding implementation of WHO FCTC Article 18. The survey covered measures that may contribute to the implementation of WHO FCTC Article 18. The questionnaire was provided in all six United Nations official languages (Arabic, Chinese, English, French, Russian and Spanish) and included six open-ended questions to be answered on the attached MS Word document. Questions addressed: (a) any measures related to environmental protection associated with tobacco use; (b) any measures focusing on the tobacco industry and tobacco products related to protecting the environment; (c) any legal or court cases to create tobacco industry accountability for costs associated with environmental harms; (d) how tobacco products and manufacturing equipment that are seized are destroyed; (e) any research associated with environmental harms of tobacco; and (f) any examples of implementation of Article 5.3 when developing measures to address tobacco-related environmental harms. Parties were invited to complete any questions for which they had information and to attach any supporting information, such as copies of legislation.

Findings

Thirty-three Parties to the WHO FCTC responded to this survey. Parties' responses represented the experience of high-, middle- and low-income countries, however, not all regions were represented.

Several Parties mentioned the celebration of World No Tobacco Day 2022, which focused on the tobacco and the environment and created opportunities for their public education campaigns. Parties also mentioned smoke-free environments legislation. There were a few mentions of bans on ENDS, as they would prevent additional environmental contamination from electronic waste from discarded ENDS.

Two Parties reported measures against littering that would be applicable to TPW, but it is unclear if enforcement of these measures now covers discarded cigarette butts.

One Party reported that tobacco producers who sell filtered cigarettes in the country must share the costs of local governments for butt clean-ups and that Government reported collaborating with a tobacco company to distribute the fees paid by tobacco companies under an EPR scheme.

Two Parties' strategic plans on tobacco control included measures to address tobacco's environmental harms, again including payments from the tobacco industry for clean-up costs. Three Parties have measures in place or in development to address plastic pollution regulation. Some Parties reported implementing the EU single use plastic directive, and they may now include measures to address certain tobacco products as plastic waste. One Party reported including ENDS under EU Directive 2012/19/EU on Waste from Electrical and Electronic Equipment (WEEE), using an EPR approach and specially designated disposal resources.

One Party reported having EPR legislation on plastic packaging, but it is unclear how it applies to tobacco products.

Two Parties reported that there were existing governmental standards to minimize the environmental impact of the tobacco industry. One Party reported non-governmental organizations and other volunteer efforts on public space TPW clean-ups. In addition, one Party reported having a registry to monitor plastic products entering the market, including ENDS. One Party reported ongoing discussions on littering abatement, but it has no policy as yet.

One Party reported a series of existing environmental regulations and legislations, including penalties, to protect against pollution and protect biodiversity, but did not specify if these are being applied to tobacco-related environmental harms.

One Party reported implementing an EPR scheme for tobacco products with filters and filters marketed for use in combination with tobacco products. It

was reported, that in accordance with a Packaging Ordinance, tobacco product manufacturers are obliged to bear certain costs for the waste from products they market, and to participate in a collection and recycling system. This reported scheme includes reimbursing the costs of TPW clean-ups, transportation, and treatments, as well as the costs of raising awareness, informing consumers, and data collection. In addition, it was reported that the tobacco companies must bear the costs of mixed waste collection, transportation, and treatment from containers in public areas as part of this programme. A reported penalty of 20% for underpaid licensing fees may be applied if indicated by a programme audit.

In addition to EPR schemes, some Parties reported that existing environmental regulations and liability laws might be applied to tobacco industry environmental accountability efforts, but they have not had experience using the legal system to assign tobacco industry accountability on tobacco's environmental harms.

Summary

Parties reported limited experience with evaluation, implementation, and enforcement of measures that address the environmental harms of tobacco use and TPW. However, several Parties, reported already have in place the legal frameworks to address the environmental harms caused by tobacco use, mainly using the EPR framework.