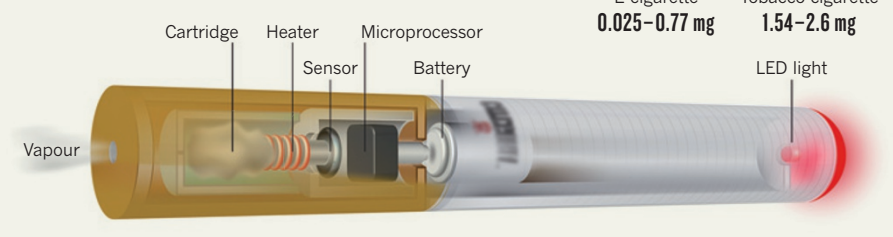


SMOKE WITHOUT FIRE

Most electronic cigarettes use a battery-operated element to vaporize a nicotine solution, which is then inhaled. Doses of nicotine (right) and toxic chemicals (bottom) from e-cigarettes are lower than from conventional ones. In this comparison, 15 puffs on an e-cigarette are assumed to be equivalent to smoking a conventional cigarette.



COMPARISON OF TOXINS IN CONVENTIONAL AND ELECTRONIC CIGARETTES

Toxic compound	Conventional cigarette (µg in mainstream smoke)	Electronic cigarette (µg per 15 puffs)	Average ratio (conventional vs electronic)
Formaldehyde	1.6–52	0.20–5.61	9
NNN	0.005–0.19	0.00008–0.00043	380
NNK	0.012–0.11	0.00011–0.00283	40

NNN, N'-nitrosornicotine; NNK, NNN and 4-(methylnitrosoamino)-1-(3-pyridyl)-1-butanone.

POLICY

Regulation stacks up for e-cigarettes

Devices may be the 'healthy' future of smoking — or a menace.

BY DANIEL CRESSEY

Electronic cigarettes could save the lives of millions of smokers, or they could set millions of non-smokers on the path to nicotine addiction, revolutionizing the tobacco industry into the bargain. So the question on the lips of health experts, policy-makers and consumers alike is, are the devices a health problem that needs tight regulation, or a welcome aid to smokers trying to quit?

In less than a decade since their first appearance, electronic or e-cigarettes have become a multibillion-dollar industry. Although there are scores of different products, most operate on the same principle: a heating element vaporizes a liquid containing nicotine, which can then be inhaled as 'smoke' (see 'Smoke without fire').

However, they are not without their dangers, and, as the number of users in the United States alone reaches an estimated 2.5 million, regulatory bodies have begun to take an interest. In October, the US Food and Drug Administration (FDA) is expected to issue a rule that affirms it has the authority to regulate e-cigarettes, overriding a previous court decision that e-cigarettes could not be controlled as medical devices. The European Union is also

overhauling its regulation of tobacco with a massive piece of legislation that, as currently drafted, will regulate most e-cigarettes as medical devices. A vote on this legislation is due in the European Parliament on 8 October.

But because little research has been done on the effects of e-cigarettes, such moves lack a solid scientific grounding. It is generally accepted that the devices are safer than conventional cigarettes, although studies by the FDA and Health New Zealand, a research consultancy based in Christchurch, have shown that some brands contain carcinogens and other toxic chemicals, including diethylene glycol and N-nitrosamines (A. D. Flouris and D. N. Oikonomou *Br. Med. J.* **340**, c311; 2010).

If e-cigarettes are used in moderation, the nicotine doses they provide may be lower than those attained from smoking cigarettes. But although the devices are smoke-free, nicotine itself causes high blood pressure and palpitations, and is highly addictive. Little is known about the long-term effects of e-cigarette vapour.

Some experts think e-cigarettes are a saviour. "They may kill smoking as we know it," says Peter Hajek, director of the Tobacco Dependence Research Unit at Barts and the London School of Medicine and Dentistry.

"That's the biggest hope we have of ending the tobacco epidemic."

But as big tobacco companies have piled into a market worth more than US\$2 billion worldwide, regulators have failed to keep up, in part because the chemicals in e-cigarettes vary so widely. Some countries, such as Norway and Brazil, have banned the products. But in the United States, e-cigarettes are currently regulated only if they are marketed as quitting aids. The United Kingdom has said it will regulate them as medicines — meaning they will have to meet strict quality standards — but its regulator, the Medicines and Healthcare Products Regulatory Agency, is holding fire until the new European rules are in place.

The decisions that regulators make will shape not just the future of the industry but also the public-health response — and scientists both for and against e-cigarettes have waded into the debate while regulation is still up in the air.

"Right now, electronic cigarettes are the triumph of wishful thinking over data," says Stanton Glantz, a tobacco-control researcher at the University of California, San Francisco, who thinks that the products should be regulated. He points to a report released earlier this month by the US Centers for Disease Control and Prevention in Atlanta, Georgia, that shows some children who have never smoked cigarettes are using e-cigarettes, suggesting that the devices may be a gateway product. And he notes that several surveys have reported high levels of smokers using both cigarettes and e-cigarettes, indicating that the products are being used to sustain nicotine addiction. The use of vapour flavourings, such as vanilla, could also be seen as an attempt to prolong use and appeal to younger consumers.

Other scientists, such as Hajek, say that regulating e-cigarettes as medical devices would be a disaster. He believes that the cost of complying with rules for medical devices would allow big tobacco companies to dominate the nascent e-cigarette industry, squeezing out innovative new products.

"To overregulate now could threaten the existence of e-cigarettes and cut down the options for people who want to quit," agrees Christopher Bullen of the National Institute for Health Innovation at the University of Auckland in New Zealand. He was the lead author on a study published this month showing that e-cigarettes were as effective as nicotine patches in helping smokers to quit (C. Bullen *et al. Lancet* <http://doi.org/nq8>; 2013).

Vaughan Rees, a tobacco researcher at Harvard School of Public Health in Boston, Massachusetts, thinks that e-cigarettes need to improve before they can replace cigarettes — and that, for now, they should be regulated as tobacco products. Although they do present an opportunity to improve public health, he adds, care needs to be taken to ensure that they don't flourish alongside conventional cigarettes. "Then we've got a double problem," he says. ■

SOURCE: M. L. GONIEWICZ ET AL., NICOTINE TOB. RES. **15**, 158–166 (2012); M. L. GONIEWICZ ET AL., TOB. CONTROL [HTTP://DOI.ORG/NXY](http://doi.org/nxy) (2013)