



# Science & Innovation

At a glance



# A purpose with impact



We have a clear purpose:

## To build A Better Tomorrow™ by reducing the health impact of our business

More than 1.1 billion people globally continue to smoke despite the serious health risks associated with smoking cigarettes<sup>1</sup>.

The only way to avoid these risks is either not to start or to quit. Yet not every smoker is willing to quit, despite knowing the health risks associated with smoking. And that is why we are transforming. We have created a portfolio of enjoyable and less risky<sup>†</sup> alternative tobacco and nicotine products that are backed by science. Our goal is clear: to have 50 million consumers of our non-combustible products by 2030.

“ We recognise the harm caused by tobacco and we are on a journey to rapidly transform ourselves by reducing the health impact of the business and, ultimately, build A Better Tomorrow. ”

Dr David O'Reilly,  
Director, Scientific Research



<sup>\*</sup>Based on the weight of evidence and assuming a complete switch from cigarette smoking. These products are not risk-free and are addictive.

<sup>†</sup>Our products as sold in the U.S., including Vuse, Velo, Grizzly, Kodiak, and Camel Snus, are subject to Food and Drug Administration (FDA) regulation and no reduced-risk claims will be made as to these products without FDA clearance.

# Advancing tobacco harm reduction



Tobacco Harm Reduction is a public health strategy that recognises the harm caused by combustible cigarettes and aims to minimise the health impacts of cigarette smoking by encouraging those adult smokers who would otherwise continue to smoke, to switch completely to use scientifically substantiated, reduced-risk alternatives\*†.

Beyond being less risky\*†, these alternatives must deliver comparable satisfaction in the sensorial experience they deliver. We continue to invest in the development of our alternative tobacco and nicotine products to ensure that they evolve technologically and scientifically as consumer preferences also evolve. Since 2018 we have invested over £1.2 billion to develop our New Category products.

## The three pillars of our THR strategy:

H

### Reducing the HEALTH impact of our business



#### Consumer choice

Smokers are most likely to switch to a product that delivers comparable satisfaction.



#### World-class science

To ensure that we are constantly innovating to meet or anticipate evolving consumers' needs, while generating robust scientific evidence for New Category products to assess their reduced-risk profile\*† compared to cigarettes.



#### Standards and regulations

Using our science to inform and evolve standards and regulations to give consumers and policy makers confidence in our products.

E

Excellence in environmental management

S

Delivering a positive social impact

G

Robust corporate governance

\* Based on the weight of evidence and assuming a complete switch from cigarette smoking. These products are not risk-free and are addictive.

† Our products as sold in the U.S., including Vuse, Velo, Grizzly, Kodiak, and Camel Snus, are subject to Food and Drug Administration (FDA) regulation and no reduced-risk claims will be made as to these products without FDA clearance.



# More choice, less risk<sup>\*†</sup>

Most of the harm associated with cigarettes is caused by the toxicants in the smoke produced by the burning of tobacco, not by the nicotine itself<sup>2</sup>.

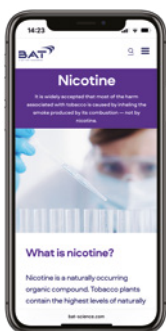
That is why we have developed a range of New Category products that contain nicotine but do not burn tobacco. This results in far fewer and lower levels of toxicants compared to combustible cigarettes. While not risk-free, the available evidence suggests they are less risky<sup>\*†</sup> than continuing to smoke.

Our three New Category products are: vapour, tobacco heating products and modern oral (nicotine pouches). All are produced to high product quality and manufacturing standards, undergoing thousands of hours of testing before they reach the consumer.



## 1 bn

packets of combustible products in 2021 included information about our New Category products to proactively encourage adult smokers to switch



Watch a short video to learn more about nicotine by scanning this code



“ As most of the harm caused by smoking arises not from nicotine but from other components of tobacco smoke, the health and life expectancy of today’s smokers could be radically improved by encouraging as many as possible to switch to a smoke-free source of nicotine. ”

UK Royal College of Physicians<sup>3</sup>

<sup>\*</sup> Based on the weight of evidence and assuming a complete switch from cigarette smoking. These products are not risk-free and are addictive.

<sup>†</sup> Our products as sold in the U.S., including Vuse, Velo, Grizzly, Kodiak, and Camel Snus, are subject to Food and Drug Administration (FDA) regulation and no reduced-risk claims will be made as to these products without FDA clearance.

# World-class science

Globally, we have more than 1,500 R&D specialists, who are focused on the research and development of New Category products. Our main R&D hub is based in Southampton in the UK and is supported by R&D teams across the world.

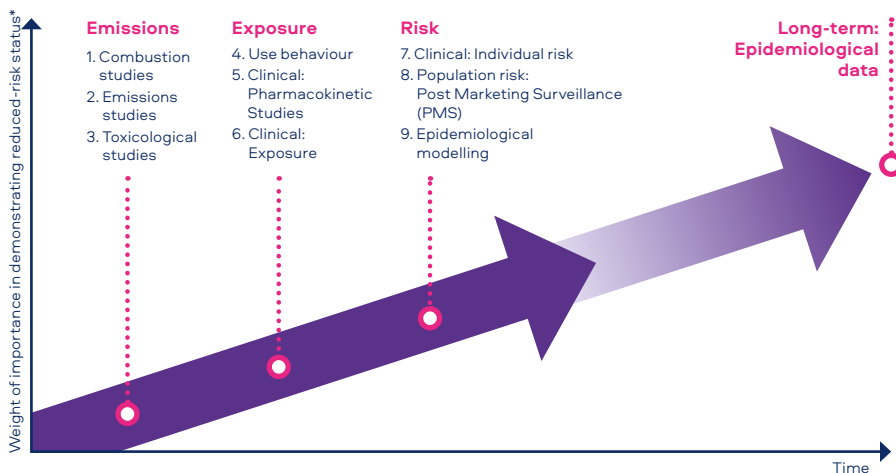
## Testing our products: our nine-step risk assessment framework

Most alternative tobacco and nicotine products are relatively new to the market. As a consequence, they lack the long-term epidemiological data, observed over decades, to determine the overall impact on public health. Therefore, it's necessary to take a weight of evidence approach. Drawing on work by the U.S. Institute of Medicine<sup>4</sup> we developed a nine-step scientific assessment framework. The framework evaluates the emissions, exposure and risk of our New Category products and compares them to smoking cigarettes or other comparators, such as nicotine replacement therapy. The graph shows the weight of importance of each of the steps in demonstrating the reduced-risk<sup>†</sup> status of new alternative products.

Our scientists have published more than 135 peer-reviewed studies on our New Category products utilising this framework. In addition to publishing our own research, our scientists constantly monitor and review external publications to gain a holistic view of the evidence base.



### Nine-step risk assessment framework



#### Emissions

What chemicals or chemical compounds do our products release?

#### Exposure

What happens to the cells when they are exposed to those chemicals or chemical compounds?

#### Risk

What does that mean for individual and population health risk in the long term?



Take a virtual tour around our R&D facility by scanning this code

<sup>\*</sup> Based on the weight of evidence and assuming a complete switch from cigarette smoking. These products are not risk-free and are addictive.

<sup>†</sup> Our products as sold in the U.S., including Vuse, Velo, Grizzly, Kodiak, and Camel Snus, are subject to Food and Drug Administration (FDA) regulation and no reduced-risk claims will be made as to these products without FDA clearance.

# Our New Categories portfolio



## Vapour products

Vapour products are battery-powered devices that heat e-liquid to produce an inhalable aerosol (vapour).

Our leading, global vapour brand, Vuse, plays a major role in providing smokers with a reduced risk<sup>†</sup> alternative to cigarettes.



### The scientific evidence

There is growing consensus among the public health community and academia about the role of vapour products as a reduced-risk<sup>†</sup> alternative to smoking. This is supported by a wealth of global reviews, studies and reports. In the UK, for example, Public Health England<sup>\*\*\*</sup> has published a series of expert reviews of the latest evidence, drawing on peer-reviewed literature, surveys and other reports, concluding; **“based on current knowledge, vaping is at least 95% less harmful than smoking<sup>6</sup>.”**

In 2021, we published a comprehensive review of the scientific evidence for vaping products, their potential health effects, and their role in tobacco harm reduction<sup>7</sup>. This is a summary of more than 300 peer-reviewed scientific papers and other evidence published by around 50 institutions over the past decade.

According to adult population modelling studies cited in the review, **a significant reduction in premature deaths could be achieved if current smokers switched exclusively to vaping rather than continuing to smoke cigarettes<sup>8</sup>.**

<sup>\*\*\*</sup> Public Health England was replaced by the Office for Health Improvement & Disparities in October 2021.

### Key highlights

**No.1**  
global vaping brand<sup>9</sup>

**30**  
markets where our vapour products are available

**81**  
peer-reviewed studies by our scientists published to date on vaping products

**99%**  
less toxicants in Vuse ePod and ePen3 aerosol, compared to cigarette smoke<sup>\*\*\*</sup>

### SPOTLIGHT

In October 2021, Vuse Solo received the first of its kind U.S. FDA Marketing Authorization for vapour products in Original flavour. This confirmed that the marketing of Vuse Solo products in the U.S. is appropriate for the protection of the public health, and underscores years of scientific research. In May 2022, our Vuse Ciro and Vibe products also received FDA Marketing Authorizations.

<sup>†</sup> Based on the weight of evidence and assuming a complete switch from cigarette smoking. These products are not risk-free and are addictive.

<sup>†</sup> Our products as sold in the U.S., including Vuse, Velo, Grizzly, Kodiak, and Camel Snus, are subject to Food and Drug Administration (FDA) regulation and no reduced-risk claims will be made as to these products without FDA clearance.

<sup>\*\*\*</sup> This is a comparison between smoke from a 1R6F reference cigarette (approx. 9mg tar) and vapour from the Vuse ePod and ePen3 in terms of the 9 harmful components the World Health Organization recommends to reduce in cigarette smoke.





## Tobacco heating products (THPs)

THPs are devices that heat tobacco to generate an aerosol.

Our flagship THP brand, glo, comprises an electronic handheld device that contains a lithium-ion battery which powers a heating chamber. A specially designed rod containing tobacco, called a Neostik, is inserted into the device.



### The scientific evidence

Due to the heating of tobacco, as opposed to burning, THPs are reduced risk<sup>\*†</sup> compared to smoking for those who switch completely. To date, much of the available research on THPs has been conducted by industry scientists, however an increasing number of independent reports are aligned with our findings and support the role of THPs as a less risky<sup>\*</sup> alternative to smoking. For example, in 2018, Public Health England<sup>\*\*</sup>, while highlighting the need for more research, found that **“compared with cigarettes, heated tobacco products are likely to expose users and bystanders to lower levels of particulate matter, and potentially harmful compounds<sup>10</sup>.”**

More long-term studies are needed on THPs, which is why we conducted our year-long clinical study to evaluate the reduced-risk potential of glo. The six-month data was published in a peer reviewed journal in 2021<sup>11</sup>. This study showed that **smokers who switched from cigarettes to the exclusive use of glo significantly reduced their exposure to certain toxicants and indicators of potential harm related to several smoking-related diseases, in some cases to a level found in participants who had stopped smoking entirely<sup>12</sup>.**

### Key highlights

25

markets where our THPs are available

75

peer-reviewed studies by our scientists published to date on the scientific evidence for THPs

90–95%

less toxicants in glo aerosol, compared to cigarette smoke

<sup>\*\*</sup> Public Health England was replaced by the Office for Health Improvement & Disparities in October 2021.



## Modern oral products

Modern oral products are disposable nicotine pouches that consumers place between their gum and upper lip, typically for around 30 minutes. Nicotine and flavours are released to be absorbed through the oral mucosa. Our global modern oral pouches, branded Velo, contain high purity nicotine, water and other high-quality ingredients.



### The scientific evidence

Laboratory chemical studies for our modern oral products show they produce substantially lower levels of toxicants than cigarette smoke and lower levels than snus<sup>13</sup> – a traditional oral tobacco product which is already regarded as a reduced risk<sup>\*</sup> alternative to smoking. Toxicology tests assessing the biological effects of our modern oral products on human cells also show they have reduced effects relative to cigarettes and snus<sup>14</sup>.

Moreover, in 2021, we published new peer-reviewed evidence<sup>15</sup>, which suggests **modern oral tobacco-free nicotine pouches have a toxicant profile that is comparable to nicotine replacement therapy products (NRT)**. The pouches were also found to have a toxicant profile that is far lower than snus.

On the basis of our evidence and informed by the wealth of independent evidence regarding snus, **switching completely to modern oral products can be expected to reduce the risk of smoking-related disease when compared to continued smoking<sup>\*†</sup>.**

### Key highlights

23

markets where our modern oral products are available

71%

volume growth in modern oral products in 2021

19

peer-reviewed studies by our scientists published to date on the scientific evidence for oral products

<sup>\*</sup> Based on the weight of evidence and assuming a complete switch from cigarette smoking. These products are not risk-free and are addictive.

<sup>†</sup> Our products as sold in the U.S., including Vuse, Velo, Grizzly, Kodiak, and Camel Snus, are subject to Food and Drug Administration (FDA) regulation and no reduced-risk claims will be made as to these products without FDA clearance.

# Accelerating A Better Tomorrow™

As a business, science and innovation are critical to our future. The speed, energy and activity in these areas is helping to drive our transformation and propel our business into exciting new areas as we build A Better Tomorrow™.

Using this momentum, we aim to accelerate the pace of our research on Tobacco Harm Reduction to encourage adult smokers who would otherwise continue to smoke to make informed choices to switch to less risky tobacco and nicotine alternatives<sup>1</sup>.



You can keep up to date with our progress at [www.bat-science.com](http://www.bat-science.com)

And by following us on twitter @BAT\_Sci



This document is not for the purpose of advertising or marketing.

<sup>1</sup> Based on the weight of evidence and assuming a complete switch from cigarette smoking. These products are not risk-free and are addictive.

<sup>1</sup> Our products as sold in the U.S., including Vuse, Velo, Grizzly, Kodiak, and Camel Snus, are subject to Food and Drug Administration (FDA) regulation and no reduced-risk claims will be made as to these products without FDA clearance.

<sup>1</sup> WHO global report on trends in prevalence of tobacco use 2000-2025 <https://bit.ly/3LZHuUT>

<sup>2</sup> Institute of Medicine. Clearing the smoke. Assessing the science base for tobacco harm reduction. Stratton K, Shetty P, Wallace R, et al. Washington, DC: National Academies Press, 2001.

<sup>3</sup> Nicotine without smoke: Tobacco harm reduction, a report by the Tobacco Advisory Group of the UK Royal College of Physicians, April 2016.

<sup>4</sup> Institute of Medicine (U.S.) Committee to Assess the Science Base for Tobacco Harm Reduction. Clearing the Smoke: Assessing the Science Base for Tobacco Harm Reduction. Stratton K, Shetty P, Wallace R, Bondurant S, editors. Washington (DC): National Academies Press (U.S.); 2001. PMID: 25057541.

<sup>5</sup> Public Health England became the UK Health Security Agency (UKHSA) on 1 October 2021.

<sup>6</sup> McNeill A, Brose LS, Calder R, Bauld L, Robson D. (2018). Evidence review of e-cigarettes and heated tobacco products. A report commissioned by PHE. London: PHE. Evidence review of e-cigarettes and heated tobacco products 2018: executive summary – GOV.UK ([www.gov.uk](http://www.gov.uk)).

<sup>7</sup> Camacho, Oscar M., Ebajemito, James K., Coburn, Steven, Prasad, Krishna, Costigan, Sandra and Murphy, James J. (2021). Evidence From the Scientific Assessment of Electronic Cigarettes and Their Role in Tobacco Harm Reduction. Contributions to Tobacco & Nicotine Research, vol.30, no.2, 2021, pp.63-108. <https://doi.org/10.2478/cttr-2021-0007>.

<sup>8</sup> Full Review paper: Camacho, Oscar M., Ebajemito, James K., Coburn, Steven, Prasad, Krishna, Costigan, Sandra and Murphy, James J.. "Evidence From the Scientific Assessment of Electronic Cigarettes and Their Role in Tobacco Harm Reduction" Contributions to Tobacco & Nicotine Research, vol.30, no.2, 2021, pp.63-108 <https://sciendo.com/article/10.2478/cttr-2021-0007>.

<sup>9</sup> Based on Vype/Vuse estimated value share from Recommended Retail Price (RRP) in measured retail for vapour (i.e. total vapour category value in retail sales) in the USA, Canada, France, UK, Germany. These five markets cover an estimated 77% of global vapour closed system net turnover (NTO), calculated in June – July 2021.

<sup>10</sup> McNeill A, Brose LS, Calder R, Bauld L, Robson D. (2018). Evidence review of e-cigarettes and heated tobacco products. A report commissioned by PHE. London: PHE. Vaping in England: evidence update February 2021 – GOV. UK ([www.gov.uk](http://www.gov.uk)).

<sup>11</sup> Gale, N., McEwan, M., Camacho, O.M. et al. Changes in biomarkers after 180 days of tobacco heating product use: a randomised trial. Intern Emerg Med 16, 2201–2212 (2021).

<sup>12</sup> Gale N, McEwan M, Camacho O, Hardie G, Proctor C, Murphy J. Changes in Biomarkers of Potential Harm Following Switching for 180 days from Conventional Cigarette Smoking to using the glo Tobacco Heating Product: A Randomised, Controlled, Ambulatory Study.

<sup>13</sup> Bishop E, East N, Bozhilova S, et al. (2020). An approach for the extract generation and toxicological assessment of tobacco-free 'modern' oral nicotine pouches. Food Chem Toxicol 2020; 145: 111713. <https://doi.org/10.1016/j.fct.2020.111713>.

<sup>14</sup> N. East, E. Bishop, D. Breheny, M. Gaca, D. Thorne, A screening approach for the evaluation of tobacco-free 'modern oral' nicotine products using Real Time Cell Analysis, Toxicology Reports, Volume 8, 2021, Pages 481-488, <https://doi.org/10.1016/j.toxrep.2021.02.014>.

<sup>15</sup> David Azzopardi, Chuan Liu & James Murphy (2021) Chemical characterization of tobacco-free "modern" oral nicotine pouches and their position on the toxicant and risk continuums, Drug and Chemical Toxicology, <https://doi.org/10.1080/01480545.2021.1925691>.

