



Resource Kit: Outdoor Spaces and Thirdhand Smoke

This packet provide accessible explanations of what thirdhand smoke is, how it behaves, it's consequences, and why it matters for outdoor spaces. Each of the following 10 posts and more can be found in English at <https://thirdhandsmoke.org/faq/> or in Spanish at <https://thirdhandsmoke.org/category/pregunta-de-la-semana/>.

What is thirdhand smoke and how does it behave in indoor environments/enclosed spaces?

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What tobacco products contribute to thirdhand smoke?

Tobacco products come in many different forms and shapes, including cigarettes, cigars, cigarillos, little cigars, pipes, electronic cigarettes, water pipes called hookah or shisha, dissolvable products, and smokeless tobacco products such as chew, spit and snuff.

All tobacco products are manufactured from the leaves of the tobacco plant. Some of toxic chemicals in tobacco smoke occur naturally in the tobacco plant, others are added or created during the manufacturing process, and others form when tobacco is burned.

All tobacco products can leave behind chemical residue. We know most about the toxic residue from burning tobacco products, such as cigarettes, cigars, and pipes and hookah. Increased levels of thirdhand smoke have also been found in indoor environments where residents used smokeless tobacco, electronic cigarettes, and marijuana.

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What surfaces does tobacco smoke stick to?

Tobacco smoke contains thousands of different chemicals in the form of gases and particles, which are tiny, oily, waxy droplets. After tobacco is smoked, research has shown that 70%-90% of nicotine and NNK (a tobacco specific lung carcinogen) chemicals stay behind in indoor environments as residue. Just like a sponge can soak up water, carpets, cushions, or drywall can “soak up” the chemicals from tobacco smoke. Although the smoke in the air seems to disappear after someone smoked, the tobacco smoke residue (also known as thirdhand smoke) remains on surfaces, in dust, and on objects. Over time, this tobacco smoke residue becomes embedded into materials and can adhere to virtually any indoor surface, including carpets, walls, furniture, windows, and doors. It can also adhere to objects we use every day, such as furniture, dishes, silverware, curtains, and pillows, as well as to our skin, hair, and clothing. In an environment where tobacco was smoked regularly, it is reasonable to assume that tobacco smoke residue has contaminated every surface and every object. This residue can build up over time and be detected years after smoking has stopped. Similar to the water dripping and evaporating from a soaked sponge, tobacco smoke residue can be later released back into the air or picked up by touching, leading to exposure long after the cigarette was smoked.

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What do we know about the health risks of thirdhand smoke?



When people smoke in their homes, the chemicals in tobacco smoke build up over time leaving a toxic thirdhand smoke residue on carpets, furniture, walls, doors, and ceilings. This toxic residue lingers long after the smoke clears, even after smokers move out. Thirdhand smoke is a mixture of particles and gasses that become embedded in surfaces and then, under certain conditions, can be released back into the air. Thirdhand smoke contains several different classes of toxic compounds, many known to harm human health.



People (and pets) contact thirdhand smoke when their skin touches a surface where thirdhand smoke has collected, when they breathe in thirdhand smoke particles and gasses that are in the air, and when they swallow particles that are on objects, such as toys, that they put in their mouths.

Five major lines of research are relevant to evaluating the impact of thirdhand smoke exposure on human health.

1) Research on the effects of chemicals found in thirdhand smoke:



Thirdhand smoke contains some of the same toxic chemicals as first- and secondhand smoke, including tobacco specific nitrosamines, polycyclic aromatic hydrocarbons, heavy metals, nicotine, and ultrafine particles with a median diameter $<0.10 \mu\text{m}$. There is overwhelming evidence that exposure to this mixture of toxic chemicals and to ultrafine particulate matter is harmful to human health.

2) Research on the effect of thirdhand smoke exposure on human cells under controlled laboratory conditions:



Studies of human cells show that exposure to thirdhand smoke can directly damage DNA (the genetic material found in nearly every cell in the human body that contains the instructions our cells need to develop, function, grow, and reproduce), induce oxidative stress, and change the function of reproductive cells. Exposure to toxic chemicals that interfere with the basic functioning and repair mechanism of human cells is harmful to human health.

3) Research on the presence of thirdhand smoke and human exposure to thirdhand smoke in real-world field settings:



The presence and persistence of thirdhand smoke has been demonstrated in a variety of real-world nonsmoking field settings worldwide, including: single-family homes, low-income multi-unit housing, and high-end condominiums; homes of nonsmokers with smoking bans, homes of smokers after they have quit, and homes after smokers moved out; nonsmoking rooms in hotels; public places; and public transportation. Exposure to toxic constituents of thirdhand smoke in these environments has been demonstrated repeatedly, based on the presence of specific metabolites of thirdhand smoke chemicals measures as biomarkers in infants, children, and adult nonsmokers.

4) Research on the effects of thirdhand smoke exposure conducted on animal under controlled laboratory conditions:

One of the earliest animal studies on thirdhand smoke, conducted in 1953, showed that mice developed skin cancer when thirdhand smoke residue was applied to their skin. A more recent study showed that mice exposed to thirdhand smoke through their bedding material have:

- slow wound healing
- inflammation in their lungs
- elevated levels of fat in their livers
- elevated LDL (“bad”) cholesterol and low HDL (“good”) cholesterol
- high blood sugar levels
- increased clotting
- hyperactive behavior/poor weight gain after birth

5) Research conducted on humans under laboratory and field conditions:

One researcher has studied the effects of thirdhand smoke exposure using human volunteers in a laboratory setting. In these healthy volunteers, just three hours of exposure to thirdhand smoke exposure damaged cells in their respiratory system.

The evidence from human cells, animals, laboratory experiments, field studies, and healthy volunteers show that thirdhand smoke contains chemicals toxic to humans, that it persists in the environment, and that exposure has the potential to cause harm to multiple organ systems in the human body. In combination, the existing evidence from laboratory experiments and field studies strongly suggest that exposure to thirdhand smoke is harmful to human health through a variety of mechanisms and with a variety of health outcomes.

As health advocates, the public, businesses, and policy makers become more aware of this research, it will be critical to review existing policies in light of these new studies to close loopholes in the protection of nonsmokers from the harmful effects of thirdhand smoke. At a minimum, we urge adoption of the precautionary principle: When human activities (i.e., exposure to thirdhand smoke) may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions should be taken to avoid or diminish that harm.

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My family members smoke, but only outside. Do they bring thirdhand smoke into my house when they come inside?

When outdoor smokers come inside, they bring thirdhand smoke with them. Often you can smell tobacco smoke when they walk in the door. But even when you can't smell it, toxic tobacco residue called thirdhand smoke, is brought in on the clothes, skin, hair, and even the exhaled breath of the person who smoked outside. The tobacco smoke odor is not just a nuisance, it is a sign that a mixture of tobacco smoke pollutants—some we can smell and some we can't—have been brought into the home.

Inside the home, the effect is similar to someone smoking a cigarette inside. The gases and particles in the tobacco residue on the smoker's clothes, skin, and hair can be transferred, stick to, and ultimately become embedded in materials and objects in your home. This includes carpets, walls, furniture, blankets, and toys. The gases and particles can also be released into the air and accumulate in house dust. As a result, nonsmokers may be exposed to toxic thirdhand smoke, even though no cigarettes were smoked inside.

To keep toxic tobacco residue out of your home, tell family members and friends about thirdhand smoke and help them adopt these strategies:

1. Remove clothes worn while smoking before entering the home. Leave them outside on a porch or patio until they can be washed.
2. Wash clothes worn while smoking each day to avoid release of toxic compounds into the air.
3. Whenever possible, shower immediately upon entering the home after smoking to remove tobacco smoke residue from hair and skin. If showering is not possible, thoroughly wash hands and face.

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If my partner only smokes outside, can toxic thirdhand smoke residue still get inside our cars?

When someone who smoked outside of a car gets into the car, they may bring toxic tobacco smoke with them. Even if you cannot smell it, toxic tobacco residue, called thirdhand smoke, comes into the car on the clothes, skin, hair, and even the exhaled breath of the person who smoked outside. The tobacco smoke odor is not just a nuisance, it is a sign that a mixture of tobacco smoke pollutants—some we can smell and some we cannot—are in the car.

Inside the car, the effect is similar to someone smoking a cigarette inside. The gases and particles in the tobacco residue on the smoker's clothes, skin, and hair can be transferred, stick to, and ultimately become embedded in the surfaces in the car—the seat covers, steering wheel, floor mats, ceiling liner. The gases and particles can also be released into the air inside the car and accumulate in dust. As a result, passengers are exposed to toxic thirdhand smoke, even though no cigarettes were smoked in it.

To protect yourself from thirdhand smoke, begin by telling your partner about thirdhand smoke. Explain how thirdhand smoke can get into the car even though he smokes outside and remind him that cars contaminated with thirdhand smoke have a lower resale value.

To protect your health and the health of passengers in your car, ask someone who recently smoked to adopt these strategies before getting into your car:

1. Wash their hands and face to remove tobacco residue from their skin.
2. Change into a clean shirt.

Be sure to thank your partner for their efforts to protect you from toxic thirdhand smoke.

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Shouldn't we be even more concerned with "thirdhand" auto exhaust and industrial pollution, which enter every home in large quantities? Why just "thirdhand" smoke?

There are indeed many pollutants that can contaminate indoor environments, and as our understanding of the adverse effects of air quality on health have increased, vehicle emissions and industrial air pollutants have received much-needed attention by policy makers and the public. There remains a lot of important work to be done to protect indoor environments from outdoor air pollution. Our focus on tobacco smoke pollutants draws attention to a source of indoor pollution that is the result of activities of the residents and visitors in indoor environments. Levels of particulate matter created indoors by tobacco smoke are much higher than typical US levels of outdoor particulate air pollution.

The term "thirdhand" was coined to describe the unique characteristics of tobacco smoke residue. Tobacco smoke contains gases and particles that stick to and become embedded in materials and objects in our homes, such as carpet, walls, furniture, blankets, and toys. Thirdhand smoke is not strictly smoke, but the chemicals and particles that adhere to objects and that are released back into the air or accumulate in house dust or on surfaces.

Thirdhand smoke can linger indoors for a long time – months to years. People can be exposed to thirdhand smoke by touching contaminated surfaces (absorption through the skin), by eating contaminated objects or dust, and by breathing in air and re-suspended thirdhand smoke components. Some toxic and carcinogenic compounds in THS are unique to tobacco smoke (TSNAs). So, thirdhand smoke adds a unique mixture of toxicants to those produced by traffic and industrial pollution.

When we think about air quality in our homes, there is one important difference between thirdhand smoke from tobacco and "thirdhand" pollution from vehicle exhaust or industry: As individuals we can decide not to bring thirdhand smoke into our homes.

- **Never allow smoking in your home or car.**
- **Keep all smoking outside away from doors and windows.**

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Updated: October 2020



Discarded Cigarette Butts Are More Than Just Litter

By: *The National Institute of Standards and Technology - January 29, 2020* [\[Source\]](#) [\[Full study\]](#)

Cigarette butts pile up in parks, beaches, streets and bus stops, places where all types of littering are frowned upon. It is estimated that more than five trillion butts are generated by smokers worldwide each year. Concern about the environmental impact of this litter has prompted studies of how they cigarette butts affect water and wildlife habitats. So far, almost no one has studied the airborne emissions coming off these tiny bits of trash.

When Dustin Poppendieck was asked to evaluate them, he was skeptical. As a measurement scientist at the National Institute of Standards and Technology he realized there was no standard way of analyzing the amounts of chemicals swirling in the air around cigarettes hours and days after they had been put out. He was intrigued, but he also thought there might not be enough chemicals present to make the measurements meaningful.

What his team found, however, was that a used butt—one that is cold to the touch—can give off in one day up to 14% of the nicotine that an actively burning cigarette emits. “I was absolutely surprised,” said Poppendieck. “The numbers are significant and could have important impacts when butts are disposed of indoors or in cars.” The measurements were performed under an agreement with the Food and Drug Administration as part of its analysis of the overall impact of cigarette smoking on people’s lives.

For a long time, most of the health impacts of smoking were misunderstood and often underestimated, in part because the emissions of cigarettes were not fully studied. Over the last 50 years, studies have improved our understanding of the health impacts of tobacco. We now know a lot about how cigarette smoking affects smokers’ own bodies as they inhale and exhale, referred to as mainstream smoking. We also know a lot about the health effects of secondhand smoke, which is the emissions from the end of a cigarette, pipe or cigar, and the smoke that is exhaled by smokers.

More recently, research has also examined thirdhand exposure, which comes from the chemical residue that stays on surfaces such as walls, furniture, hair, clothing and toys after a cigarette has been extinguished. Like mainstream smoking and secondhand smoke, thirdhand exposure can increase the risk of cancers and cause numerous other health problems, especially in the still-developing bodies and brains of infants and children.

Poppendieck’s team measured eight of the hundreds of chemicals typically emitted from cigarettes, including four that are on the FDA list of harmful and potentially harmful constituents. The overall goal of the study was to measure the emissions from cigarette butts and discover what happens to those emissions when the butts are left in different environments. “If you have ever sat on a park bench when somebody next to you smoked, then they got up and left their cigarette butt behind, that odor you were smelling is indicative of what we are trying to capture and measure,” Poppendieck said. “Anyone with a good sense of smell knows it’s there.”

The team had to “smoke” over 2,100 cigarettes, although the scientists didn’t actually light up and inhale. Instead, Poppendieck’s team built a “smoking machine” that uses robotic movements to simulate what humans do when they light up. The machine was made to move air through each cigarette in the same way.

Once the cigarettes were “smoked”, the cigarettes butts were placed in a walk-in, stainless steel chamber in order to characterize airborne emissions. The team also tried to determine if environmental differences in temperature, humidity and saturation in water would change those emission rates. They found that most of the chemicals from the cigarette butts were emitted in the first 24 hours, Poppendieck noted. However, about 50% of the nicotine and triacetin was still present five days later. The team also found that butts emitted these chemicals at higher rates when the air temperature was higher.

“The nicotine coming from a butt over seven days could be comparable to the nicotine emitted from mainstream and sidestream [secondhand or thirdhand] smoke during active smoking,” Poppendieck said. This means if you don’t empty an ashtray in your home for a week, the amount of nicotine exposure to nonsmokers could be double current estimates.

“You might think that by never smoking in your car when kids are present, you are protecting the nonsmokers or children around you,” Poppendieck said. “But if the ashtray in your hot car is full of butts that are emitting these chemicals, exposure is happening.”

Posted: February 12, 2020



Cigarette Butts and Other Tobacco Product Waste Costs Taxpayers Millions of Dollars

By: Lucia Alvarez-Malo Flores - July 25, 2020 [\[Full study\]](#)

Cigarette butts are the single most common form of litter in the world. Just like thirdhand smoke, cigarette butts leave behind a toxic legacy in the environment for years after being discarded. Managing this waste is expensive and paid for by taxpayers and communities.

Anyone who spends time on the beach has noticed cigarette butts lying around or washed up with the tide. Mixed in with shells and seaweed, they are an all too common sight. Tobacco product waste is mostly cigarette butts, but it also includes things like discarded e-cigarettes, liquid cartridges, packaging, and snuff pouches. Large amounts of tobacco product waste also accumulate on our streets, sidewalks, parks, school grounds, and other public places. It also flows into storm water drains, waste treatment plants, and solid waste collection facilities. Cities and towns invest significant resources to clean up and manage this waste. But how much does it actually cost?

Dr. Thomas Novotny of San Diego State University has been researching tobacco product waste for more than ten years. Recently he and Dr. John Schneider of Avalon Economics led a team of researchers to try to answer the question: How much does tobacco product waste cleanup cost communities and taxpayers? The researchers used an econometric model to estimate these costs for large U.S. cities.

Dr. Novotny explains, "Estimating the costs of cleanup and removal of tobacco product waste can help inform policy makers and the public about the economic burden to local communities. This information can help policy makers use an economic argument for better regulatory policies, changes in tobacco product sales, and even possible cost recovery litigation against the tobacco industry."

In this study, the researchers developed new methods to estimate the direct and indirect costs of tobacco product waste in the 30 largest cities across the U.S., including Los Angeles, San Francisco, and San Diego in California. They estimated the total cost for each city based on the size of the population, the smoking rate, and the cost per person spent on overall litter clean-up and removal.

Previously, Dr. Schneider had estimated cleanup costs in San Francisco to be more than 20 cents for each pack of cigarettes sold in that city. This estimate encouraged San Francisco's City Council to levy a litter fee on cigarettes sold there. The current litter fee is 75 cents per pack.

For the 30 largest U.S. cities, the researchers estimated the annual cost of tobacco product waste cleanup ranged from \$4 million for Portland and Las Vegas (the two smallest cities) to \$80 million for New York City (the largest city), with a total cost of \$264.5 million per year for all 30 cities combined. These costs are generally proportional to population size, but the prevalence of smoking in those cities also contributes to different costs—cities with fewer smokers have lower costs.

Dr. Novotny points out that these costs are largely borne by taxpayers. Scientists refer to such costs as "negative economic externalities...that is, costs of tobacco use that are paid for by people other than the tobacco product's producer or the product user." While this study has put a price tag on the clean-up cost of tobacco product waste to cities, other important questions remain. How can we reduce tobacco product waste by changing smoking behavior? How can cities recover the costs for tobacco product waste cleanup? How can we prevent tobacco product waste from spoiling the environment and our quality of life?

You can read more about tobacco product waste at the Cigarette Butt Pollution Project (www.cigwaste.org).

Posted: July 29, 2020



THIRDHAND SMOKE Resource Center

Cigarette Butts on Our Beaches Release Harmful Chemicals

Thirdhand Smoke Resource Center researchers find cigarette butts on the beach are not just unsightly litter. Chemicals from the butts get into the water, and these chemicals are harmful to human health.

By Padma Nagappan, Science/Research Writer - July 2019 [Source]

It's not just secondhand smoke or thirdhand smoke, but also cigarette butts that litter our streets and beaches and get swept into storm water drains that cause significant harm.

Recent research spearheaded by Dr. Eunha Hoh with SDSU's School of Public Health found that leachate from cigarette butts contaminates fresh water bodies, oceans and beaches, and it can harm human health. Chemicals in the leachate can trigger estrogen hormone receptors and aryl hydrocarbon receptors (proteins that regulate gene expression) in our bodies. Triggering these receptors causes endocrine disruption, which is one of the pathways that could lead to cancer.

That cigarette butts create considerable amounts of litter is well-known, but now for the first time, environmental health scientist Hoh and her co-authors including Thirdhand Smoke Resource Center researchers Dr. Nate Dodder of San Diego State University and Dr. Susyann Schick of University of California San Francisco studied the direct effects of the toxicology on health. What they found is disturbing. Their findings show that outdoor smoking also causes harm and there needs to be regulations on littering, in addition to indoor smoking bans.

The paper was published in the American Chemical Society's Chemical Research in Toxicology journal on July 29, 2019. The study was also selected to be featured as one of the ACS Editor's Choice papers that are available open-access, because "the subject of study is highly important and timely, and the findings are very important to the field of chemical toxicology."

Source:
Strategic Communications and Public Affairs
Office of the President
San Diego State University



Posted: August 14, 2019



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Toxic Chemicals in Tobacco Waste Products Hurt Our Beaches and Our Health

By: Jennifer Campbell and Thomas Novotny - January 26, 2020 [\[Source\]](#)

Visit any part of San Diego's beautiful coastline and you'll see a lot of familiar things — beach towels, surfers and, of course, the waste from tobacco products like cigarette butts. Schools across the state have also seen a rise in e-cigarette waste as more and more young people catch on to a health-hazardous fad of using disposable vaping devices. As residents (and the representative) of a district that's home to some of our city's postcard-perfect beaches, we know firsthand what's often the most common items left behind. However, the problem of waste from tobacco and vaping products extends well beyond our beaches and something can be done to address it.

There's no butts about it: these products are terrible for health and the environment. Made up of the poorly degradable cellulose acetate (plastic) filter, cigarette butts take years to break down while leaching out toxic chemicals and contributing to our worsening single-use plastic pollution problem. Whether it's in the sand, in our storm drains, or on our sidewalks, tobacco product wastes are the most collected items at every beach and community cleanup. Over the last 10 years, Surfrider Foundation has collected more than 2 million butts at monthly cleanups alone.

We've led the way on reducing our single-use pollution, yet there's a big blind spot when it comes to plastic-filtered cigarette butts. Californians have taken steps to try and turn things around, with limited success. Restrictions on smoking on the beach and in parks have helped, but have not meaningfully changed the butt count. The California litter ordinance calls for fines of up to \$1,000 plus community service for each littering event, but this law is difficult to enforce for cigarette butt dumping. More action must be taken. Beyond the environmental impacts, as physicians we are totally aware of and committed to reducing the health consequences of smoking. It shortens so many lives (more than 40,000 a year in California alone), costs enormous resources for health care (about \$487 per California resident), and creates terrible heartache for families who lose loved ones due to smoking. We are always looking for new ways to reduce this preventable disease since we know that simply advising smokers to quit is just not enough.

As new regulations on vaping and tobacco are being developed to address the immediate public health crisis of vaping and its linkage to illnesses and deaths, there is still a gap in the effort to mitigate the environmental damage brought on by waste. So, what can be done about this? Recently, the California Senate passed a bold measure to change how tobacco products are sold in California: Senate Bill 424. This bill would ban the sale of filtered cigarettes, disposable plastic holders and mouthpieces, and single-use electronic cigarettes. It also calls for a take-back regimen for e-cigarette parts that cannot be recycled (much like the California Paintcare Program).

That's why the District 2 City Council office is asking our state legislative liaisons to support SB 424 as part of the San Diego's state platform for 2020. It is unclear whether SB 424 will emerge unscathed from the state Assembly's Government Organizations Committee. If the bill simply burns out, San Diego, along with other California communities, should take independent and completely legitimate local action to ban the sale of filtered cigarettes and disposable vaping products. The Federal law regulating tobacco products expressly gives local governments the power to regulate the sale of tobacco products.

Filters, like flavors, make it easier to smoke and fraudulently suggest to smokers that they are "doing something" to protect themselves from the horrible diseases attributable to smoking. In fact, adoption of filters over the last 60 years or so has been associated with an increase in the risks for some types of lung cancer. For all these reasons, filters should be considered a health risk and therefore eliminated through local regulation of tobacco product sales. Cities and counties can and have already banned sales of flavored tobacco products, including San Diego County. Beverly Hills has actually banned the sale of any tobacco products altogether. San Francisco levied a litter fee on all cigarette packs sold in that city. Municipalities are stepping up to make a difference and San Diego can join in. There is also the ticking clock of the State Water Board's trash amendment. By 2030, California will require that communities prevent trash greater than 5 millimeters in size from flowing through storm drains, and that includes cigarette butts. Removing them will help San Diego reach that objective even sooner.

While we can expect push back from the tobacco industry, San Diego can do something truly novel to remove cigarette waste from our beaches and our neighborhoods while striving to reach the state goal of a tobacco-free society by the year 2035. To get to that goal, this effort requires new and strategic collaborations among environmentalists, public health advocates, and communities. If California won't act then San Diego should. It can start here, where we treasure our beaches, our communities, and the health of our people.

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