Thirdhand smoke worries researchers

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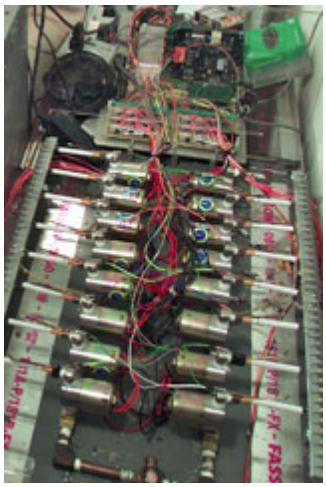
By Andy Evangelista



Researchers at the Berkeley Lab use this smoking machine to gauge how much nicotine from cigarette smoke is absorbed into drywall and other common surfaces.

After a cigarette is puffed and snuffed, it may leave much more than a stench.

UC researchers have found that the residue from tobacco smoke clings to furniture, clothes, rugs, walls and floors. It may linger there for months and then mix with common pollutants to form carcinogens and tiny particles that are potentially hazardous, particularly to children.

"There are many parents who smoke, and they do it in ways that they think protects their kids. They smoke only when the children are not present and open windows so that the smoke clears the room," said Hugo Destaillats, a chemist in Lawrence Berkeley National Laboratory's Indoor Environment Department. "But there really may be no safe way to smoke indoors."

While recent studies on the health dangers of cigarettes point to a new tobacco hazard from thirdhand smoke, more investigation is needed to find out whether the noxious remnants of extinguished cigarettes actually cause disease and kill like first- and secondhand smoke.

Firsthand smoke is inhaled by the actual smoker. Secondhand smoke, a combination of smoke from burning tobacco and that exhaled by the smoker, is breathed by another person. Thirdhand smoke, which sticks in rooms and cars, is often smelled but not seen.

"We are just beginning to learn about the dangers of toxins in thirdhand smoke and in identifying the public health risks from exposure to thirdhand smoke in homes, apartments, hotel rooms, casinos and motor vehicles where cigarette smoking occurs," said Kamlesh Asotra, research administrator at the UC Tobacco-Related Disease Research Program.

The program, which is funded by a California state cigarette tax, has launched a $3.75 million research initiative to concentrate on thirdhand smoke — its chemistry and molecular toxicology, for example — and find out how it may penetrate the body and affect health. The initiative, the first organized research effort to examine thirdhand smoke, also will fund studies on cigarette butts and how they can harm the environment.

Cigarettes butts are not just eyesores on beaches and sidewalks. Stan Glantz, a UCSF scientist who has been called the Ralph Nader of the anti-tobacco movement, describes them as "toxic waste pellets."

The tobacco research program, which is administered by the UC Office of the President, will announce this fall the research projects that will receive the special funding.

The new research will follow up on landmark studies by a Berkeley Lab team, which has stoked public and research interest in thirdhand smoke.

Earlier this year, LBNL scientists reported that nicotine from thirdhand smoke reacts with nitrous acid, an indoor pollutant commonly found in homes with gas-burning appliances, to form carcinogens called tobacco-specific nitrosamines.

"These are among the most broadly acting potent carcinogens present in unburned tobacco and tobacco smoke," said Destaillats.

Since the most likely exposure to these particular carcinogens is through either inhalation of dust or contact of skin with contaminated surfaces, thirdhand smoke would seem to pose the greatest danger to infants and toddlers who crawl on rugs and floors, touch furniture and put dirty fingers or objects in their mouth.

The study also indicated that opening windows or running a fan to ventilate the room while a cigarette burns doesn't eliminate the hazards of thirdhand smoke. Smoking outdoors is risky, too.

"Smoking outside is better than smoking indoors, but nicotine residues will stick to a smoker's skin and clothing," said Lara Gundel, a chemist and a leader of the Berkeley Lab team. "Those residues follow a smoker back inside and get spread everywhere. And if nitrous acid is in the air, which it usually is, then TSNAs will be formed."

Since most vehicle engines emit nitrous acid that can seep into passenger compartments, the researchers also examined surfaces inside a light-duty pickup truck of a heavy smoker. During three days of testing when 34 cigarettes were smoked inside the truck, they found high levels of the tobacco-specific nitrosamines, which stuck around hours after the cigarette smoke dispersed.

Blowing smoke with ozone

Sounding another alarm, a study reported in mid-August by Mohamad Sleiman of the Berkeley Lab found that nicotine from tobacco smoke can combine with ozone to form tiny particles that may be a bigger threat to asthma sufferers than the nicotine itself. Ozone is a major component in outdoor smog, and, ironically and commonly, it is blown into cars and hotel rooms to get rid of the smell of cigarette smoke.

The California Air Resources Board three years ago banned the use of popular in-home ozone air purifiers, but ozone is still allowed for commercial and industrial uses, as long as people are not in the room or car. On the Web, many sites tout ozone as a good way to blow away the nasty smell of cigarettes, especially in cars, but the new study certainly warns against that practice.

"In general, we would not recommend ozone as cleaning anything in indoor air," said Peggy Jenkins, manger of the California Air Resources Board's indoor air research division. "It is not really very effective, and it can cause health problems, including respiratory tract irritation and breathing difficulty."

Jenkins is pleased that UC researchers continue to look at smoking and indoor air-related issues, as agencies like hers rely on their scientific findings when they enact guidelines and policies.

Electronic cigarettes

The Berkeley Lab group's thirdhand smoke studies also raise concerns about a curious and controversial e-cigarette growing in popularity throughout the world. These battery-operated, pen-sized devices, produced mainly in China, are touted as a smoke-free substitute for cigarettes. And because they don't contain tobacco, they don't carry the risk of cancer, manufacturers claim.

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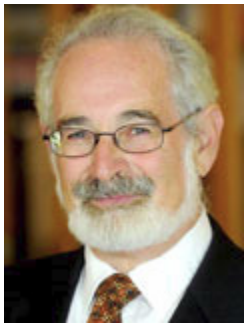
— Stan Glantz, UCSF tobacco researcher



Users hold and suck on the device like a real cigarette, and the tip even lights up red to simulate smoking. Instead of tobacco, e-cigarette smokers inhale a nicotine vapor. Because there is no tobacco or combustion with e-cigarettes, they are not restricted by anti-smoking laws and are used indoors. UC researchers contend the smoky mist of nicotine released by e-cigarettes or exhaled by the smoker also may form thirdhand smoke.

Prue Talbot, professor of cell biology and neuroscience at UC Riverside, conducts studies of e-cigarettes and questions their purported safety.

"Electronic cigarette aerosol contains nicotine, and we found that the cartridges used in these cigarettes readily leak nicotine-containing fluid onto surfaces and users' hands," she said. "It will be important to evaluate health risks of unwanted exposure to environmental nicotine from electronic cigarettes."

The Food and Drug Administration recently recommended that e-cigarettes be banned in the United States because their

toxicology and the health risks they pose are poorly understood. The FDA also said more research on these devices is needed.

Also worrisome to Talbot is that these unregulated devices, purchased mainly online, are being marketed to kids.

"Someone in my lab just showed me a bright pink one. And they're selling them with flavors like chocolate and bubble gum," she said. "These things have nicotine, and you can tell who they're trying to hook."

UCSF's Glantz, who conducted seminal research linking secondhand smoke to heart disease and demonstrating that tobacco control programs reduce smoking and save lives, is pleased that UC's Tobacco-Related Disease Research Program is driving the closer examination of thirdhand smoke and cigarette butts.

The "thirdhand smoke" expression was coined less than two years ago by Harvard pediatrician Jonathan Winickoff, but the concern about toxins that first- and secondhand smoke may leave behind has been around for several years, said Glantz.

"I remember years ago and before smoking was banned in most indoor public places, getting calls from worried workers who had to clean up bars and other places where there was a lot of smoking," he said.

"Thirdhand smoke isn't likely as dangerous as smoking cigarettes yourself (firsthand smoke)," said Glantz. "Clearly, the level of toxicity in cigarette smoke is astronomical. Could exposure to thirdhand smoke be as bad as passive smoking (secondhand smoke)? That's what we need to find out."

Butts dangerous, too?

On the issue of cigarette butts, Glantz said they are more than a litter problem and expensive burden for cities trying to clean them off streets and beaches. They can be a source of environmental pollution, he warned.

UC tobacco research program administrator Asotra agrees, and the program's new research initiative will gather California scientists to examine the myriad compounds — such as toxic metals, polyaromatic hydrocarbons and nicotine — that leach out from cigarette butts to contaminate air, soil and water. They will also study the effects these compounds may have on people, animals and plants and the economic impact and policy implications of cigarette butt litter in California.

In the last 50 years, 99 percent of smokers have switched to filtered cigarettes. Nearly all filtered cigarettes in the United States are made of cellulose acetate, a non-biodegradable plastic. In 2007 alone, 1.35 trillion cigarettes were made — 360 billion of them smoked in the United States — and 680,000 tons of cellulose acetate was used, said Asotra.

Glantz said the UC Tobacco-Related Disease Research Program's new initiative to delve into thirdhand smoke and cigarette butts is typical of its leadership and innovation as a research funding agency. Since it was established in 1989 as a result of California's Proposition 99 (The Tobacco Tax and Health Protection Act), the program has awarded nearly $400 million in grants to some 950 researchers investigating a wide range of studies, from tobacco-related disease and cessation programs to secondhand smoke and the economics of tobacco use.

But the TRDRP is much more than an administrative program, said Glantz, who now directs the Center for Tobacco Control and Research Education at UCSF. He credits it for providing key seed monies for his own research and landmark studies. Since then, other funding agencies have poured necessary attention and dollars into smoking-related studies, and other states have copied the program model, Glantz said.

"California has been a leader in implementing guidelines and laws that protect people from the dangers of tobacco and cigarette smoke," said Glantz. "The TRDRP has been integral to the tobacco control programs in the state."

Another of the good things about UC's TRDRP, said Glantz, is that it brings together scientists and practitioners in the community to discuss and decide what research is urgent, trend-setting and useful for policymakers.

And the new initiative, said Asotra, will bring together top researchers from a variety of fields to get to the scientific bottom of thirdhand smoke and cigarette butts.

***Andy Evangelista** is the research coordinator for the UC Office of the President Strategic Communications Department. For more information, visit the **UC Newsroom** or follow us on **Twitter**.*

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