

Tobacco Product Waste in California: A White Paper

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Executive Summary

Over the past decade, Californians have increasingly become aware of environmental pollution caused by tobacco product waste (TPW), particularly from cigarette butts. This concern has grown along with efforts to protect aquatic and land-based ecosystems, to reduce sources of plastic pollution, and to sustain the overall quality of its environmental treasures. In doing so, more Californians have become aware of what had been largely invisible to them in plain sight – large quantities of toxic cigarette butts and other TPW, including plastic cigarillo tips, chewing tobacco tins, snus packets, spent e-cigarette pods, and so-called “disposable” e-cigarettes. Volunteers and communities have collected these for decades from beaches and urban neighborhoods along with other single-use items of trash such as plastic bags, straws, and food packaging. This *White Paper* aims to provide California policymakers, advocates, and the public with comprehensive information about what is known about the environmental and social impacts of TPW, the activities of the tobacco industry in response to TPW concerns, and potential solutions to the environmental problems of TPW.

Main Findings

1. Contaminants associated with TPW, primarily cigarette butts, are numerous. They include nicotine and its key metabolite, cotinine; tobacco-specific nitrosamines; metals; and polycyclic aromatic hydrocarbons (PAHs).

2. Some of these compounds may be relatively short lived in the environment (e.g., nicotine), while others can persist (e.g., metals and larger PAHs) or bioaccumulate in biota (tobacco alkaloids and metals).
3. While the chemical pollutants associated with tobacco use are well characterized, their fate in the environment, including in aquatic systems that are commonly the endpoint for TPW, are not. Nicotine and the nicotine metabolites, cotinine and trans-3'-hydroxycotinine, are important tracers of tobacco product pollution in the environment.
4. The trillions of cigarette butts littered into the environment every year are sources of pollution via leaching of chemicals and emission of gas-phase pollutants. Data on the release of these chemicals into water or air are not well characterized, and thus more research is needed regarding their environmental contamination potential and ecotoxicity.
5. Environmental contamination from electronic smoking device (ESD) use and disposal is less well documented than from commercial cigarette use. This waste requires more research, especially given the growing popularity of these products. Pollution sources include discarded e-liquid pods and their contents, ESD that include batteries and other metallic components, entire single-use ESD, and newer heated tobacco products (HTP).
6. Because of the ubiquitous disposal of cigarette butts and ESD, several waste management systems may be sources of tobacco pollutants to the environment. These include the effluents of treated domestic wastewater, leachates seeping out of landfills, and discharges from urban storm drains.

7. The cellulose acetate cigarette filter is a primary, poorly degradable component of TPW, and it has no benefit in preventing the adverse health effects of smoking. It has been a fraud in terms of its implied health protections to smokers, while succeeding since the 1950s as an important marketing tool for the tobacco industry.
8. Cellulose acetate filters are a form of bulk, non-point source pollution, even without tobacco remnants. They are also a source for microplastics as they age and break physically apart in the environment. The environmental impact of this plastic pollution merits further exploration.
9. In the past 40 years, the tobacco industry has repeatedly expressed concern about the environmental impact of tobacco use without taking any effective measures to mitigate the TPW problem upstream. Partnerships with the tobacco industry will not result in effective action against TPW.
10. The tobacco industry conducts market research and consumer surveys to develop its public relations campaigns focused on the environment. The companies were aware of the environmental concerns about TPW and have opted for highly visible, and mostly ineffective, downstream cleanup programs.
11. Current industry campaigns and initiatives resemble environmental initiatives and campaigns from the past. The more recent emphasis on reducing manufacturing and distribution environmental impacts continues the industry's focus on public relations and image ('corporate social responsibility' [CSR]) instead of directly addressing the environmental impacts of TPW.

12. The tobacco industry continues to oppose policies that may reduce the environmental impact of TPW such as the elimination of cellulose acetate filters, a primary source of plastic TPW.
13. There are policy options available now to communities and the State that could reduce the environmental burden of discarded filters and further denormalize tobacco use. These outcomes would jointly serve California's near-term and long-term environmental and public health goals.

Key Recommendations

1. Additional public information and advocacy is needed to address misconceptions about the composition and health risks of the cellulose acetate filter, other types of cigarette filters, ESD, and the role of these products in the burden of TPW.
2. Upstream solutions to address TPW are, as compared with midstream and downstream policies, likely to be the most efficient, most economical, and most effective in reducing TPW and its impacts. However, some solutions, particularly sales restrictions on specific products, may be politically difficult in many jurisdictions due to misconceptions among policy makers and consumers and the political influence of the tobacco industry.
3. An integrated approach to TPW mitigation that uses multiple tools to address consumption and disposal patterns, including through retailer density controls, pricing, imposing regulatory costs on the industry, and addressing TPW under existing environmental legislation, could assist with state and local tobacco control progress.

4. Interventions/strategies are needed to: a) support dissemination of comprehensive and accurate information about TPW toxicity and the cellulose acetate filter; b) change norms about public smoking and TPW disposal; and c) eliminate disparities in where tobacco products are sold, consumed, and discarded.
5. A more comprehensive picture of direct and secondary environmental costs of cigarette and ESD use and disposal to communities is needed to support policies that can reduce the negative economic externalities of TPW pollution.
6. Further research is needed to identify ways to shift costs of TPW onto manufacturers, distributors, and retailers of tobacco products and away from vulnerable communities, voluntary groups, and governments.

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Tobacco Product Waste in California: A White Paper

Introduction

The California Tobacco Control Program (CTCP) of the California Department of Public Health (CDPH) commissioned this *White Paper* to inform decision makers, public health advocates, and environmental groups about the public health and environmental problem of tobacco product waste (TPW).

TPW includes all items of discarded material produced through tobacco product consumption that are disposed of as waste, whether in a solid, semi-solid, liquid, or gaseous form. (See Barclays Official California Code of Regulations [§66261.2](#). [Definition of Waste](#)). Manufactured cigarettes butts are the predominant type of TPW, typically composed of shredded tobacco leaf, chemical additives, a plastic (cellulose acetate) filter, and tipping paper. TPW also includes roll-your-own cigarettes, kreteks (clove cigarettes), cigars, little cigars, cigarillos, blunts, bidis, betel quid, pipe tobacco, waterpipes (hookah shisha, hubbly bubbly), smokeless chewing tobacco, moist snus, dry snuff, nicotine pouches, and all other products that contain tobacco, and tobacco-derived nicotine. Newer electronic smoking devices (ESD) such as Puffbars contain synthetic nicotine. Although California regulations include synthetic nicotine as a tobacco product, it is not classified as such by the US Food and Drug Administration (FDA).ⁱ Additionally, TPW could include packaging made of cellophane, plastic, foil, metals, wood, and paper. Implements used to consume tobacco such as matches,

ⁱ See: <https://truthinitiative.org/research-resources/harmful-effects-tobacco/what-you-need-know-about-new-synthetic-nicotine-products> and <https://www.publichealthlawcenter.org/resources/us-e-cigarette-regulations-50-state-review/ca>

lighters, plastic cigar tips, pipes, and waterpipe and e-hookah components are also of concern as waste products. TPW is post-consumption waste regardless of where it is disposed of, including ashtrays, ashcans, trash bins, sidewalks, parking lots, roadways, storm drains, wastewater facilities, landfills, backyards, parks, forests, beaches, and other natural habitats.

TPW also includes components of discarded ESD, including vapes, e-cigarettes, or other electronic nicotine delivery systems). This electronic product waste (EPW) includes plastic, metal, rubber, electronic circuitry, metal heating coils, wicks, paint, flammable lithium-ion batteries, and alkaline batteries. All ESD have a vessel that contains e-liquid. In larger tank-type ESD, the vessel is built into the device. Pod-based ESD such as Juul use “disposable” plastic cartridges (“pods”) made of plastic, metals and rubber. ESD vessels contain e-liquid residues of chemicals, principally nicotine, propylene glycol, vegetable glycerin, and flavorants, some of which are suspected carcinogens. Additionally, EPW includes packaging made of plastic and paper and chargers with electronic components.

Heated tobacco products (HTP) also produce TPW. The components of discarded HTP devices are similar to those in ESD including plastic, electronic and metal parts, and lithium-ion batteries. The major difference between ESD and HTP is that HTP do not have vessels containing e-liquids, but rather a metal blade or chamber to heat tobacco contained in disposable mini-cigarettes (“sticks”) or plastic capsules. HTP waste from mini-cigarettes and capsules includes scorched tobacco, plastic filters, and casings with tobacco residues. As with EPW, HTP waste also includes chargers with electronic components and packaging made of plastic and printed paper.

Cigarette butts have been the most commonly collected trash item on beach cleanups globally for more than three decades.¹ Urban litter audits from several cities indicate that 10-20% of all small litter is cigarette butts.^{2,3,4} The main component of discarded butts is the cellulose acetate filter, which is a form of plastic. According to *The Tax Burden on Tobacco*,⁵ cellulose acetate filters were attached to 99.8% of the 12.46 billion commercial cigarettes sold in California in 2019.

While the majority of TPW research to date has focused on cigarette butt waste, all other tobacco products as well as their containers and packaging create environmental harms. Nonetheless, the vast majority of tobacco users in California and globally smoke filtered cigarettes, hence the focus of this *White Paper* is on cigarette butt waste, while research is emerging on other forms of TPW.

Discarding cigarette butts and other TPW is a sociocultural normative behavior among smokers that is influenced by multiple variables. These variables include a lack of awareness about environmental harms, the ingrained smoking/butt-flicking ritual, misunderstanding of cigarette butt toxicity and composition, improper use and availability of disposal options, and the widespread presence of TPW in environments.^{6,7,8,9} The environmental consequences of this behavior are not readily observable to smokers, non-smokers, or policymakers. However, there is increasing evidence for the ecotoxicity (the potential for biological, chemical, or physiological stressors to effect ecosystems) of TPW¹⁰ as well as growing concern for microplastic pollution (plastic pieces less than five millimeters long, which can be harmful to oceanic and aquatic life) from cigarette butts.^{11,12} There are also expectations for requirements!

¹Nothing great than 5 mm should be permitted into storm water

of the *Trash Amendment to the California Clean Water Act* (See Page 14 for further discussion),¹³ and growing evidence from litter audits,^{2,3,4} cleanup campaigns,¹⁴ and research projects^{15,16,17} that demonstrates the ubiquity and cost of TPW, including that from ESD.¹⁸ Hence, there is now heightened interest in reducing tobacco use and its waste products through policies that would have favorable impacts for both the California environment and the health of Californians. This *White Paper* has the following aims:

- (1) Summarize the effects of TPW on the environment and humans;
- (2) Describe the role TPW may play in contributing to social disorder and stress in urban and disadvantaged communities;
- (3) Describe the role of the tobacco and vape industry in producing TPW; and
- (4) Provide recommendations for action that focus on upstream solutions that go beyond anti-litter campaigns and ash can approaches to the TPW problem.

Findings

This section will summarize the findings of literature reviews provided *in toto* in Appendices A and Appendix B1-3. In addition, a summary of findings from key informant interviews is presented in Appendix C. First, a review of the environmental impact of TPW in general will be presented; next the issues surrounding the cigarette filter will be reviewed, followed by a review of tobacco industry actions regarding TPW and the environment. Finally, a discussion of the social and community impacts of TPW will complete this section. Although there is increasing evidence regarding ESD environmental waste impacts, there is little regarding HTP impacts. Hence, most research reviewed here addresses cigarette butts, their toxic potentials, and the problems due to the cellulose acetate filter.

Environmental Toxicity of Tobacco Product Waste

This section draws from Appendix A (Beutel et al., A Review of Environmental Pollution from the Use and Disposal of Cigarettes and Electronic Cigarettes: Contaminants, Sources, and Impact, published in the journal, *Sustainability* 2021;13(23),12994). This document provides a detailed review of TPW chemicals and ecotoxicity studies regarding cigarette butts and ESD.¹⁰ Contaminants associated with TPW (primarily cigarette butts) include: nicotine; its key metabolite cotinine; carcinogenic tobacco-specific nitrosamines; metals; and polycyclic aromatic hydrocarbons (PAHs). There has been extensive laboratory research on the potential ecotoxicity of TPW. These studies have involved microorganisms, insects, aquatic invertebrates and vertebrates, birds, plants, and *in vitro* human cells. Field research

has been more limited, but studies of urban runoff, wastewater, drinking water sources, beach environments, and the cellulose acetate filter's role in environmental pollution have gained attention as the filter has been identified as a source of microplastic waste.¹¹

Nicotine and tobacco byproducts enter landfills through discarded TPW as well as through discarded thirdhand smoke (THS)-polluted building materials, carpets, and household objects. Cotinine is among the most frequently detected chemicals in fresh landfill leachate, in groundwater contaminated with landfill leachate, and in reclaimed water used to irrigate fields.^{19,20} Cigarette butts also are a significant source for nicotine found in stormwater systems^{21,22} and for metals and PAHs found in roadside wastes.²³ Tobacco chemicals can also persist in treated wastewater, and even advanced treatment cannot eliminate these compounds, meaning that they can pollute waterways and potentially contaminate drinking water sources.

Nicotine is produced by tobacco plants, and it is an addictive chemical compound present in all tobacco products. Each cigarette has 7 to 15 mg of nicotine, and smokers absorb up to 20% of that nicotine systemically;²⁴ the balance and its transformation products are released to the environment in secondhand smoke (SHS) and THS residue or are retained in the cigarette filter and remnant tobacco as part of TPW. Nicotine has been implicated as an environmental toxin in laboratory studies of fish, mollusks, worms, and other aquatic biota.^{25,26,27,28} It is a neurotoxin that has previously been used in the United States as a pesticide; since 1980, the US Environmental Protection Agency (EPA) has classified it as an acutely toxic, hazardous waste product.²⁹ This categorization is particularly important regarding ESD disposal.

Discarded ESD themselves, when accumulated in quantity, are toxic hazardous waste products and may contaminate the environment with other potentially hazardous chemicals.³⁰ Nicotine and other tobacco alkaloids produce additional toxic and potentially carcinogenic transformation products, i.e., tobacco-specific nitrosamines (TSNAs, classified by the [International Agency for Research on Cancer](#) (IARC) as Group 1 human carcinogens) that form during curing and combustion.³¹ Little is known about TSNA aquatic environmental contamination, but these chemicals are found in indoor surfaces exposed to cigarette smoking.

Cigarette butts are potential sources of arsenic and heavy metal environmental contamination that may cause acute and chronic harm to various organisms.³² Discarded TPW may provide significant environmental contamination with metals such as chromium and nickel, especially as they are associated with nanoparticles produced in tobacco combustion.³³

PAHs are compounds produced by the incomplete combustion of organic matter and are found in tobacco smoke and the 'tar' that is produced when tobacco is burned. Benzo[a]pyrene, a PAH in tobacco tar, is also classified by IARC as a Group 1 human carcinogen. Laboratory and field studies demonstrate that PAHs are primary tobacco-related toxicants and that cigarette butts release PAHs into environments. PAHs may persist in environments, depending on conditions and their chemical structure; benzo[a]pyrene is conspicuously persistent. PAHs from tobacco overlap with those from other forms of combustion such as biomass and fossil fuels, and thus it is difficult to ascertain specific TPW sources for PAHs in the environment. Field studies, however, have confirmed presence of cigarette butt-sourced PAHs in environmental samples.³⁴

The cellulose acetate of commercial cigarette filters is a synthetic plastic, derived by reacting cellulose from cotton and wood pulp with acetic anhydride and acetic acid.³⁵ Cellulose acetate flake precipitates out of the reaction, which is then dissolved in acetone to yield a viscose solution. This solution is transformed into multiple solid, uniform strands of cellulose acetate filament, which are combined into a ribbon of cellulose acetate strands (known in the industry as a 'tow'). The tow is formed into a tube of cellulose acetate foam, comprised of 12,000-15,000 filaments, and cut into segments. It is then treated with a plasticizer and affixed to the cigarette.³⁶

Discarded cigarette filters comprise a significant source of plastic waste to environments.^{11,37} While somewhat susceptible to photodegradation, they are relatively resistant to biodegradation and may take months to years to break apart depending on environmental conditions.^{38,39,40} Recent experiments suggest that cigarette butts may be a chronic environmental source of toxic plastic micro-fibers.¹¹ Due to the ubiquity of cigarette butts, these micro-fibers are found in urban runoff (water flowing over man-made surfaces in densely populated areas).¹² They are often discarded onto hard surfaces on sidewalks, streets, and entertainment venues. There, they are subjected to mechanical degradation and may not be completely picked up by street and sidewalk sweeping.⁴¹ Currently, the *Trash Amendment to the California Clean Water Act*¹³ mandates that trash items five millimeters and larger must not enter the storm water system; this would include cigarette butts but not the cellulose acetate fibers resulting from cigarette butt breakup. Cellulose acetate also has been used in other products such as diapers, medical gauze, ribbons, apparel linings, home furnishings, eyeglasses, and photographic film. However, these items are not as likely as cigarette butts to be

discarded onto urban surfaces. Currently, it is not possible to differentiate cigarette butt-sourced cellulose acetate fibers found in aquatic environments from that derived from such other products.¹¹

Aquatic animals such as turtles and fish and terrestrial animals such as dogs and birds may consume whole cigarette butts.⁴² Cellulose acetate fibers may also be ingested by a variety of aquatic animals, may end up in aquatic biome sediment, or may even be transported to the oceanic environment.^{11,12}

Aside from the risks to wildlife and pets due to accidental consumption of cigarette butts, concern has been raised regarding the impacts of TPW more broadly on ecosystem services. According to the *2005 Millennium Ecosystem Assessment* of the human impact on environments,⁴³ ecosystem services include *provisioning*, such as the production of food and water; *regulating*, such as the control of climate and disease; *supporting*, such as nutrient cycles and oxygen production; and *cultural*, such as spiritual and recreational benefits. Environmentally relevant concentrations of nicotine can impair life forms at the bottom and higher up the food chain.⁴⁴ Thus, animal population dynamics and food web interactions are at risk where nicotine enters aquatic systems. Additionally, adverse impacts of cigarette butts on the diversity of microbial communities in environments have been reported.⁴⁵ The implications of such changes in microbial communities, if attributable to cigarette butt toxins, are important to understand as part of a broad TPW environmental risk assessment.

Recent studies have also documented the effects of cigarette butts in soil and cigarette smoke on plant growth processes. For example, researchers have suggested the potential for discarded cigarette butts to reduce the net carbon assimilated by plants

via photosynthesis in terrestrial plants.⁴⁶ Other researchers have reported elevated levels of metals in plants located near outdoor smoking areas.⁴⁷ Metal accumulation in plants could affect humans indirectly by lowering plant nutritional value and directly through consumption of contaminated crops, even at low levels of chronic exposure;⁴⁸ however, there are no studies linking metal accumulation in plants to TPW.

Several studies have reported bioaccumulation of TPW pollutants in aquatic animals and potential impacts on growth and behavior. These include studies on rainbow trout exposed to non-lethal cigarette butt leachate⁴⁹ and on filter-feeding organisms such as clams and mussels.^{50,51} However, no research has yet addressed transfer of cigarette butt pollutants up the aquatic food chain as the toxins accumulate and predators consume their prey. Several studies have found tobacco contaminants in key parts of the physical environment that may imply potential pathways to animals and humans; these include water,⁵² soil⁴⁷ dust,⁵³ and plants.⁵⁴ There is evidence that drinking water could be a significant exposure route, with several studies showing measurable nicotine and cotinine levels in drinking water supplies.^{10,52,55}

The cleanup and disposal of TPW, much of it related to cigarettes, is a negative economic externality, defined as a harmful effect to a third party not directly involved in tobacco use and which is not compensated. This externality is borne by non-smokers, taxpayers, communities, and voluntary groups that conduct cleanups, disposal, education, transport, and enforcement. Cities incur significant TPW cleanup and disposal annual costs, such as up to \$6 million for San Francisco.⁵⁶ In addition to the direct impacts associated with TPW cleanup, there is a range of secondary economic impacts that need further study. TPW impacts environmental quality by fouling natural

environments such as beaches and parks. It degrades neighborhoods and public spaces, especially in areas more highly affected by tobacco use. Collected TPW still has to be disposed of, usually in landfills, and this is not without concern. Such indirect environmental impacts may translate to economic consequences due to water and waste purification needs and impacts on cultural and aesthetic services including tourism, neighborhood cleanliness, and recreation.

The Cellulose Acetate Cigarette Filter as a Source of Toxic Plastic Waste

It is important first to understand the history and anatomy of the cellulose acetate filter as a product additive, and then to ascertain whether it has any place in protecting people from the health hazards of smoking. Filters were first used to keep loose tobacco out of smokers' mouths.⁵⁷ In the 1930s and 1940s, they were marketed to protect smokers from 'poisons', such as nicotine, and were typically composed of paper, wool, or cotton. In 1936, the Brown & Williamson Tobacco Company commercialized the first American cigarette with a filter, calling it *Viceroy*. As concerns about the adverse health effects of smoking became evident in the 1940s and 1950s, applied research on cigarette filters rapidly increased. By the mid-1950s, scientific evidence implicated cigarettes as a contributor to the reported increase in lung cancer cases.⁵⁸ In response to both internal and external research about the potential and real health consequences of smoking, cigarette companies expanded marketing efforts to suggest implicitly and explicitly that cigarettes could be safer with the addition of filters. In 1951, only 1% of cigarettes on the market had a filter. However, by 1958, almost half of the cigarettes on the market were filtered.⁵⁹

In 1962, the United Kingdom's Royal College of Physicians published a report (*Smoking and Health*) highlighting the link between smoking and lung cancer, other lung diseases, heart disease, and gastrointestinal problems.⁶⁰ In 1964, the United States Surgeon General's Advisory Committee on Smoking and Health published the first *Report on the Health Consequences of Smoking*. Based on evidence from more than 7,000 articles relating to smoking and disease, the Committee concluded that cigarette smoking is a cause of lung and laryngeal cancer in men, a probable cause of lung cancer in women, and the most important cause of chronic bronchitis.⁶¹ The report also provided suggestive evidence that smoking caused other illnesses such as emphysema, cardiovascular disease, and various other types of cancer. These reports may have fueled the shift in tobacco industry marketing to emphasize the potential health value of smoking filtered cigarettes. By 1993, almost all manufactured cigarettes consumed in the United States were filtered (Appendix B1, Figure 1). According to the *2020 Federal Trade Commission Cigarette Report*, the market share for filtered cigarettes across all major manufacturers was 99.8%.⁶²

The tobacco industry documented early on the inability of filters to reduce exposure to harmful chemicals in smoke without damaging the cigarette's marketability (See Proctor R, *Golden Holocaust*, Page 365⁵⁷). Nonetheless, cigarette companies achieved marketing success in the 1950s and 1960s through strategic advertising and efforts to ease increasing concerns over health risks associated with smoking. They were assisted at that time by free advertising in widely read sources such as *Reader's Digest*.⁶³ Advertising touting filters' efficacy in reducing 'tar and nicotine' were common in medical journals such as *Journal of the American Medical Association*.⁵⁷ Lower

machine-measured tar and nicotine yields were thought by smokers to reduce cancer risks, and “light,” “low tar,” and “mild” became key advertising messages. This was despite growing evidence that lung cancer and other disease risks were increasing, despite lower machine-measured tar and nicotine yields.^{64,65} These fraudulent terms are now prohibited from use in the United States by the 2009 *Family Smoking Prevention and Tobacco Control Act* ([Tobacco Control Act](#)), unless authorized by the US Food and Drug Administration for Modified Risk Tobacco Products.

In 2001, the US National Cancer Institute’s *Monograph 13*,⁶⁶ asserted that changes in machine-measured tar and nicotine yields in cigarette smoke (with the so-called ‘FTC Method’⁶⁷) did not reduce smokers’ actual exposure to tobacco toxicants. Chapter 6 (on ‘Cancer’) in the 2014 *US Surgeon General’s Report*,⁶⁸ extensively reviewed the way changes in cigarette design, mainly the filter and its ventilation, have not protected smokers from the adverse health effects of smoking. The evidence cited in that *Report* was sufficient to conclude that there has been an increased risk of lung adenocarcinoma^k among smokers resulting from changes in the design and composition of cigarettes since the 1950s.

Ventilated filters can lower the tar and nicotine levels measured by machine smoking. Ventilation involves providing small holes in the filter that allow the dilution of the smoke with air when the cigarette is puffed. Because smokers need to extract sufficient nicotine to maintain their addiction to this powerful drug, they are able to obstruct the vents, (so-called compensatory smoking) and puff more deeply, thereby

^k Adenocarcinoma is a more aggressive lung cancer cell type, originating in the periphery of the lungs. Prior to changes in cigarette design, the more common lung cancer cell type was small cell. See: Appendix B1, Figure 3.

obviating any reduced delivery of toxins or nicotine to the smoker. The addition of ventilated filters has clearly changed the pattern of smoking, including more intense puffing, and this has changed the pattern of lung cancer incidence in particular.⁶⁹

There are other marketing gimmicks that have been incorporated into filters, including flavorings, colorings, and carbon. These design features intended to enhance product appeal and suggested reduced health risks of smoking. This made it easier for young people to initiate smoking and enhanced smokers' perception of a safer product.⁷⁰

A published research report based on [Truth Tobacco Industry Documents](#) housed at the University of California suggests cellulose acetate filters are 'defective'.⁷¹ Fibers breaking off from cellulose acetate filters are known as 'filter fallout'. They are produced during smoking and are inhaled into the lungs of smokers. In addition, there has been one study of the particulate matter (PM_{2.5}) emitted as SHS from smoking filtered vs unfiltered cigarettes; this study showed significantly more PM_{2.5} emitted from the filtered cigarette as SHS than from the non-filtered cigarette.⁷²

Despite the accumulating evidence regarding the inability of filters to eliminate toxic tobacco chemicals and the increase in lung adenocarcinoma that is likely attributable to the design changes in commercial cigarettes,⁷³ there still seems to be uncertainty expressed by the public⁸ and some scientists⁷⁴ about the health value of filters. A small proof-of-concept study reported on a controlled trial to assess perceptions, changes in topography (the patterns of smoking such as puff length, inter-puff intervals, puff volume, etc.), and changes in exposure to nicotine and some carcinogens.⁷⁵ Preliminary data from this trial suggest that committed smokers, when

switched to unfiltered cigarettes, smoke fewer cigarettes per day, experience less satisfaction from their smoking, report more aversion and harshness, and do not differ with respect to nicotine absorption (as measured by urinary cotinine).⁷⁶ Additional data from this study comparing urinary NNAL levels (a tobacco carcinogen biomarker) are still pending.

Stanford historian Robert Proctor summarized in his book, *The Golden Holocaust*,⁵⁷ the three reasons why filters have been part of almost all commercial cigarettes since the 1960s. These are: 1) to lower the cost of manufacturing (cellulose acetate is actually cheaper than tobacco leaf); 2) to keep tobacco bits from entering the mouths of smokers (probably the principal reason people had used cigarette holders in the past); and 3) to convince people into thinking that filtered brands were somehow 'safer' than unfiltered brands. Given that unfiltered cigarettes may be less satisfying and more aversive, unfiltered cigarettes may also be less attractive to youth initiators.⁷⁶ The filter ultimately has become nothing more than a fraudulent marketing tool designed to reassure smokers and young initiators that they are doing *something* to reduce their risks.³⁷ Cigarette smoking, filtered or unfiltered, is still the leading cause of preventable death in the United States and California, and, in fact, one might consider the filter additive as a health risk.⁶⁹

The Tobacco Industry and Tobacco Product Waste

The tobacco industry has responded to scientific inquiry and advocacy regarding TPW and its impact on the environment with a mix of voluntary initiatives, best described as efforts to display CSR. See Appendix B2 for detailed information on

tobacco industry activities regarding TPW. The tobacco industry has persistently emphasized downstream approaches such as financial and media support for cleanup campaigns, donating and distributing handheld ashtrays and waste bins, and supporting educational efforts directed at tobacco users to encourage them to discard their cigarette butts properly. The industry also has established partnerships with non-profit organizations such as Keep America Beautiful, the Ocean Conservancy, and others, to address TPW.^{77,78} The overall objective seems to be for the industry to portray itself as a responsible corporate entity. Rather than support any upstream, source reduction interventions against TPW, which companies see as a criticism directed towards the industry, its downstream efforts continue to emphasize voluntary cleanups and recycling schemes.

The industry recognized in 1991 that the cellulose acetate filters attached to almost all commercial cigarettes were not biodegradable and that public interest in environment protection was growing. Subsequently, a multi-company association known as CORESTA (Cooperation Centre for Scientific Research Relative to Tobacco) established a task force to study the feasibility of developing biodegradable filters. The task force was disbanded in 2000, reporting that it was "...unlikely that the level of interest could justify the scale of the effort."⁵⁹

Currently, all major tobacco companies now have statements and programs on their websites about the environment and sustainability. For example, Altria, the parent company of Philip Morris USA (PM), provides messages that commit to implementing "environmentally sustainable practices where possible," and to consider the environment in its "business processes."⁷⁹ In 2020, PM International (PMI) launched its

“Our World Is Not an Ashtray” Initiative, which stated a goal to “halve plastic litter from products by 2025.” In its *Sustainability Materiality Report*, PMI asserts, “Promoting anti-littering behavior among consumers through awareness and cleanup campaigns and partnerships” as the main activities to achieve this goal. This means, “PMI will encourage volunteers in every corner of the world to...geotag litter and join cleanup challenges ranging from local neighborhoods to global initiatives.”⁸⁰ These are ‘downstream approaches’ (meaning, dealing with the problem after items have been discarded) to TPW, deferred to volunteers, communities, and partner groups (some of whom receive funding from PM), to address the waste produced by tobacco products. Even though cleanup campaigns might identify the extent of TPW and collect millions of discarded cigarette butts, trillions of different types of tobacco products are produced and utilized each year. Such downstream solutions do not stop smokers from discarding cigarette butts or provide any meaningful recycling or sustainable cleanup programs that will make a difference in the TPW environmental burden. As part of this activity, PMI’s own consumer survey found that only 13% of smokers knew filters are made of plastic, and 25% thought that discarding cigarette butts on the ground was appropriate.⁸⁰

It is important to recognize that under the environmental principle of *product stewardship*, manufacturers may be held responsible to reduce the impact of post-consumption waste from their products. In the case of TPW, this could mean stopping sales of cellulose acetate filter cigarettes.⁸¹ As previously discussed, this solution is unlikely to be embraced by manufacturers, even though the filter additive has no positive health utility. Instead, the industry

recognizes the cellulose acetate filter as a commercially important product component. Nonetheless, local, state, tribal, or national jurisdictions may implement such product sales regulations as authorized under the *2009 Tobacco Control Act*.⁸²

Social and Community Impacts of Tobacco Product Waste

This section summarizes a broad range of social and community concerns for TPW (see Appendix B-3 for a detailed discussion of environmental justice and TPW). According to the California EPA, environmental justice calls for “fairness, regardless of race, color, national origin or income, in the development of laws and regulations that affect every community’s natural surroundings, and the places people live, work, play and learn.”⁸³ Thus, TPW can be described as an *environmental justice issue* because TPW is concentrated around businesses that sell tobacco products,¹⁶ which are disproportionately located in low-income communities and communities of color.⁸⁴ In addition, as previously described, TPW creates a negative economic externality, which assigns responsibility for cleanup to those not involved in production, distribution, sales, or use of tobacco products. This then can also describe TPW as an *economic injustice* affecting communities throughout California. Currently, the CTCP is investigating how to model the economic impacts of TPW at the community level. This econometric model will be implemented in 2023 and will provide an estimate of costs borne by communities for TPW cleanup as well as for indirect impacts on environmental quality. However, recent research has already provided minimum estimates for TPW direct

cleanup costs in several large California cities;¹⁷ for example, annual TPW cleanup costs are \$3.9 million in San Jose, \$7.1 million in San Diego, and \$19.7 million in Los Angeles.

Cleanup campaigns have been conducted by a variety of voluntary groups and communities, including those participating in the International Coastal Cleanup (ICC), led by the Ocean Conservancy for the last 35 years.¹ This effort involves hundreds of thousands of volunteers and dozens of different volunteer organizations for an annual cleanup event each September. In 2020, cigarette butts were the most common picked up item globally (n=964,521), as they have been for almost the entire history of the ICC. Of course, there are millions of other trash items collected at the same time, especially plastics, but with almost six trillion commercial cigarettes sold each year globally, one might wonder what additional quantity of TPW was *not* collected and reported, including packaging, ESD, snus packets, cigars, etc. The time spent by these volunteers picking up TPW is not negligible and may be considered a lost opportunity cost associated with TPW cleanups.

Other cleanup examples in California include [Save Our Beach](#), which conducts monthly cleanups of beaches and wetlands in Long Beach and Seal Beach. Nationally, [Surfrider Foundation](#) conducted 927 cleanups in 2020; of the 414,037 items collected by almost 9,000 volunteers, 75,997 were cigarette butts (ranking second only to plastic fragments, which may also include TPW components). The California Department of Parks and Recreation sponsors an [Adopt-a-Beach Program](#) that calls for community groups to conduct three beach cleanups per year for a designated state beach. Municipal voluntary groups, such as [I Love a Clean San Diego](#) sponsor monthly

cleanups and participate in the ICC. Campus cigarette butt cleanups have led to the establishment of smoke-free college campuses throughout California.^{85,86} Cleanups serve to point out the problem of TPW, but these community efforts will not significantly reduce the amount of TPW in the environment, given the enormous number and persistence of cigarette butts and other TPW.

TPW contaminates beaches, parks, schools, natural reserves, urban communities, and the general environment throughout the world. This *White Paper* and Appendix A describe the growing body of (primarily) laboratory research on the ecotoxicity of TPW and the concerns about the plastic cigarette filter. What still needs investigation are the long-term effects of TPW on ecosystems. TPW may harm several of these services, including those related to California's recreational resources. To prevent harms to California's natural areas and reduce citizen exposure to SHS, the California legislature in 2019 banned smoking in state parks and beaches to sustain recreational environment quality.⁸⁷ Even with such efforts, TPW persists, and more educational, enforcement, and upstream interventions are needed at state and local levels to protect these fragile and valued California resources.

Given that smoking and other forms of tobacco use continue to create enormous burdens on health care systems, communities can take specific actions to reduce the health consequences of smoking while addressing the environmental impacts of tobacco use through regulatory efforts for which they have authority. These can further denormalize tobacco use (such as bans on smoking in public outdoor areas⁸⁸), increase

the price of tobacco products (such as San Francisco levying a 20-cent litter fee¹ on cigarette packs⁵⁶), and restrict sales of tobacco products or specific components (such as the first complete community ban on tobacco sales in Beverly Hills⁸⁹ or flavor bans in San Francisco and a growing number of other communities⁹⁰). Communities bear the majority of the TPW burden, and therefore communities may take action to control it through existing authorities.

Proposed Solutions

This section presents a discussion of potential solutions to the problem of TPW. It draws from Appendix B-3 (Hill et al., *A Review of Policy Options to Address Tobacco Product Waste*). First, the policy options in the environmental regulatory domain are discussed, including critiques of various proposed approaches. Next, specific recommendations are provided for consideration by local agencies, tribal entities, and other stakeholders regarding actions that may be engaged under existing authorities or regulatory regimes.

Upstream/Midstream/Downstream Policy, Systems, and Environmental Solutions

¹ Since the 2010 passage of this local legislation, Proposition 26 was passed in California which mandates that two-thirds of the voting population affected must approve any fee or levy before a local government can implement such an intervention (see more information on page 207, footnote 13 of this document: <https://www.publichealthlawcenter.org/sites/default/files/resources/article-freiberg-cigarette-litter-hamlinelawreview-2014.pdf>)

Some solutions to TPW may fundamentally shift consumption and use patterns, thereby reducing the number of products sold, used, and then discarded. These are *upstream* policy solutions, as they deal primarily with the source of the problem. Other proposed solutions call for imposing additional costs or regulatory requirements on the consumption of tobacco products, and these are considered *midstream* policy solutions. Mitigating, managing, or paying for the costs for cleanups imposed on the public by TPW are *downstream* policy solutions.

Upstream Solutions

Upstream policy solutions can include sales restrictions, hazardous waste or materials laws, comprehensive smoking restrictions, and educational campaigns. These solutions may be thought of as *source reduction* because they aim to denormalize tobacco use overall, reduce the availability of the products themselves, and change the patterns of tobacco product use rather than attempting to mitigate TPW that has already been discarded. For example, a policy to prohibit the sale of cigarettes with filters could effectively minimize their resulting environmental impact as plastic waste.

The effectiveness of policies that propose to regulate single-use plastics should incorporate clear definitions that articulate specifically what “single-use” means in the context of tobacco products. Without clear definitions that identify which products are covered, such policies may have minimal impact and risk being influenced by the tobacco industry, as the cellulose acetate filter is recognized as such a critically valuable marketing tool.⁹¹ Current efforts to prohibit the sale and provision of single-use

plastic products, including those targeting specific products such as plastic bags^m and strawsⁿ could be applied to cellulose acetate cigarette filters and the myriad of other tobacco product-related plastic waste. It is possible such a sales restriction would be challenged by the tobacco industry as a “tobacco product standard”, which might be preempted by the federal 2009 [Tobacco Control Act](#). However, the ability of a locality to impose limitations on the sale (rather than the manufacture or formulation) of a product is expressly preserved by the *Act*. Hence, such sales restrictions would likely not be preempted.⁸² Numerous federal courts have affirmed that local jurisdictions can prohibit the sale to consumers of tobacco products with a particular characteristic, such as flavors or even vapes, without creating a “product standard” under federal law.^o

Restrictions on the density of retailers in a specific area could reduce the sale and consumption of tobacco products in a given community.⁹² Because point-of-sale marketing is concentrated where tobacco products are sold, and because tobacco retailers are disproportionately located in low-income communities and communities of color due to decades of industry targeting and exploitation, those with lower socioeconomic status are more exposed to environments that facilitate tobacco use. This suggests that limiting exposure to tobacco sales and marketing could reduce existing tobacco-use disparities in communities disproportionately exposed to such marketing. Retailer density restrictions could be an environmental intervention that

^m Several jurisdictions have enacted bans, imposed fees, or otherwise regulated the provision of plastic bags to customers, including California, Connecticut, District of Columbia, Oregon, and others.

ⁿ Several jurisdictions in California and Seattle have banned the use of straws, while the State of California prohibits restaurants from automatically disseminating them to customers.

^o See Nat’l Ass’n of Tobacco Outlets, Inc. v. City of Providence, 731 F.3d 71 (1st Cir. 2013); Independents Gas & Serv. Stations Ass’n v. Chicago, 112 F. Supp. 3d 749 (N.D. Ill., 2015); R.J. Reynolds Tobacco Co. v. Cty. of Los Angeles, 2020 WL 4390375 (C.D. Cal. July 13, 2020); U.S. Smokeless Tobacco Mfg. Co. LLC v. City of New York, 708 F.3d 428 (2d Cir. 2013); R.J. Reynolds Tobacco Co. v. City of Edina, 2020 WL 5106853 (D. Minn. Aug. 31, 2020)).

addresses inequities, for example, by focusing on density per roadway mile rather than on a per capita basis. With respect to TPW, multiple studies note that TPW accumulates around where tobacco is used and sold.^{15,16} Recent studies indicate that retailers of newer tobacco products, such as vape shops, appear to follow the predatory tactics of other tobacco retailers by locating in low-income, Asian, Black/African-American, and Hispanic/Latino communities.⁹³ Research findings on the relationship between tobacco retailer density, presence of TPW, and tobacco use supports the adoption of density-reducing tobacco policies, in conjunction with policies that help foster social capital, as an integrated approach to reducing tobacco-use and TPW disparities.

There is also growing realization that various aspects of hazardous waste and hazardous materials law could be used to regulate TPW as hazardous waste.⁹⁴ There is evidence that indicates cigarette butts and filters could meet California's aquatic toxicity threshold for hazardous waste.⁹⁵ The U.S. EPA has affirmed that discarded, unused tobacco products containing processed leaf tobacco could be considered hazardous waste.⁹⁶ A recent study found that 30% of the chemicals identified in an analysis of leachates from cigarette butts are listed in the FDA's established or proposed *Harmful and Potentially Harmful Constituents in Tobacco Products and Tobacco Smoke* list published pursuant to the *Tobacco Control Act*.⁹⁷ Nicotine is also listed as an acute hazardous waste under the federal Resource Conservation and Recovery Act (RCRA). This means that when it is discarded in certain quantities, it must be handled, transported, and disposed of according to specific regulatory requirements.⁹⁷ Research has demonstrated that some ESD also meet the threshold

for hazardous waste toxicity due to their metal content and nicotine residual.⁹⁸ Many new commercial tobacco products contain batteries that are themselves treated as hazardous waste in some states,⁹⁹ including in California. A parallel example of hazardous waste regulations applying to widely available consumer products is a recent California State law ([Toxic-Free Cosmetics Act, California Assembly Bill 2762](#)) to ban the manufacture or sale of cosmetics containing 24 toxic substances. In addition, federal legislation ([Federal Hazardous Substances Act](#)) prohibits the sale of certain hazardous substances in consumer products. Sales restrictions based on a product's status as hazardous waste would also reflect the "precautionary principle,"^p which could be applied to the regulation of TPW, especially new products that are subject to FDA regulatory review. Even though there is not yet an established adverse human health outcome for TPW, the precautionary principle would support interventions even before its public health and environmental impacts are well understood.¹⁰⁰

There is unquestionably an information gap in both smokers' and non-smokers' understanding of the toxicity of TPW and its potential risks to both human health and the environment.¹⁰¹ Thus, educational campaigns are a necessary component of comprehensive approaches to reducing TPW, including cigarette butts, ESD, and other types of TPW. Educational campaigns that provide environmental messaging could specify the economic costs associated with TPW, the costs of cleanups and voluntary

^p The precautionary principle is a tenant of environmental protection that provides that an action should not be taken where there are threats of serious or irreversible damage or scientific uncertainty surrounding the action's potential impacts. In the context of regulated industries, any uncertainty about potential impacts stemming from industry or governmental action should be resolved in favor of prevention.¹⁰³

group efforts, and the potential damage to ecosystems associated with the entire life cycle of tobacco product cultivation, production, and use.¹⁰²

Like graphic warning labels that warn of the health consequences of smoking, an environmental hazard label could also be an effective way of providing information to consumers about the environmental impact of TPW as well as information about proper disposal. Because of existing federal legislation on labeling, this would only be possible at the federal level in the United States.¹⁰³

Smokers may believe that cigarette butts are biodegradable or do not constitute “trash”. This is evidenced by the fact that a self-reported littering rate for cigarette butts was 65% (in the last month) compared to a 17% littering rate of other products such as plastic bottles.¹⁰¹ Smokers and non-smokers alike generally do not know that cigarette butts are made of plastic and are poorly degradable.^{8,104} Comprehensive, non-industry-funded campaigns focused on providing accurate information about the extent of TPW’s environmental risks could have a meaningful impact on TPW and tobacco product use. However, educational campaigns with a limited focus on anti-littering have not been shown to have a significant impact on the amount of TPW that is discarded.¹⁰⁵

Midstream Solutions

A “midstream” policy solution may impose additional costs or burdens on either the consumer or the regulated industry, rather than entirely shift the regulatory paradigms regarding sale and marketing to the producer. Taxes or fees imposed on cigarettes or other tobacco products at the point of sale, for example, could help fund the costs of proper disposal and cleanup of TPW, as well as any administrative costs

associated with such programs paid by jurisdictions.¹⁷ Any increased income for the retailer in such schemes should be accompanied by regulatory requirements to use the funds for programs or tasks addressing TPW.

It is possible that requiring a large deposit for each tobacco product sold could effectively reduce use and consumption, as higher tobacco product prices have been shown to result in a reduction in use.¹⁰⁶ Some have suggested deposit/return schemes that would require manufacturers to take back cigarette butts or other TPW.¹⁰⁷ While the deposit system has been successful in other consumer products, it may encourage continued consumption and use and create a perception that the product could actually be managed in such programs.¹⁰⁸ There would be substantial infrastructure and costs to handle the returned toxic waste, and such a scheme may be impractical for collection and storage of the toxic, potentially flammable TPW at collection points.¹⁰⁹ ESD with batteries may be candidates for a deposit and return system. However, the high cost and complications of disposing of e-cigarettes that contain several different hazardous waste materials in a small and difficult to disassemble package would make such a return system difficult to administer.

Federal environmental law places strict requirements on the handling of certain types and quantities of hazardous waste.⁹⁹ Additional State requirements could be imposed on the handling of ESD and the potentially large quantities of cigarette butts or other TPW that may be collected under intensified cleanup programs. How these requirements would apply to tobacco retailers and distributors is unclear; therefore, additional research would be needed to better understand how existing hazardous waste management programs could be expanded to include TPW.

Place-based restrictions on the use of tobacco products (e.g., on beaches, in parks, on public streets), could have the effect of denormalizing tobacco use if adopted widely and there is a high degree of compliance. However, they address the presence of TPW in specific areas rather than overall. Further, because cigarette butts and their associated microplastic breakdown products travel to storm drains, rivers, streams, and the ocean, specific place-based smoke-free laws will not prevent TPW from entering these aquatic biomes.

Some research supports the imposition of fines or strict punishments for violating use restrictions or existing laws. California's litter law prohibits disposal of cigarette butts on public and private lands ([Penal Code § 374.4](#)). California's Health and Safety Code prohibits disposal of TPW within 25 feet of a playground or a tot lot sandbox area and using tobacco products within 250 feet of a youth sports event ([Health and Safety Code § 104495\(c\)](#)). California's highway litter law prohibits discarding TPW along highways ([Vehicle Code § 23112](#)). Inappropriate disposal of cigar or cigarette waste is prohibited at state parks and beaches ([Public Resources Code § 5008.10](#)). Referring to the previous discussion on environmental justice, while these laws exist, enforcement could be problematic. Minor infractions of such laws may lead to increased interactions with law enforcement, especially for low-income individuals and people of color. Broader, integrated interventions such as those described in the [Guidelines](#) provided by the US Centers for Disease Control and Prevention for general tobacco control, would likely have more meaningful positive environmental impacts on TPW mitigation than only place-based restrictions.

Rather than constituting one specific policy solution, *extended producer responsibility/product stewardship* (EPR/PS) concepts could underlie several different policy solutions, including several of the ones discussed above, such as deposit/takeback schemes, hazardous waste management requirements, recycling, and cleanups.⁸¹ A true EPR structure would place responsibility for running and operating those programs onto the manufacturers, distributors, or retailers themselves. In the case of PS, this would extend to all responsible parties involved in the life cycle of the product. However, industry involvement in an EPR-based structure could be extensive, and this could include financing systems for collecting and transporting waste, developing performance standards, and even creating educational programs. Given the tobacco industry's history of denial of the health consequences of product use as well as its manipulation of policies and public opinion through faux CSR schemes and false advertising, such approaches involving the tobacco industry in planning or implementation should be strictly avoided.

Downstream Policy Solutions

Cleanups

Downstream policy solutions focus on cleaning up or eliminating litter once it has been discarded. These approaches are least likely to denormalize or reduce tobacco use or accumulation of TPW. In fact, the tobacco industry, as noted above, favors anti-litter campaigns, and has funded distribution of hand-held ashtrays and ashcans, researched biodegradable filters, and promoted cleanups.¹¹⁰ While cleanup campaigns have been undertaken by many environmental and community organizations and can serve to educate participants and the public about the environmental impact of TPW, it

is impossible to have a substantive impact on TPW through cleanups alone. Given the volume of cigarette butts and other TPW, the relatively small reduction in TPW attributed to butt disposal cans on beaches and disposable ashtrays means they are also not a meaningful solution. These policy approaches do nothing to address the source of the waste, and hence they provide neither an environmental nor a behavioral solution to the problem of TPW.

The industry and some entrepreneurs have expressed hope that biodegradable filters could reduce the burden of TPW.^{111,112} As discussed previously, prior attempts by the tobacco industry to develop a biodegradable filter have not been marketable.⁵⁹ While some suggest that biodegradable filters are a potential alternative to the plastic cellulose acetate filter problem, others have concluded that biodegradable filters could lead to even more butt littering and “littering without guilt.”¹¹⁰ Such efforts also enable industry exploitation and greenwashing.⁸⁹ Even if they were commercially viable, however, biodegradable filters would still contain and release toxic chemicals into the environment and will not address other sources of TPW.²⁶

Litigation

The legal doctrine of ‘public nuisance’ has been successfully used to litigate other toxic consumer products (e.g., lead based-paint) and could be used to hold tobacco product manufacturers accountable for interfering with common rights. These include damage to water, parks, or air.⁹⁴ Litigation against the pharmaceutical industry and lead-based paint manufacturers suggests that manufacturers can be held responsible for some public nuisance impacts of products they put into the stream of

commerce.⁹ However, those cases are extremely costly, complex, and can take years or even decades to resolve. Some researchers have cited the potential utility of using enforcement mechanisms of hazardous waste law to litigate on TPW. This may particularly apply in California where cigarette butt leachate has been shown to meet certain aquatic toxicity thresholds.⁹⁵ However, hazardous waste laws generally take effect once the products become “waste”. Hence, this approach could also have an adverse result because it would place liability on public institutions where waste accumulates, while sparing entities that produce the toxic TPW in the first place.^f

Recycling

Recycling programs proposed in New York and implemented in Vancouver, British Columbia, have been proposed as potential solutions by some.¹¹³ However, as discussed previously, recycling programs may be complicated and costly to administer, and the products to be recycled may still contain harmful chemicals, meaning that they could pose harm even in recycled form.¹¹⁴ There are also examples of industry-supported cigarette butt recycling programs,¹¹⁵ and the e-cigarette industry has also attempted to demonstrate an interest in recycling.¹¹⁶ As with the ineffectiveness of efforts that rely on the personal actions of individual smokers, recycling is likely not a viable solution for a meaningful reduction of TPW. Even if 50% of cigarette butts were recycled in California, there would still be more than six billion discarded somewhere.

⁹ State of Oklahoma v. Purdue Pharma L.P., No. CJ-2017-816, 2019 WL 9241510, at *1 (Okl. Dist. Nov. 15, 2019) and People v. ConAgra Grocery Prod. Co., 17 Cal. App. 5th 51 (2017).

^f Barclays Official California Code of Regulations. §66261.2.

Recommendations to Local/Tribal Projects, Stakeholders, California Tobacco Control Program

As with all tobacco control policies, multi-component strategies are likely to be more effective than single, categorical approaches. Upstream solutions to address TPW, as compared with midstream and downstream, are likely to be the most efficient, most economical, and most likely to reduce the amount of TPW. However, they are likely to require the most political will to implement. An integrated approach to address TPW could include:

- Upstream approaches through:
 - Prohibiting the sale of filtered cigarettes;
 - Controlling density of tobacco distributors; and
 - Disseminating comprehensive and accurate information about the environmental impacts of TPW and the health risks of the cellulose acetate filter.
- Midstream approaches including;
 - Implementing fees (given restrictions of Proposition 26) to offset costs of cleanup and environmental damages;
 - Transferring environmental regulatory costs on the industry where feasible, and
 - Litigating to recover costs of nuisance and damages to ecosystems services.
- Downstream approaches including:

- Addressing TPW accumulation through existing environmental regulations such as the *Trash Amendment to the California Clean Water Act*;
- Conducting scientifically valid TPW monitoring programs to assess TPW burdens on specific communities;
- Establishing and enforcing outdoor smoking prohibitions;
- Assessing specific industry contributions to TPW burdens, and
- Measuring progress in TPW burden reduction.
- Conducting additional research to assess:
 - Specific damages done to ecosystems, natural areas, animal health, and human health by TPW;
 - Impacts of cigarette butt-specific cellulose acetate in aquatic biomes;
 - Costs of TPW cleanup, prevention, program administration, and long-term environmental impacts;
 - Impacts of non-cigarette butt TPW, including on new and emerging ESD, cigar products, hookah, packaging, and other forms of TPW; and
 - The unique impacts of TPW in communities where retailer density, and likely exposure to TPW, is highest.

Summary and Conclusions

This *White Paper* summarizes existing evidence about the environmental impacts of TPW, focusing primarily on discarded commercial cigarette butts and ESD. A review of the environmental toxicity of TPW summarizes extensive laboratory studies on potential chemical pollutants, hazardous waste concerns, limited field studies, and

gaps in the knowledge base regarding short- and long-term impacts of TPW on ecosystem services—including the various benefits to humanity from healthy ecosystems.

A review of issues surrounding the cellulose acetate filter, attached to 99.8% of the more than 12 billion commercial cigarettes sold each year in California, reveals significant concerns about its use and environmental impacts. These include its poor degradability as a plastic waste product, its potential for chemical ecotoxicity, its status as a leading source of collected waste, and the widespread misunderstandings regarding its composition and lack of utility as a means of reducing the health risks of smoking.

A review of tobacco industry activities describes the industry's long-standing downstream focus on mitigating TPW, the lack of industry accountability for environmental degradation due to ubiquitous TPW, the direct costs of cleanup and mitigation of TPW, and, more broadly, tobacco's adverse environmental impacts along the entire life cycle of production, distribution, use, and post-consumption waste.

A review of existing and potential policy solutions to TPW at the local and state levels describes upstream (source reduction) approaches to TPW, midstream approaches (increasing costs and environmental regulatory interventions), and downstream (waste management) approaches.

The key informant interviews conducted in support of this *White Paper* are summarized in Appendix C. These interviews suggest the need for more public education about the poor degradability of cellulose acetate filters and the lack of health

protection from these filters. In addition, there is a concern about environmental justice issues for communities most affected by tobacco use and TPW. The interviewees emphasized the importance of local policy approaches to mitigate TPW and the importance of policy linkage between tobacco control and environmental protection objectives. Finally, the interviewees emphasized the need for more research to ascertain possible human health effects of TPW contamination in environments. These observations are important considerations for developing approaches to eliminating TPW pollution.

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