



**PUBLIC HEALTH
LAW CENTER**
at Mitchell Hamline School of Law

September 2019

COMMERCIAL TOBACCO, HEALTH, & THE ENVIRONMENT

The Problems




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Suggested citation: Thomas Hexum and Hudson Kingston, Public Health Law Center, *Commercial Tobacco, Health, & the Environment: The Problems* (2019).

This publication was made possible by the financial support of the Robert Wood Johnson Foundation.

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TABLE OF CONTENTS

INTRODUCTION	4
<hr/>	
TOBACCO GROWING AND CURING	5
<hr/>	
Deforestation	5
Food and Water Security	7
Pesticide Usage	7
Farm Worker Conditions	8
TOBACCO MANUFACTURING	9
<hr/>	
Resource Usage	10
Industrial Waste and Emissions	11
TRANSPORTATION OF TOBACCO	11
<hr/>	
TOBACCO CONSUMPTION	12
<hr/>	
Secondhand Smoke	12
Thirdhand Smoke	13
Cigarette Lighting	15
TOBACCO PRODUCT WASTE	15
<hr/>	
Cigarette Waste Toxicity	16
Litter Prevalence	17
Electronic Cigarettes and Heated Products	18
CONCLUSION	19
<hr/>	
ENDNOTES	20
<hr/>	



Introduction

No item of litter is more ubiquitous than the discarded cigarette butt. In addition to the disastrous effects exposure to nicotine and tobacco smoke has on human health, commercial tobacco also exerts an enormous toll on the environment.¹ As measured by unit, cigarette butts comprise 30 to 40 percent of all urban and coastal litter collected worldwide, and this represents only one of the stages in the lifecycle of tobacco products, each of which results in extensive consequences for the environment, climate, and human population.² For decades, the tobacco industry has skirted responsibility, instead creating ineffective voluntary “corporate social responsibility” programs for the purpose of portraying the industry in a more positive light while minimizing its accountability³. Meanwhile, governments, local communities, and taxpayers carry the burden of managing commercial tobacco’s destructive environmental consequences.

This document provides an overview of each major stage in the commercial tobacco lifecycle and the detrimental effects it has on the environment and, ultimately, human health. The first stage in the process encompasses the industrial growing of tobacco leaf, which exacts its toll in numerous ways ranging from deforestation to toxic pesticide use and exposure. Following the

harvest of raw tobacco leaf, tobacco is manufactured into products such as cigarettes that are subsequently transported to retailers. The manufacturing stage is highly resource-intensive and produces large quantities of waste and greenhouse gas emissions. Cigarette consumption results in the production of smoke that pollutes outdoor and indoor spaces, while clothing, furniture, and other materials contaminated with tobacco smoke end up polluting waterways and landfills. Finally, tobacco product waste is often discarded onto roadways and greenspaces, where it leaches thousands of toxic chemicals into ecosystems. Various policy options for intervening at each of these stages to reduce tobacco's devastating environmental health impacts are discussed in a companion publication *Commercial Tobacco, Health, and the Environment: Policy Solutions*.

Tobacco Growing and Curing

In the United States, tobacco farming is mainly concentrated in five states: Kentucky, North Carolina, South Carolina, Tennessee, and Virginia.⁴ However, the U.S. is only the fourth largest tobacco producer worldwide. The seven largest producers in decreasing order are China, Brazil, India, the U.S., Indonesia, Zimbabwe, and Turkey, together accounting for nearly 80 percent of global tobacco leaf production.⁵ With the exception of the U.S., the major tobacco-producing countries are low and middle income.⁶ In fact, 90 percent of tobacco growing is now located in low- and middle-income countries, where environmental regulation and enforcement is often less stringent.⁷ As such, the direct environmental impacts of tobacco cultivation — and the working conditions tobacco farmers and farm workers are often subject to — are largely felt in those countries, although there are far-reaching global consequences for the climate and marine environments.

Deforestation

One of the most significant side effects of industrial tobacco agriculture is deforestation, which occurs for multiple reasons. In addition to the need to clear land for agricultural use, curing (the process of drying out the tobacco leaf) is heavily dependent on wood-burning in many low- and middle-income countries.⁸ One tree's worth of wood is used to cure tobacco for roughly 300 cigarettes.⁹ After taking into account that over 6 trillion cigarettes are manufactured each year, this could amount to an annual loss of more than 20 billion trees for tobacco curing alone.¹⁰ Depending on the country, it is estimated that tobacco growing and curing is responsible for between 5 percent and 70 percent of deforestation that occurs,¹¹ adding up to a total annual loss of more than 200,000 hectares of forest.¹² Yet the role of tobacco in deforestation does not just end with growing and curing, as additional wood is required for cigarette paper, packaging, and matches for lighting.



Deforestation is a significant environmental problem. Forests are a major carbon sink, which are environments that can remove carbon dioxide (CO₂), the most prevalent greenhouse gas, from the atmosphere by absorbing and storing it. Deforestation reduces the capacity of this sink, while tree burning (such as for fuel or clearing land) also releases large quantities of CO₂ back into the atmosphere, making these practices significant contributors to global climate change.¹³ An additional carbon reservoir impacted by deforestation is the soil itself, which can rapidly lose carbon reserves to the atmosphere in the form of greenhouse gases due to agricultural practices such as plowing.¹⁴ This has the dual effect of both contributing to climate change and reducing the soil's fertility. It is estimated that tobacco-related deforestation alone is responsible for as much as 5 percent of the world's total greenhouse gas production.¹⁵

In addition to greenhouse gas emissions, deforestation also has a negative effect on land quality and biodiversity. Tree cover protects soil from becoming dried out by providing shade against the sun and by releasing water into the atmosphere.¹⁶ Without this protection, the soil is prone to quick erosion. The land is further degraded by practices used in tobacco cultivation like monocropping and heavy pesticide and fertilizer usage. Monocropping, the practice of growing a single crop variety on the same plot of land each year without rotation

with other crops, increases crops' vulnerability to pests and diseases due to the plants' genetic homogeneity.¹⁷ Not only does monocropping require the extensive use of pesticides and fertilizers in order to obtain adequate yields, but this practice also depletes nutrients from soil and reduces the soil microbial community's diversity, resulting in a more fragile soil ecosystem.¹⁸

Forest ecosystems in regions of tobacco growing operations also suffer from fragmentation and loss of habitat for some of the most diverse arrays of species in the world. For example, 90 percent of all tobacco growing in Africa occurs on land within the Miombo ecosystem, consisting of one of the world's largest and most biodiverse areas of tropical forest and woodland.¹⁹ The Miombo ecosystem covers a vast region in southern Africa running from Angola in the west to Tanzania and Mozambique in the east. The impact of tobacco growing on ecosystems is concerning because human health is dependent on biodiversity for food and nutrition, natural products, medicine, control of infectious diseases, and even geopolitical stability.²⁰

Food and Water Security

Tobacco farming often occurs in the best and most fertile regions of countries such as Kenya and Bangladesh, displacing the production of other crops such as vegetables and rice.²¹ Zimbabwe, the largest tobacco producer in Africa, continues to prioritize tobacco over all other crops despite facing growing food insecurity and widespread hunger.²² Compared to many food crops, tobacco growing is also more water-intensive: the water use per metric ton of cultivated tobacco is twice the water use for a ton of wheat, five times greater than for tomatoes, and more than eight times greater than for potatoes.²³ As discussed earlier, tobacco agriculture erodes the soil and depletes it of nutrients, carbon, and microorganisms, causing what is often irreversible damage to the land. Displacement of food crops by tobacco, in addition to the destruction of forest resources, has contributed to food-surplus regions becoming food-insecure regions.

Pesticide Usage

Because tobacco plantations often grow the plants without rotation with other crops, vulnerability to pests and diseases is heightened.²⁴ To preserve plant health and yield in spite of monocropping practices, commercial tobacco growers use large quantities of chemical pesticides. Since the vast majority of production occurs in countries with lower environmental standards and/or less enforcement capacity, the industry is subject to little or no regulation of the pesticides used and occupational safety measures taken.²⁵

Due to the unregulated nature of chemical pesticide use by tobacco growing operations, workers are at great risk of pesticide poisoning. Commonly used chemical pesticides for

tobacco agriculture include DDT,²⁶ aldicarb, chlorpyrifos,²⁷ methyl bromide, disulfoton, and imidacloprid.²⁸ These chemicals are toxic to animals and humans alike, and many of them have been banned in the U.S. and/or the European Union.²⁹ For example, the U.S. banned DDT in 1972 and has been in international negotiations to regulate the use of DDT and similar chemicals globally as well.³⁰ However, these bans have not stopped industrialized nations such as the U.S. from exporting the pesticides to lower-income countries and contributing to pesticide-related death and disease. In the 1970s and 1980s, for instance, at least 25 percent of all pesticide exports from the U.S. consisted of banned, severely restricted, or never-registered chemicals. This practice is still a concern since the number of unregistered chemicals exported from the U.S. has been increasing.³¹

Documented health effects of exposure to chemical pesticides include increased cancer risk, birth defects, neurological and psychiatric disorders, and Parkinson's-like symptoms. Little to no information about these chemicals' toxicity or occupational safety measures is provided to tobacco farmers and farm workers in low- and middle-income countries, leaving them at risk of significant exposure.³² Even workers who are not directly involved with the pesticide application can be exposed by handling the tobacco plants. Studies observed that about 26 percent of tobacco farmers and farm workers in Kenya and 33 percent in Malaysia exhibited symptoms of pesticide poisoning.³³ Yet the impact of pesticide use is not limited to the farmers and farm workers; the chemicals can leach into the environment, contaminating drinking water, ruining soil health, and killing off sources of food such as fish populations and other organisms upon which ecosystems rely.³⁴ For example, the pesticide imidacloprid (a neonicotinoid, which is in fact chemically related to nicotine) can accumulate in plants and groundwater and is highly toxic to beneficial pollinators such as bees, ultimately disrupting ecosystems and threatening food security worldwide.³⁵ The serious environmental consequences of tobacco-related pesticide and fertilizer usage can threaten the well-being of entire communities.

Farm Worker Conditions

In addition to being exposed to significant quantities of chemical pesticides, tobacco workers also experience acute nicotine poisoning from the handling of tobacco plants, an ailment called green tobacco sickness (GTS). Poisoning arises from the dermal absorption of nicotine from tobacco plants, especially when the leaves are wet, or from clothing that has come in contact with wet tobacco plants.³⁶ Some common symptoms of GTS are nausea, vomiting, headaches, weakness, and abdominal pain.³⁷ Other health issues related to tobacco farming besides GTS include respiratory issues from inhaling tobacco dust and musculoskeletal problems from the physically-demanding manual labor.³⁸ Although many environmental issues due to tobacco agriculture are concentrated in low- and middle-income countries, high-income countries are

not immune to tobacco-related environmental and health concerns. For instance, a majority of tobacco farm work in the U.S. is performed by Latinx migrant workers, who are vulnerable to GTS and pesticide exposure — not only because they often are not provided protective equipment, information on health risks, or health insurance, but because they face additional obstacles due to language barriers.³⁹ While the Occupational Safety and Health Administration guides agricultural employers on how to prevent GTS, and requires employers to provide a place of employment free from certain recognized hazards, tobacco farm workers are still often subject to unsafe and unhealthy work environments.⁴⁰

Of the different groups of people whose health is impacted by tobacco agricultural practices, children are especially vulnerable. Tobacco production in many regions of low- and middle-income countries relies heavily on unpaid child labor, resulting in tobacco industry savings of \$1.2 billion per year.⁴¹ Child labor is even prevalent in U.S. tobacco-growing, as well as the broader agricultural industry in the U.S., due to exemptions in federal labor standards.⁴² Nearly 75 percent of U.S. child tobacco workers ages 7 to 17 interviewed by Human Rights Watch in 2013 reported symptoms of acute nicotine poisoning; and many children also reported adverse symptoms of pesticide exposure, with pesticide spraying occurring while they worked in the same or adjacent fields.⁴³ Almost all child tobacco workers reported that employers did not provide them with health education, safety training, or personal protective equipment. Instead, many children wore plastic garbage bags over their clothing, and some reported working barefoot.⁴⁴ Children are particularly susceptible to pesticide toxicity, with both acute and chronic exposure capable of resulting in long-lasting health consequences such as cancer, reduced cognitive function, behavioral problems,⁴⁵ and hormone disruption.⁴⁶ Although multinational tobacco companies make claims that they are working to combat child labor, the apparent purpose of their efforts is to brighten the industry's public image while they infiltrate and undermine tobacco control.⁴⁷

Tobacco Manufacturing

Imperial Tobacco has admitted that of the various stages in the tobacco product lifecycle, “Our greatest direct impact on the environment comes from our product manufacturing activities.”⁴⁸ This situation is likely similar for the other major tobacco companies. However, tobacco manufacturing is also one of the most difficult steps to evaluate because very little data pertaining to its environmental effects exist other than companies' own self-reported data. It is therefore especially difficult to compare data between different tobacco companies because there is no shared format for these reports, and there is no independent way to verify the extent of their accuracy and completeness. Moreover, China's National Tobacco Company

(CNTC) does not release any publicly available environmental data, yet produces 44 percent of the world's cigarettes.⁴⁹ Despite these challenges, it is possible to get a sense of the scale of tobacco manufacturing's environmental impact.

Resource Usage

Cigarette manufacturing is a very resource-intensive multi-step process from tobacco processing to the final packaging.⁵⁰ The first step in the process of making cigarettes is shredding the cured tobacco leaf.⁵¹ Dry ice and a large amount of energy are used for a specialized process invented by Philip Morris, called the dry ice expanded tobacco process, which is used to artificially expand the shredded tobacco. This expansion process allows tobacco companies to effectively fill cigarettes with less tobacco leaf, cutting manufacturing costs while driving smokers to smoke more cigarettes.⁵² Similar expansion processes have been invented by the other tobacco companies: Imperial Tobacco created a process called IMPEX, which uses isopentane instead of dry ice; and the German tobacco company Reemtsma uses INCOM, which requires nitrogen.⁵³

Water is another resource that tobacco manufacturing requires extensively. According to self-reported 2014 data, the tobacco company Altria consumed 11.2 billion liters of water for tobacco manufacturing. In that same admission, Altria reported that one of its manufacturing facilities in a water-stressed area consumed 36 million liters of water.⁵⁴ This amount of water usage can put significant strain on water reserves in regions that are dry. Water consumption for paper manufacturing alone is extensive, permeating every step in the industrial process either directly from pulping and chemical preparation or indirectly by consumption through power generation and transportation.⁵⁵ Because the tobacco packaging market is expected to continue growing in the coming years, its water consumption can also be expected to rise unless the companies' processes improve significantly.⁵⁶

However, the greatest contributor to cigarette manufacturing's environmental impact is energy usage.⁵⁷ China, which produces nearly half of the world's cigarettes,⁵⁸ relies on coal for nearly 70 percent of its total energy consumption.⁵⁹ This dominant use of coal over other energy sources in China could increase tobacco product manufacturing's carbon footprint by 35 percent and its impact on aquatic ecosystems by 20 percent over typical estimates.⁶⁰ Despite corporate social responsibility claims by some tobacco companies that they have switched from using coal as an energy source to natural gas, there is no way to independently verify how many manufacturing facilities have actually been converted.⁶¹ Additionally, while natural gas usage might result in a lower carbon footprint than coal,⁶² it can ultimately cause more fossil fuel waste and depletion, as well as land degradation.⁶³ With a total of more than 6 trillion

cigarettes produced each year, not to mention the other varieties of tobacco products, tobacco manufacturing processes consume enormous amounts of resources.

Industrial Waste and Emissions

Just as tobacco manufacturing consumes a significant amount of resources, it also produces an enormous amount of waste products and emissions. According to 1995 estimates, tobacco manufacturing resulted in the production of more than 2 million metric tons of solid waste, 300,000 metric tons of nicotine-containing waste, and 200,000 metric tons of chemical waste, with toxic byproducts such as ammonia, hydrochloric acid, and methyl ethyl ketone.⁶⁴ The manufacturing stage is also responsible for an output of nearly 9 billion liters of wastewater annually.⁶⁵

As a major greenhouse gas and contributor to global climate change, CO₂ emissions from tobacco manufacturing are alarming. A 2015 estimate based on self-reported data places total annual emissions of CO₂ equivalents from tobacco manufacturing processes at 8.76 million metric tons,⁶⁶ although a 2018 study estimates that the yearly total is closer to 16 million metric tons.⁶⁷ Regardless, this makes manufacturing the second most impactful step for CO₂ release behind the growing and curing phase. This is another area where tobacco companies have made corporate social responsibility claims. For example, Philip Morris claims to have cut its manufacturing-related CO₂ emissions from 914,000 metric tons in 2010 to 691,000 metric tons in 2015.⁶⁸ British American Tobacco claims that its CO₂ emissions have been reduced by 47 percent since 2000, although it does not provide any absolute amounts on which that claim is based.⁶⁹ Regardless, tobacco use and production are growing — especially in low- and middle-income countries. Global yearly production is predicted to reach 9 trillion cigarettes by 2025.⁷⁰ This will put increased pressure on the environment as the major tobacco-producing countries face food and water insecurity, land destruction, and a changing climate.

Transportation of Tobacco

An additional factor must be taken into account when discussing tobacco's environmental impact, especially as the tobacco industry has become more globalized: Cured tobacco leaf must be transported to manufacturing facilities and manufactured products must be transported to retailers. This tobacco distribution relies primarily on shipping both by road and by sea.⁷¹ Road transportation of tobacco mainly utilizes diesel-engine trucks, which release CO₂ emissions, carcinogenic particulate matter, and other pollutants into the air,⁷² disproportionately affecting certain communities of color and those in poverty.⁷³ Ships and their ports also present a host of environmental problems, including greenhouse gas and

particulate matter emissions, energy consumption, ballast water (which can transfer invasive aquatic organisms and pathogens to other regions of the world), and the discharge of sewage, garbage, and oil into the oceans.⁷⁴

Most tobacco transportation occurs prior to the manufacturing stage,⁷⁵ likely due to the tobacco industry's creation of regional manufacturing plants for nearby markets.⁷⁶ From tobacco cultivation to product manufacturing, about 1.7 billion ton-kilometers (tkm, a measure of transport of a metric ton of freight shipped one kilometer) of tobacco are shipped by truck each year, and nearly 17 billion tkm are shipped by sea.⁷⁷ After manufacturing, about 0.6 billion tkm of tobacco products are shipped by truck and 5.4 billion tkm are shipped by sea.⁷⁸ Shipping all the tobacco to and from manufacturing facilities also requires paper for the production of 235,000 metric tons of cardboard boxes, which comes with yet another environmental cost on top of individual product packaging and cigarette paper.⁷⁹ Even then, it is likely that the amount of resources consumed and waste produced by all of the processes discussed here are underestimates, given that much of the existing manufacturing and transport data are incomplete.

Tobacco Consumption

By smoking cigarettes, people inhale thousands of toxic and carcinogenic chemicals that wreak havoc on the body. Yet health consequences are not limited to the user, as both the smoke released from the burning end of the cigarette (referred to as sidestream smoke) and the smoke exhaled by smokers (mainstream smoke) pollute the air and can be inhaled by non-smokers as secondhand smoke or persist in indoor and outdoor environments and re-aerosolize as thirdhand smoke. Furthermore, the act of lighting cigarettes also has a detrimental effect on the environment, regardless of whether matches or lighters are used.

Secondhand Smoke

More than 10 percent of tobacco-related deaths and 1.0 percent of total deaths worldwide are attributable to secondhand smoke exposure,⁸⁰ which occurs through involuntary inhalation of sidestream smoke and mainstream smoke.⁸¹ Sidestream smoke contains greater amounts of nicotine, ammonia, formaldehyde, and numerous other toxic chemicals compared to mainstream smoke, making sidestream smoke more dangerous. Additionally, sidestream smoke particles are generally smaller than mainstream smoke particles and can thus be inhaled deeper into the lungs.⁸² Any amount of exposure to sidestream smoke carries risk of developing respiratory and cardiovascular diseases, among others.⁸³

Even though smoke-free policies for indoor public places have helped reduce secondhand smoke exposure in multiple countries,⁸⁴ indoor secondhand smoke remains a concern among populations of lower socioeconomic status, especially in multiunit housing (MUH). One U.S. study reports that even among MUH buildings where home smoking bans were enforced, 50 percent of residents experienced tobacco smoke from other units.⁸⁵ Among minority populations like Latinx MUH residents in the U.S., the tobacco smoke infiltration rate among units with smoking bans can be as high as 80 percent.⁸⁶ This underscores the need for more smoke-free policies in public and private multiunit housing properties, as well as more education about, and access to, cessation resources.

While most research on secondhand smoke has focused on indoor settings, outdoor tobacco smoke can also pose a threat to health and the environment. This is especially noteworthy now that the growing number of smoke-free policies for indoor settings are resulting in smokers increasingly relocating outside.⁸⁷ In outdoor settings such as restaurant patios and parks, tobacco smoke particle concentrations in the vicinity of a smoker can rival those of indoor smoking environments, and high levels of smoke can be maintained downwind of a burning cigarette for as far as three meters.⁸⁸ Smoking near building entrances can also compromise indoor smoke-free policies by allowing tobacco smoke to infiltrate indoor settings.⁸⁹

Collectively, cigarette smoking emits thousands of tons of toxic chemicals, particulate matter, and greenhouse gases each year, contributing to both air pollution and climate change,⁹⁰ the effects of which are felt hardest by disproportionately impacted groups, such as lower-income communities.⁹¹ Outdoor tobacco smoke can ultimately exert its influence on people's health directly through secondhand smoke and indirectly by polluting the air, augmenting climate change, and intensifying environmental inequity among populations.

Thirdhand Smoke

Recently, another classification of tobacco smoke has been developed to recognize that tobacco smoke particles can deposit and accumulate on surfaces and in dust and later be re-emitted into the air, oftentimes after reacting with compounds in the environment. This is referred to as "thirdhand smoke." Thirdhand smoke exposure can occur not only through inhalation of re-emitted tobacco smoke particles, but also through dermal contact with or ingestion of tobacco smoke-contaminated substances. Tobacco smoke particles can remain on surfaces for months at a time and undergo oxidation and other reactions, and re-emission of the particles can occur continuously, exposing unwitting bystanders to amounts of nicotine and at least one carcinogen comparable to or greater than mainstream smoke.⁹² Surfaces that can become contaminated with thirdhand smoke include walls, doors, furniture, carpets, mattresses, and vehicle interiors. Even if precautions such as smoking outside are taken to limit



Photo: Karen Mason

nonusers' exposure to secondhand smoke in smoking households, they may not be sufficient to mitigate thirdhand smoke exposure, such as from smokers' clothing.

In addition to posing a threat to indoor environments, items contaminated with thirdhand smoke can also end up in landfills and waterways, where nicotine and its metabolite cotinine are among the most frequently detected chemicals.⁹³ From there, thirdhand smoke-contaminated waste can leach into groundwater, rivers, and lakes, threatening the environment and native animal life. Nicotine, which has in fact been used as an insecticide along with the related neonicotinoid class of chemicals, is toxic to various microorganisms crucial to the balance of aquatic ecosystems.⁹⁴ Moreover, conventional water treatment systems utilizing ozonation, which are popular in places such as Europe and Canada,⁹⁵ are only 79 percent

effective at eliminating nicotine from drinking water and 94 percent effective for cotinine.⁹⁶ While chlorination, which is used for water treatment in the U.S.,⁹⁷ has been shown to be very effective at eliminating nicotine from water, only 74 percent of cotinine was removed with that method in one study,⁹⁸ meaning that people can potentially be exposed to residual amounts through their drinking water.

Cigarette Lighting

Matches and gas-filled lighters also come with their own environmental cost, particularly considering that trillions of cigarettes are smoked each year. This translates to millions of trees, primarily aspen,⁹⁹ cut down to produce the wood for manufacturing matches — a modest contribution to global deforestation, but a huge impact on specific ecosystems. Regarding cigarette lighters, there are environmental costs to manufacturing as well as disposing of the plastic, metal, and butane used to make them.¹⁰⁰ Besides environmental damage, cigarette lighting and burning are accompanied by significant injury and property damage due to fires. Cigarette use remains a leading and wholly preventable cause of fires in many countries, including the U.S., where cigarette-related home fires caused an average of 590 deaths, 1,130 injuries, and \$476 million in property damage per year from 2012 to 2016.¹⁰¹ In 2016, the U.S. Department of Housing and Urban Development (HUD) finalized a rule requiring all public housing agencies to implement a smoke-free policy, and one of its main reasons for doing so was to reduce the risk of fires. According to a HUD estimate, a smoke-free policy would save a public housing agency about \$4.7 million each year due to the reduced fire risk.¹⁰² Effectively, no aspect of tobacco consumption and cigarette use leaves the integrity of the environment or the health of users and nonusers unharmed.

Tobacco Product Waste

The impact of tobacco does not end with product consumption, since all of the burnt cigarette butts, cigar tips, and product packaging, among other sources of waste, must be disposed of somewhere. Most often this disposal occurs improperly in the form of millions of kilograms of product waste discarded into the environment each year, making the final stage of the tobacco product lifecycle just as destructive as the others. While a nuisance and an eyesore for communities, tobacco product waste poses environmental health hazards to humans and ecosystems due to the thousands of toxic chemicals still contained within the waste that can leach out over time.

Cigarette Waste Toxicity

Cigarette butts still contain thousands of toxic and carcinogenic chemicals from tobacco smoke that are deposited in the filters. These filters are made of the plastic material cellulose acetate, which does not biodegrade except under severe or specific environmental circumstances.¹⁰³ Because of this, the filters of cigarette butts can leach out chemicals such as nicotine, pesticides, polycyclic aromatic hydrocarbons (PAHs), arsenic, and heavy metals such as lead and cadmium into the environment for years.¹⁰⁴ This can lead to contamination of both soil and water systems, with the latter being of particular concern since most litter from land ultimately ends up deposited in oceans and other aquatic environments.¹⁰⁵ In fact, one study analyzed over 100 marine turtles from all seven known species and detected plastic particles (a major source of which is cigarette filters) in every single turtle.¹⁰⁶ Moreover, studies have already demonstrated that chemical leachates from cigarette butts are toxic to other aquatic species including both microorganisms and fish.¹⁰⁷ The pollution of water systems by cigarette butt leachates can result in contaminated drinking water supplies as well as bioaccumulation of toxic chemicals in fish and other sources of food, potentially posing serious health risks to humans.

Another route of human and animal exposure to the toxic chemicals of cigarette litter is through direct ingestion of cigarette butts themselves. Nearly 14,000 tobacco-related injuries among children were reported in 2011, and 90 percent of those cases were due to the ingestion of cigarettes or cigarette butts.¹⁰⁸ Nicotine is acutely toxic to young children, capable of causing symptoms such as nausea and vomiting at doses as low as 1-2 mg and neurological damage at higher doses. Meanwhile, a single cigarette typically contains between 9 mg and 30 mg of nicotine.¹⁰⁹ Animals such as pets are also susceptible to nicotine poisoning, as the ingestion of even a single cigarette can be lethal for small dogs and birds.¹¹⁰

While incidents of severe nicotine poisoning in children have historically been relatively rare, children's exposure to e-liquid (highly-concentrated nicotine solutions) from electronic cigarettes is rising dramatically in the U.S., up from about a dozen documented cases a month in 2012 to 223 cases a month by the end of 2015 — an increase of more than 1,500 percent.¹¹¹ Children exposed to e-liquid (i.e., by accessing and drinking a family member's container of e-liquid) are also more likely to have a severe health outcome than children exposed to conventional cigarettes.¹¹² The U.S. Environmental Protection Agency (EPA) recently acknowledged this risk, and the death and poisoning toll among children, in a rulemaking where nicotine e-liquids were reconfirmed to be hazardous waste.¹¹³ Additionally, the Child Nicotine Poisoning Prevention Act of 2015 and a 2019 guidance document by the U.S. Consumer Product Safety Commission establish that liquid nicotine products must be sold in child-resistant packaging compliant with standards outlined in the Poison Prevention



Packaging Act.¹¹⁴ The ubiquity of cigarette butt litter and the rapid surge in e-cigarette prevalence makes accidental nicotine poisoning a present and growing concern for parents, childcare providers, and others, not to mention the other toxic chemicals a child could be exposed to by ingesting tobacco product waste.

Litter Prevalence

As many as 5.6 trillion cigarettes are discarded as litter each year, comprising up to 770,000 metric tons in waste (one of the world's largest offshore oil platforms weighs 750,000 metric tons, for a comparison¹¹⁵) and making cigarette butts consistently the single most collected litter item worldwide.¹¹⁶ In fact, it is estimated that, measured by units collected, cigarette butts make up between 30 percent and 40 percent of the world's litter debris.¹¹⁷ Along U.S. shorelines, cigarette butts as a percentage of total debris collected through cleanup programs did decrease from 34 percent¹¹⁸ by unit to 14 percent¹¹⁹ between 2007 and 2017, yet remain the most prevalent form of shoreline litter (842,837 cigarette butts collected in 2017), more than twice the second most frequently collected litter item, food wrappers (345,241).¹²⁰

Besides cigarettes, other tobacco products make significant contributions to the prevalence of tobacco-associated litter. Plastic cigar tips, which are most commonly used with cigarillos and small cigars,¹²¹ are one of the most abundant items of plastic marine debris on beaches around the world, sometimes second in quantity only to cigarette butts.¹²² For example, plastic cigar tips constituted 10 percent of all debris collected in a beach cleanup effort around the Mediterranean Sea.¹²³ Cigar tips have also been found in abundance along coastline and beaches of Lake Erie,¹²⁴ Northwest Africa,¹²⁵ and South Korea.¹²⁶ Plastic packaging for smokeless tobacco is also a littering concern, especially in countries where the use of smokeless tobacco is prevalent. In fact, smokeless tobacco packaging litter became enough of an issue in India that the country's government banned the use of plastic for smokeless tobacco packaging in 2016.¹²⁷

The cost of cleaning up tobacco product litter can be around \$6 million annually for a city the size of San Francisco (about 900,000 residents) and as much as \$16 million for a city the size of Toronto (about 2.8 million residents),¹²⁸ with much of the burden falling on taxpayers, local governments, and advocacy groups rather than the tobacco companies and smokers who litter.

Among many smokers, improper cigarette disposal is viewed as more acceptable than other forms of littering behavior and is even a social norm. In a national U.S. survey of cigarette smokers, 74.1 percent reported littering cigarette butts at least once in their lives, and 55.7 percent reported littering in the past month.¹²⁹ Reasons for littering behavior range from rebelliousness or defiance to feelings that it is a conscientious thing to do to prevent fires, while other smokers feel compelled to litter since they claim not to know how else to dispose of cigarettes.¹³⁰ According to tobacco industry documents, some smokers believe they have permission to litter because they are under the impression that cigarette butts are not harmful to the environment.¹³¹ These documents show that the industry has been aware of these views for decades, yet its only response has been to sponsor policies such as the installation of outdoor ashtrays in cities, even though the industry's own research showed that public ashtrays are ineffective at mitigating cigarette litter — even in the presence of a proper waste receptacle, many smokers instead dispose of their cigarettes on the ground.¹³² Social norms and misconceptions about cigarette disposal can be significant contributing factors to tobacco product litter.

Electronic Cigarettes and Heated Products

While the rapid growth of electronic cigarette and heated tobacco product usage poses serious health concerns, the disposal of these new products also presents a dilemma. Components such as batteries, metals, and plastics can leach toxic chemicals and make these products qualify as electronic waste. Meanwhile, the liquid nicotine cartridges of electronic cigarettes can also qualify them as biohazard waste. These dual classifications greatly complicate the

disposal and recycling of the products.¹³³ EPA has recently confirmed that both e-liquids and “electronic nicotine delivery systems” are “hazardous waste” under federal minimum standards.¹³⁴ Regardless of whether or not these electronic products are single-use or reusable, their components sometimes only last for a matter of weeks;¹³⁵ and many of the reusable products such as JUUL rely on disposable plastic cartridges containing e-liquid, the chemical makeup of which is unregulated and variable. Discarded electronic cigarettes and e-liquid cartridges still containing these solutions could be considered hazardous waste and be subject to regulation in the U.S. since they leach nicotine into the environment.¹³⁶ For example, one study compared seven electronic cigarette products sold in the United Kingdom and found 19 to 90 percent of the liquid’s original nicotine content remained inside the cartridge after typical use.¹³⁷ Furthermore, poorly manufactured e-cigarettes and their use of lithium-ion batteries creates flammability and explosion risk, documented by researchers and government agencies¹³⁸ — and flammability and explosion potential are both criteria that could make these products hazardous waste under federal law.¹³⁹ Taken together, electronic tobacco products could have an environmental impact that is just as detrimental, if not more so, than other commercial tobacco products. It is urgent that the environmental effects of the manufacturing, use, and disposal of this largely unregulated class of products be understood and adequately addressed.

Conclusion

Not a single stage of the tobacco lifecycle is without consequences to human health, ecosystems, and the global climate. The smoke from cigarette use and the cigarette butt litter that is ubiquitous to streets, walkways, parks, and beaches around the world are visible reminders of the far-reaching impact that commercial tobacco has on the environment, which ultimately affects the entire human population and ecosystems we never see, such as the deep ocean. While perhaps less visible than tobacco product use and litter, the upstream stages of tobacco production are just as damaging to the environment, if not more. Tobacco product manufacturing is extremely resource-intensive and releases millions of tons of hazardous waste and emissions, while tobacco-associated deforestation alone is a substantial contributor to climate change. The individual health and societal harms of tobacco use are irrefutable and justifiably receive attention from regulators, policymakers, and public health practitioners. Less attention, however, has been paid to the incredible amount of human and environmental harm the entire tobacco product lifecycle inflicts. Both the human and environmental crises created by commercial tobacco demand urgent attention and action.

Potential policies to address these issues are discussed in our publication, *Commercial Tobacco, Health and the Environment: Policy Solutions*.

Endnotes

- 1 The Public Health Law Center recognizes that traditional and commercial tobacco are different in the ways they are planted, grown, harvested, and used. Traditional tobacco is and has been used in sacred ways by Indigenous communities and tribes for centuries. Comparatively, commercial tobacco is manufactured with chemical additives for recreational use and profit, resulting in disease and death. For more information, visit: <http://www.keepitsacred.itcml.org>. When the word “tobacco” is used throughout this document, a commercial context is implied and intended.
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The Public Health Law Center helps create communities where everyone can be healthy. We empower our partners to transform their environments by eliminating commercial tobacco, promoting healthy food, and encouraging active lifestyles.

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