BAT
A BETTER TOMORROW

Forward Thinking

For a Smokeless World

2024

Omni™

Foreword

A refined purpose:

The best choice any adult smoker can make will always be quitting combustible tobacco products completely.

For the last few years our aim has been to build A Better Tomorrow™. This has meant working to reduce the health impact of our business by offering adult consumers a greater choice of enjoyable and reduced-risk*† products compared to cigarettes.

Now is the time to take a step forward.

The Omni™ is a summary of BAT's progress on our journey to A Better Tomorrow™ by Building a Smokeless World.

A smokeless world built on Smokeless Products where, ultimately, cigarettes have become a thing of the past.

A world where smokers, who would otherwise continue to smoke, have migrated from cigarettes to smokeless alternatives.

A world where Tobacco Harm Reduction is both understood and accepted.

A world where smokers make a switch to better.

We believe that through knowledge sharing we can build that world, which is why we created the Omni™, a resource intended for scientists, public health authorities, regulators, policy makers, and investors.

The Omni™ is intended to be a compendium of information that underpins our corporate and scientific strategy and offers insights into the work being done at BAT to create A Better Tomorrow™. Across nine chapters, it addresses the Big Questions facing us, provides an overview of the science supporting our Smokeless Products, and offers a summary of the global Tobacco Harm Reduction evidence base created over the last decade.

What is our vision for the Omni™?

Given the significant public health opportunity presented by Tobacco Harm Reduction, it is our hope that the Omni™ will spur a dialogue with stakeholders—scientists, public health authorities, regulators, policy makers, and investors—and across the wider scientific and regulatory ecosystem related to tobacco and nicotine products. We welcome such an exchange of views and encourage dialogue, which would enable us to learn from one another and accelerate the adoption of effective Tobacco Harm Reduction regulatory strategies and frameworks.

We recognise that some stakeholders may be sceptical of our motivations and actions. The Omni™ is not intended to be a panacea. However, it is our hope that our commitment to science, to open engagement with stakeholders, and continued investment in innovation will enable us to connect and carry on these important conversations.

How to use the Omni™

The Omni™ is organised as a collection of materials and is structured to enable interested readers to visit the sections of the Omni™ in any order they wish, to learn more about Tobacco Harm Reduction, and to understand BAT's journey.

asmokelessworld.com

* 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 US, including Vuse, Velo, Grizzly, Kodiak, and Camel Snus, are subject to FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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What is BAT's strategy?

Our strategic aim is to actively migrate adult smokers, who would otherwise continue to smoke, from cigarettes to Smokeless Products and to Build a Smokeless World. We know that combustible products pose serious health risks. The only way to avoid those risks is to not start or to quit smoking. That's why we are changing: creating new products, backed by science, that provide adult smokers with smokeless alternatives.

We are committed to delivering long-term, multi-stakeholder value and aim to become a predominantly smokeless business by 2035. We will do so by actively encouraging adult smokers to switch to smokeless alternatives – in essence, to 'Switch to Better.'

To enable this, our strategy is built around the three pillars of priorities:

- Quality Growth
- Sustainable Future
- Dynamic Business

Building a Sustainable Future is about seeking to actively migrate adult smokers, who would otherwise continue to smoke, away from cigarettes and to Smokeless Products sustainably, responsibly and with integrity.

Science will continue to be a primary driver of our efforts, supported by more active external engagement with regulators and other key stakeholders.

We further commit to Build a Smokeless World by investing in the science and products needed to make A Better Tomorrow™.

Our ambition remains to have 50 million consumers[#] of our Smokeless Products by 2030 and to accelerate the growth of our Smokeless Products reaching at least 50% of our revenues by 2035.

Challenges

Over the past decade, we have transformed our business and made significant progress on our goals. However, Building a Smokeless World is not without its roadblocks.

These are among the key challenges we face in moving to a Smokeless World:

- Rejection of Tobacco Harm Reduction by key regulatory bodies and non-governmental organisations
- Markets that prevent the sale of Smokeless Products
- Onerous regulatory frameworks that hinder innovation
- Scepticism toward industry research
- Widespread misperceptions about nicotine and the risk profile of Smokeless Products when compared to cigarettes

As detailed in the Omni™, we will continue our efforts on the journey to A Better Tomorrow™ through open and constructive dialogue with our stakeholders, working towards global regulatory frameworks that support the principles of Tobacco Harm Reduction and the availability of Smokeless Products to which adult smokers can switch.

We are proud of the Omni™, though it is simply the most recent manifestation of our ongoing commitment to Build a Smokeless World. We hope you will join us in the conversation.

This publication contains certain statements referring to Smokeless Products being less risky than conventional cigarettes. These statements are often, but not always, made through the use of phrases such as "reduced risk", "lower risk", "less risky", "lower profile of risk", "lower risk profile", "reduced risk potential", "reduced harm potential" and similar expressions. These statements are made 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

Smoking Cessation
For the purpose of the Omni™, references to BAT's Smokeless Products do not include smoking cessation devices or other products licensed for Nicotine Replacement Therapy. BAT's Smokeless Products are not smoking cessation devices and are not marketed for that purpose.

Underage
A person younger than 18 years old, or, if higher, younger than the minimum age in the relevant market for the lawful sale, purchase, possession, or consumption of the type of products being sold or advertised.

Audience
The material in this publication is provided to scientists, public health authorities, regulators, policy makers, and investors only and is not intended for general consumers. BAT, its directors, officers, employees, agents or advisers do not accept or assume responsibility to any other person to whom this material is shown or into whose hands it may come and any such responsibility or liability is expressly disclaimed.

Unless stated to the contrary, all figures relating to BAT's performance have been taken from the 2023 Combined Annual and Sustainability Report.

The material in the Omni™ is not provided for product advertising, promotional or marketing purposes. This material does not constitute and should not be construed as constituting an offer to sell, or a solicitation of an offer to buy, any of our products. Our products are sold only in compliance with the laws of the particular jurisdictions in which they are sold.

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References in this publication to 'British American Tobacco', 'BAT', 'Group', 'we', 'us', and 'our' when denoting opinion refer to British American Tobacco p.l.c. and when denoting business activity refer to British American Tobacco p.l.c. and its subsidiaries, collectively or individually as the case may be, as well as in some circumstances those who work for them. When denoting business activity these collective expressions are used for ease of reference only and do not imply any other relationship between British American Tobacco p.l.c. and its subsidiaries. The companies in which British American Tobacco p.l.c. directly and indirectly has an interest are separate and distinct legal entities.

This publication contains forward-looking statements. For our full cautionary statement, please see page 377.

[#] The number of consumers of Smokeless Products is defined as the estimated number of Legal Age (minimum 18 years) consumers of the Group's Smokeless Products - which does not necessarily mean these consumers are solus consumers of these products. In markets where regular consumer tracking is in place, this estimate is obtained from adult consumer tracking studies conducted by third parties (including Kantar). In markets where regular consumer tracking is not in place, the number of consumers of Smokeless Products is derived from volume sales of consumables and devices in such markets, using consumption patterns obtained from other similar markets with adult consumer tracking (utilising studies conducted by third parties, including Kantar).

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Smokeless Products: An Introduction

As the world changes at unprecedented speed, bringing innovation with agility is critical to a multi-category company like ours.

Since the launch of our first vapour product in 2013, we have been on a transformation journey to become a truly multi-category consumer products business, with a mission to build A Better Tomorrow™. We are creating new Smokeless Products, that encourage adult smokers, who would otherwise continue to smoke, to switch to scientifically-substantiated, reduced-risk*† alternatives.

Our Smokeless Products can be categorised into four types: Heated Products, Vapour Products, Oral Tobacco Products, and Oral Nicotine Pouches. Through our transformation journey several terms are used to collectively define these products, e.g. Next Generation Products, Non-Combustible Products, New Category Products, and Reduced-Risk*† Products (RRPs). Additionally, each product type may have had a different term during the past decade (Figure 1). The commonality all these products share is that they operate with the absence of combustion. This is one of their key differentiators compared to cigarettes and the main factor as to why they have a reduced-risk*† relative to cigarettes.

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

Figure 1: Smokeless Products

	Inhalable		Oral	
	Heated Products	Vapour Products	Oral Tobacco Products	Oral Nicotine Pouches
Other Names/Types	• Heat-not-burn (HNB) • Tobacco Heating Products (THP) • Heated Tobacco Products (HTP) • Herbal Heating Products (HHP)	• Electronic Nicotine Delivery Systems (ENDS) • E-Cigarettes • Vaping Devices • Vapes	• Traditional Oral • Smokeless Tobacco • Snus • Moist-Snuff	• Modern Oral • Nicotine Pouches
Absorption	Inhalation (Lung)	Inhalation (Lung)	Buccal Mucosa (inner lining of the cheek between the lip and gum)	Buccal Mucosa (inner lining of the cheek between the lip and gum)
BAT Lead Brand	glo	Vuse	Camel, Lundgrens, Grizzly	Velo
Device			N/A	N/A
Consumable				
Consumer Operation	The consumer inserts the consumable into the battery-powered device and starts the heating session. Once the consumable has reached the necessary temperature, the consumer puffs on the product and inhales the aerosol. (Note: the consumable remains in the device)	The consumer inserts the consumable into the battery-powered device and turns on the device. Once on, if the device is puff-activated, the consumer will puff on the consumable and inhale the formed aerosol. If the device is button-activated, the consumer will press the button, puff on the consumable, and inhale the formed aerosol. Note: for Vapour Products that do not have separate consumables (i.e. a disposable e-cigarette) the consumer only needs to turn on the device before then puffing on the product as required.	The consumer takes a single portion or pouch and places it within the mouth, between the lip and gum.	The consumer takes a single pouch and places it within the mouth, between the lip and gum.
How they work	The consumable contains a plant-based (tobacco leaf or non-tobacco leaf) substrate that is heated to a temperature typically <300°C that forms an aerosol comprised of a carrier (glycerol), nicotine and flavours.	The product contains an e-liquid comprised of carriers (glycerol and propylene glycol), nicotine and flavours, and a heating element. When activated, via puff or button, the heating element heats the liquid (to a temperature typically <200°C) and forms an aerosol comprised of the carriers, nicotine and flavours.	When a portion or pouch is placed within the mouth, between the lip and gum, nicotine and flavours are absorbed from the pouch into the blood stream via the buccal mucosa (inner lining of the cheek).	When a pouch is placed within the mouth, between the lip and gum, nicotine and flavours are absorbed from the pouch into the blood stream via the buccal mucosa (inner lining of the cheek).

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A History of Smokeless Products

Smokeless Products were first conceived as early as the 17th century, with Oral Tobacco Products, such as snus, used in Sweden. In the 1980s and 1990s, RJ Reynolds introduced Premier and Eclipse in the U.S. as the first Heated Products, which was followed by Accord from Philip Morris International. While unsuccessful commercially at that time, Heated Products were reintroduced in 2014, with Philip Morris International launching IQOS in Japan, followed closely by BAT under the brand glo. The largest category of Smokeless Products is Vapour Products. The first such products were introduced in China in 2004. In 2006, the Ruyan Group (Holdings) Limited launched the first e-cigarette in Europe and the U.S., called the 'Ruyan V8'. We launched our first Vapour Products, Vype in the UK and Vuse Solo in the U.S., in 2013. The most recent category of Smokeless Products is Oral Nicotine Pouches, where we launched Velo in the U.S., in 2016. Innovation continues at pace in all categories to create a range of Smokeless Products that meet consumer demand and facilitate adult smokers switching to lower risk*† Smokeless Products.

- Heated Products
- Vapour Products
- Oral Tobacco
- Oral Nicotine Pouches



1950s — 1988 — 1996 — 1998 Accord Launched — 2006 Heatbar Launched — 2006 First e-Cigarette Launched by Ruyan Group — 2013 — 2013



2014 IQOS Launched — 2015 JUUL Launched — 2016 — 2016 — 2016 — 2020 — 2022 — 2024

A history of selected BAT Smokeless Product launches and other significant product introductions

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A Better Tomorrow™ Means Building a Smokeless World

A world where Tobacco Harm Reduction is both understood and accepted. A world where smokers, who would otherwise continue to smoke, have migrated from cigarettes to smokeless alternatives.



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01 Our Vision: A Need for Reappraisal



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My Reflections on BAT's Smokeless World

Surprise. Disbelief. Outright suspicion. These might be some of the reactions if the Chief Executive of a tobacco and nicotine company told you they were actively working towards a world without cigarettes. Yet that is exactly what I, and BAT, are trying to do.

It won't happen overnight. Despite the well-known health risks associated with cigarettes, the number of adult smokers globally has remained at around one billion since 1990.[1,2]

People still choose, for a variety of reasons, to smoke. However, it doesn't have to be that way. New Smokeless Products, while addictive, have emerged that are better alternatives to smoking.

Crucially, through significant investment and product development over many years, these new products have become much better at meeting consumer demand and encouraging adult smokers to make a complete switch. That is, at its core, what we mean by Building a Smokeless World and creating A Better Tomorrow™.

The best choice any adult smoker can make will always be to quit smoking altogether. For those who would otherwise continue to smoke though, Smokeless Products provide a compelling alternative to cigarettes. We believe people deserve a choice.

What is the difference between these new products and cigarettes? They don't burn tobacco and so avoid the creation of the smoke which contains high levels of harmful chemicals associated with smoking-related diseases.

By not burning (or combusting) tobacco, significantly fewer and lower levels of toxicants are produced by these new products, compared to conventional cigarettes.[‡] By replicating the pleasure of smoking, but without the combustion, we believe these products offer adult smokers a better alternative experience to smoking.

From a business perspective, it will take more time, money and resources for a Smokeless World to become a reality. Our commitment though is clear: today, we have a multi-billion-pound Smokeless Products business. By 2035, I want Smokeless Products to account for at least 50% of our revenue globally. We also want to have 50 million adult consumers[#] of our Smokeless Products by 2030.

> **Today, we have a multi-billion-pound Smokeless Products business. By 2035, I want Smokeless Products to account for at least 50% of our revenue globally.**



Tadeu Marroco
Chief Executive

We cannot do this alone. Achieving an accelerated reduction in the number of adult smokers globally will require governments, regulators, and public health authorities to agree that adult smokers should be given better choices. Unfortunately, many countries restrict our ability to offer these smokeless alternatives for sale.

For our part, we have invested billions of pounds into product development and science behind these Smokeless Products. More needs to be done, but it's clear that these products represent far better alternatives to cigarettes. They are better choices for adult smokers.

The benefit of a consumer choice-led approach is just that; adults can make a choice. The choice between a cigarette and, if we've done our job, products that are both enjoyable and pose less risk[*†].

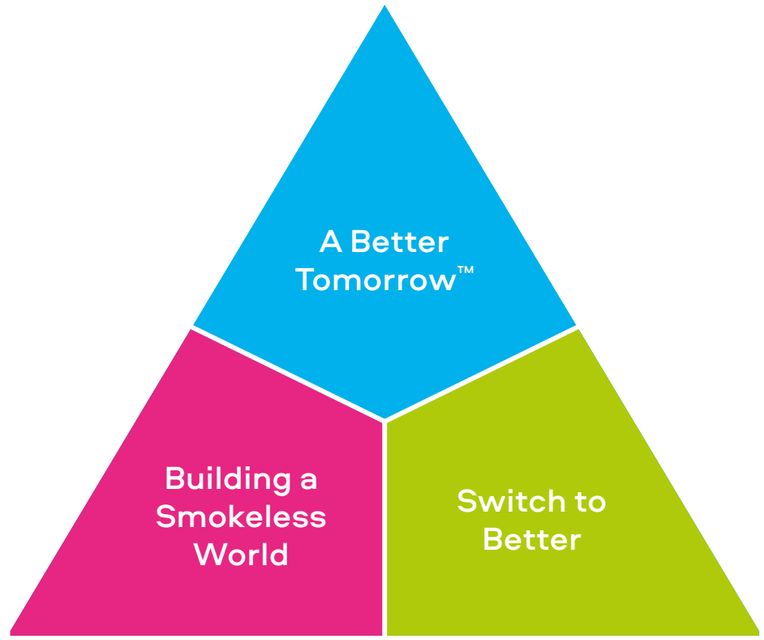
Will every smoker choose one of these Smokeless Products to completely replace cigarettes? I don't know. But we are certainly trying to get as many adult smokers, who would otherwise continue to smoke, to do just that. It is what is meant by Tobacco Harm Reduction, a concept which the Omni™ will explore in detail.

Why is Tobacco Harm Reduction something that we at BAT would want to draw attention to? Because we believe it is an issue of such importance that we have built our purpose, vision, and mission around it.

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Our Purpose, Vision and Mission



> **Our ambition is to reduce the health impact of our business, and this is front and centre of our corporate vision 'to build A Better Tomorrow™ through a Smokeless World'.**
>
> **Tadeu Marroco**
> Chief Executive

Critically, what's contained in the Omni™ is grounded in science, both our own and that of third parties.

My hope is that you find the information contained in the Omni™ insightful and thought provoking. We believe we are at a moment when there is a real opportunity to create A Better Tomorrow™. It won't be easy. We acknowledge that.

All I ask is that you look carefully at the science and become familiar with what kind of regulatory actions are driving significant declines in smoking rates in a number of countries around the world.

We are also open to discussion. For Tobacco Harm Reduction to become a reality, we must work constructively with key stakeholders to reduce smoking-related disease through new product offerings.

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‡ Comparison with smoke from a scientific standard reference cigarette (approximately 9mg of tar) in terms of the average of the 9 harmful components the World Health Organization recommends to reduce in cigarette smoke.

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OUR Strategy



Kingsley Wheaton
Chief Strategy & Growth Officer

Our purpose:
Creating A Better Tomorrow™.

Our vision:
Building a Smokeless World.

Our mission:
Reducing the health impact of our business by encouraging adult smokers who would otherwise continue to smoke to switch to better Smokeless Products.

The World Health Organization (WHO) estimates that cigarette smoking causes over eight million deaths annually. Yet, more than one billion people continue to smoke.[1]

Tobacco Harm Reduction (THR) is consistent with offering adult smokers who would otherwise continue to smoke, reduced-risk*† tobacco and nicotine products.

Our business is now focused on facilitating the acceleration of THR globally. Our Smokeless Products are available in more than 80 markets, we have an ambition to achieve 50 million adult consumers# of our Smokeless Products by 2030, and we want at least 50% of our revenue to come from Smokeless Products by 2035.[2]

In short, our strategy is to Build a Smokeless World by advancing THR.

We believe that innovative Smokeless Products provide sustainable solutions to improve public health, while simultaneously meeting our business goals. Markets such as Poland (Heated Products, Vapour Products, and Oral Nicotine Pouches) and Sweden (Vapour Products, Oral Tobacco Products, and Oral Nicotine Pouches) have shown that Smokeless Products can deliver a commercially sustainable future.[3]

Three strategic pillars underpin our strategy for Building a Smokeless World. To drive success across these pillars, we have nine key initiatives that span the entire business.

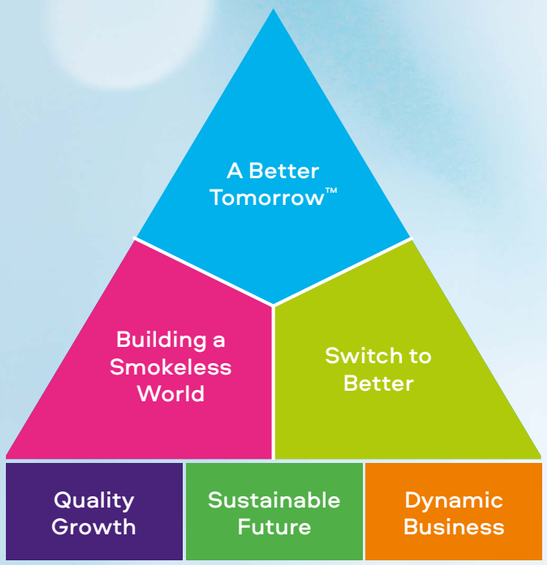
By focusing our efforts and resources into these areas, we can continue to deliver long-term, sustainable growth, advance Tobacco Harm Reduction globally and create A Better Tomorrow™.

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Our Strategic Pillars and Nine Underpinning Initiatives

Quality Growth

Inspiring Smokeless Product Innovations & Brands

A portfolio of Smokeless Products (Heated Products, Vapour Products, Oral Tobacco Products and Oral Nicotine Pouches) which we aim to comprise at least 50% of our global revenues

Managed Combustible Transition

Funding the transition while managing our commercial reliance on cigarettes to less than 50% of our global revenues by 2035

Beyond Nicotine Foundations

Prudently developing new sources of business through state-of-the-art science and technology

Sustainable Future

Tobacco Harm Reduction Acceptance

Communication and education with a broad range of stakeholders that nicotine is not carcinogenic and is not the primary cause of smoking-related diseases,[4] and that using Smokeless Products has a lower risk profile than smoking

Shaping the Landscape

Creation of global regulatory frameworks that enable access for consumer relevant Smokeless Products to adult smokers while preventing underage access

Leading in Sustainability and Integrity

Building sustainability for our Company

Dynamic Business

Exciting, Winning Company

Creating an aspirational and engaged organisation, representative of the diverse nature of our global community

Operational Excellence

Allocating our resources in the most efficient manner to deliver a business with at least 50% revenue from Smokeless Products

Capital Effectiveness

Delivery of the global commercial plan

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Our Vision for a Smokeless World

Almost twenty years ago, I joined BAT as an R&D Management Trainee and the BAT I joined then was a very different company from what it is today.

Our ambition is to reduce the health impact of our business, and this is front and centre of our corporate vision to create A Better Tomorrow™ by Building a Smokeless World.[1] This approach is underpinned by Tobacco Harm Reduction (THR). First described by the Institute of Medicine in the U.S.,[2] THR involves the complete switching^ of adult smokers who would otherwise continue to smoke combustible tobacco products like cigarettes, to lower risk profile Smokeless Products.

Harm reduction refers to policies, programmes and practices that aim to minimise the negative health and social impacts associated with the use of certain harmful products.

Dr James Murphy
Director,
Research & Science



I am pleased to introduce the first edition of our science and innovation resource, Omni™.

Today, if I were to describe BAT in one word, it would be 'transformation'. We are at the vanguard of the development and scientific assessment of a range of innovative Smokeless Products. We now have three global brands for our portfolio of Smokeless Products: glo (Heated Product), Vuse (Vapour Product) and Velo (Oral Nicotine Pouches). Our Smokeless Products are free from the combustion associated with cigarettes and thus have substantially (>90-99%) reduced levels of a number of toxic chemicals, which are believed to be the primary cause of smoking-related diseases.[3,4,5]*†‡

Our transformation parallels that of many other legacy combustion-based industries (e.g. energy, automotive), which are today transforming their businesses to non-combustion products. In all cases, the combustion of organic material produces toxic chemicals which then have a significant, negative impact on society.

Transforming industries that move from combustion to non-combustion can have a profound benefit to humankind and the environment.

A decade ago, we launched our first Smokeless Products in both the UK and the U.S., and today we have 23.9 million adult consumers of Smokeless Products.[1]

Our Chief Executive recently re-articulated our Group strategy with clear goals and milestones:[1]

- **Reducing the health impact of our business through adult smokers, who would otherwise continue to smoke, switching to lower risk profile Smokeless Products**
- **50 million Smokeless Products adult consumers# by 2030**
- **50% of our Group revenues from Smokeless Products by 2035**

Proof that these metrics and milestones are achievable exist today in Sweden, where (i) Sweden has the lowest lung cancer rates in the whole of the EU as a result of (ii) Sweden's smoking rates being the lowest in the EU (5.6%) as adult smokers have transitioned to Smokeless Products, such as Oral Tobacco Products and Oral Nicotine Pouches.[6]



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^ While we are aware of some evidence suggesting that dual use of cigarettes with Smokeless Products can, for some smokers, function as a step towards completely switching, we are clear that smokers should not delay making a complete switch.

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Sweden is on target to meet the EU's 'Beat Cancer 2040 plan' a full 16 years ahead of the deadline. It's been reported that if Sweden's mortality rates were applied to the rest of the EU, there would be 3.5 million fewer deaths over the next decade;[6] an outcome we believe public health and regulators should seek. Finally, (iii) in Sweden, BAT's revenues from Smokeless Products are far greater than from cigarette sales, dispelling the myth that we wish only to sell cigarettes.[7]

If we could replicate the Swedish experience in all of our global markets it would be a win-win-win for adult consumers, stakeholders and BAT itself.

Over the course of the Omni™, we will show that world-class objective science is crucial to providing answers to the Big Questions (Pages 16-17).

THR requires multi-stakeholder collaboration: regulators need science to form the basis of regulation and public health scientists require it to assess population health impact.

Tobacco and nicotine science is necessary as regulators require specific data on the manufacturers' products as seen in, for example, the U.S. with Premarket Tobacco Product Application (PMTA) requirements or in the EU with the Tobacco Products Directive (TPD).

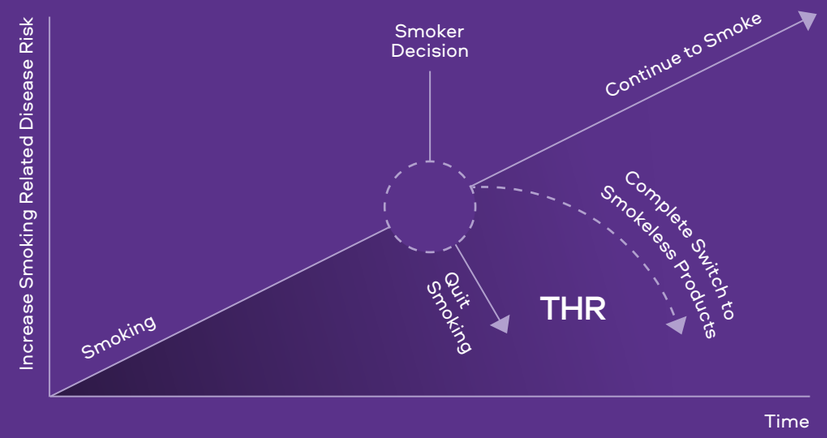
Independent science is also required from other stakeholders whether it's from public health authorities, tobacco control, or regulators.

> I understand there may be scepticism around THR and its science and thus we will endeavour to utilise the Omni™ to demonstrate the totality of THR scientific evidence from a range of institutions and BAT and respond to many of the Big Questions from our stakeholders.

Dr James Murphy
Director,
Research & Science



Figure 1. An illustrative model of THR potential



Unfortunately, there remain few scientific forums where all stakeholders (industry included) can discuss scientific evidence and come to common conclusions on THR science to drive progress forward.

We urgently need a major regulator/public health stakeholder to take the lead and offer to chair forums where all parties can participate in an active dialogue on THR.

My hope is that one day very soon we will have multi-stakeholder science-based discussions on tobacco and nicotine products, which would result in informed communications to facilitate the migration of adult smokers who do not wish to quit to lower risk profile Smokeless Products, in turn providing what can be expected to be a beneficial outcome on public health.

The public health message for tobacco use doesn't change...

> "If you don't use tobacco, don't start. If you use tobacco the safest thing to do is quit."

If adult smokers do wish to continue to use tobacco and/or nicotine they should do so with scientifically-proven, lower risk profile products. Tobacco Harm Reduction offers a method of using non-combustible forms of tobacco and nicotine with the potential of lowering an individual's disease risk, resulting in a net public health benefit.

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The Big Questions

Our aim for the Omni™ is to catalyse today's discussion on THR, outlining the opportunities and addressing the challenges.

THR is, quite simply, one of the greatest public health opportunities for global society today and we aim to address the following Big Questions in Chapter 2.

01

What is Tobacco Harm Reduction?

02

What are the Desired Outcomes of THR?

03

What Current Progress is Being Made on Global THR?

04

Why Is THR Important to BAT?

05

What is BAT Doing to Address Underage Access to Tobacco and Nicotine Products?

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What is the Risk of Using Smokeless Products Compared to Smoking?

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Are Smokeless Products a Gateway to Cigarette Smoking?

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What is the Role of Flavours in Smokeless Products and THR?

10

Are Smokeless Products Associated with Reductions in Smoking?

Look out for a deeper dive into the Big Questions later in the Omni™ on page 32

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Tobacco Harm Reduction: A Need for Balance



Introduction

The concept of Tobacco Harm Reduction (THR) aims to mitigate the adverse health effects associated with continued smoking by encouraging adult smokers who will not quit to switch completely to reduced-risk*† alternatives.[1] We continue to demonstrate our commitment to THR through the development, scientific assessment and commercialisation of a multi-category portfolio of Smokeless Products. We recognise, however, that important stakeholders, for example The Royal College of Physicians,[1] are critical of the genuineness of our THR efforts.

Stakeholder Perceptions

Our critics suggest that we manipulate the concept of THR by portraying our Smokeless Products as safer than smoking without sufficient long-term evidence. Critics also argue that our portfolio transformation is driven purely by profit motives and is aimed at misleading adult consumers about the risks associated with our Smokeless Products. Our critics have also raised concerns that our strategies target the underaged and adult never smokers, potentially creating new generations of nicotine consumers.[1]

Commitment to Innovation and Tobacco Harm Reduction

We maintain that our THR efforts are genuine. As an initial point, we are very clear that Smokeless Products are not risk free. Moreover, we are also clear that our Smokeless Products are intended for adult smokers and existing nicotine consumers only.

Through development of our portfolio of Smokeless Products, we have invested significant resources into THR. This investment has resulted in Smokeless Products being more acceptable to adult consumers and commercially sustainable. Our engagement with regulators and policy makers on THR is underpinned by our open and transparent regulatory positions. In the UK, we have recently advocated for more extensive regulation of e-cigarettes and other Smokeless Products.[2] We seek to engage with public health authorities and regulators, to help develop policies that balance THR objectives with concerns about underage access, environmental impacts and consumer safety. These partnerships can lead to more effective and comprehensive THR strategies.

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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Supporting Scientific Research

Our research into Smokeless Products and THR strategies is fundamental for complying with global regulations and has contributed valuable data to the scientific community. Mindful of concerns about bias, our studies follow standardised regulatory-endorsed methodologies where those exist, comply with requisite quality standards and practices (e.g. Good Laboratory Practice and Good Clinical Practice), and where possible are conducted in third party Contract Research Organisations. We seek transparency and scientific integrity of our findings and as such we publish our science, which undergoes rigorous peer review, and participate at global scientific conferences.

Absolute Risk vs Relative Risk

We are clear that many of our Smokeless Products have not been on the market long enough to assess the long-term impacts of their use. Some stakeholders maintain that this absence of long-term data means that Smokeless Products have no role to play in THR. For example, the EU's Scientific Committee on Health, Environmental and Emerging Risks (SCHEER) issued an opinion in April 2021 focusing on the potential absolute risk of e-cigarettes.[3] While the SCHEER report reviewed the evidence for an association between a number of risks and e-cigarettes use, classifying the evidence base for each risk as “strong, “moderate”, or “weak”, it did not compare the level of these risks to the well documented risks associated with combustible cigarettes. We believe that this relative perspective is crucial for THR, as the primary goal is to reduce tobacco-related morbidity and mortality for those who would otherwise continue smoking.

Numerous other public health authorities similarly focus on the absolute risks of Smokeless Products compared to cigarettes. These authorities argue that because Smokeless Products are not risk-free, they should not be promoted as part of THR strategies. Such arguments overlook the significant reduction in risk when comparing these alternatives to traditional smoking. For example, studies highlighting the potential carcinogenic or cardiovascular risks of Smokeless Products tend to ignore the actual and substantial risks posed by combustible tobacco products. We believe that this narrow focus on absolute risk fails to acknowledge the public health benefits of switching to Smokeless Products for adult smokers, who would otherwise continue to smoke.



Relative Risk at the Core of THR

The essence of THR lies in the relative risks between cigarettes and Smokeless Products. Our Smokeless Products are not risk-free, but the key is that they, based on the weight of evidence, are less risky than combustible cigarettes. This reduction in relative risks underscores the potential of Smokeless Products as effective tools in THR. Indeed, in numerous markets that have embraced THR, the introduction of Smokeless Products has been associated with further declines in smoking prevalence. This highlights that when properly regulated, Smokeless Products can support rather than undermine public health efforts.

Conclusion

We accept that our role in the THR discussion is complex. What is clear, however, is that we have the resources and capabilities to significantly contribute to THR efforts. By investing in new products, supporting regulatory frameworks, and funding research, we can play a positive role in reducing tobacco-related harm. A balanced approach that provides all stakeholders (including BAT) with a seat at the table and which includes strong regulation, transparency, and accountability is essential to ensure that THR regulation genuinely benefits public health.

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A Better Tomorrow™ for Shareholders

There is increasing pressure on investors and financial institutions to ensure the companies they invest in, or provide services to, are responsible stewards, led by accountable management teams.

For BAT, this means further evidencing and amplifying our critical role in Tobacco Harm Reduction (THR) to our key stakeholders.

To do this, we are committed to communicating the strength and rigour of our world-class science and stewardship, enabling the continuous development of our reduced-risk*† portfolio of Smokeless Products.



Soraya Benchikh
Group Chief
Financial Officer

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Our vision of Building a Smokeless World is not just an opportunity for public health, but also investors.

Revenue growth in the global nicotine sector is accelerating, allowing for the necessary investment in Smokeless Products that offer viable alternatives for adult smokers who are seeking to switch.

We believe our established multi-category strategy provides the greatest opportunity for long-term growth, Tobacco Harm Reduction and portfolio transformation.

Our three global Smokeless Product brands benefit from our world-class R&D as well as our manufacturing, distribution, marketing and brand-building capabilities.

We strive to continue to profitably and responsibly manage our transition away from combustibles, driving funds to further invest in our transformation and deliver sustainable profit growth and cash flow over the long term.

Over the last decade, we have delivered 8% adjusted[1] diluted EPS (at constant rates)[2] and a 5% dividend Compound Annual Growth Rate (CAGR). We are confident in moving progressively to our medium-term targets of 3-5% revenue growth and mid-single digit adjusted profit from operations[3] growth (organic basis[4] at constant rates) by 2026.

With strong profitability and more than 90% operating cash conversion[5] annually, we are committed to deleveraging the balance sheet to within our 2.0-2.5x adjusted net debt to adjusted EBITDA[6] target range, in combination with a progressive dividend policy and a sustainable share buyback starting with £1.6 billion by December 2025.

Together with our long-standing experience operating within complex regulatory, legal and fiscal frameworks, we believe we have a compelling competitive advantage to drive portfolio growth and transformation to Build a Smokeless World.

For definitions of the non-GAAP measures mentioned, please see Chapter 10 at the end of the Omni™.

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

Transformation in the Automotive Industry: a BMW Case Study

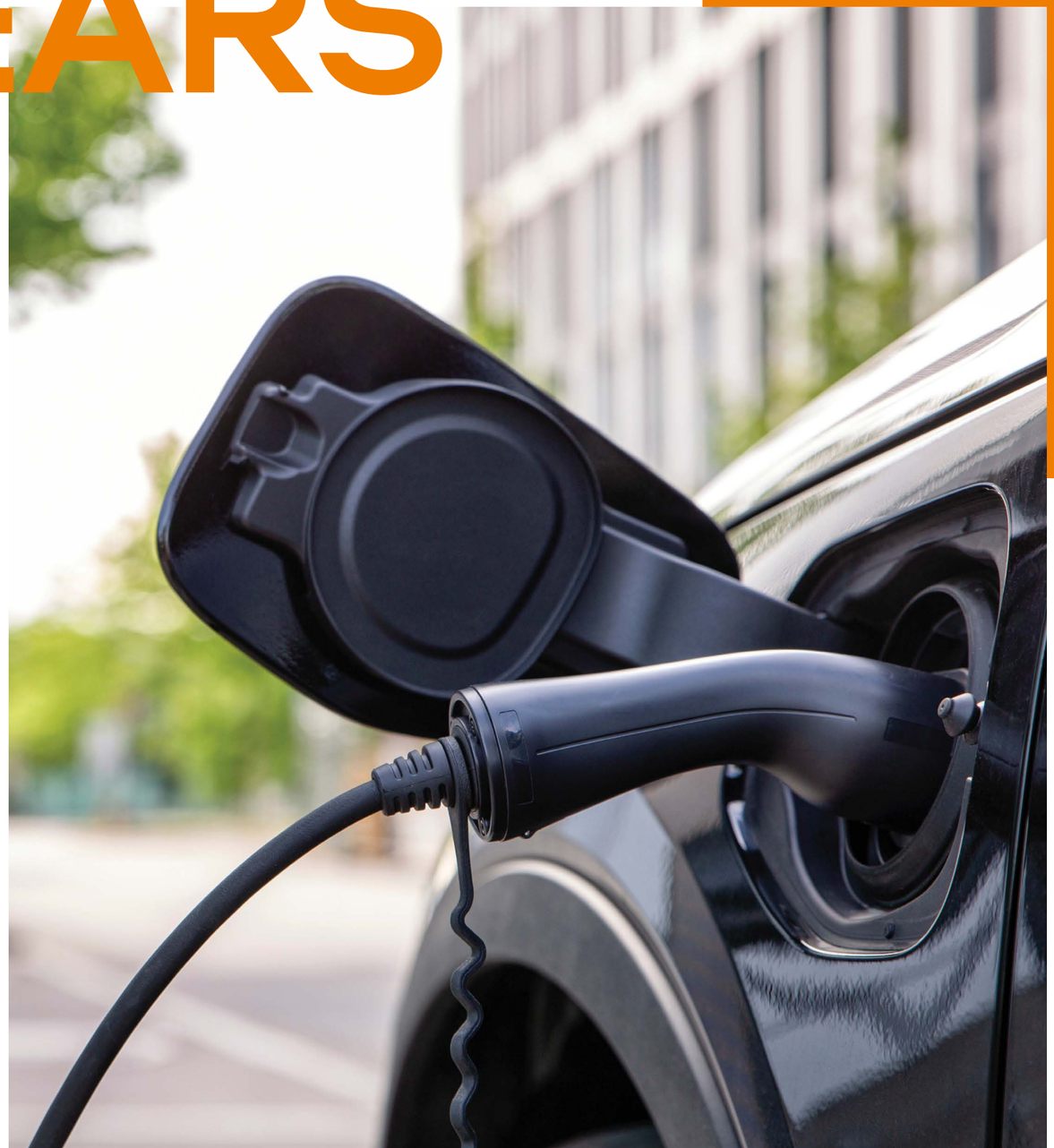
Shifting GEARS

An example from a different industry that is transferring from a combustion business to a new, innovative non-combustion business. Through observing other businesses on their transformation journey, the initial solution may not be the optimal solution.*

BMW shifts gears from combustion engines to electric vehicles. BMW's bold transformation has seen it steer away from the internal combustion engine that has defined its identity for decades, to embracing an electric, combustion-free future.

Vehicle emissions are a major contributor to climate change and can be extremely damaging to health by increasing air pollution. A 2010 study found that BMW ranked among the bottom five automakers in Europe for average CO_2 emissions from new cars sold at over 150g CO_2/km – well above the 2015 target of 130g CO_2/km.[1]

During this period, regulatory pressure mounted, as countries set aggressive emissions reduction targets, realising the dangers of fossil fuel combustion to both people and planet. Many governments and governing or political bodies, including the EU and U.S., instituted stiff financial penalties for automakers failing to meet fleet CO_2 targets.



AT A GLANCE

BMW's bold transformation has seen it steer away from the internal combustion engine that has defined its identity for decades, to embracing an electric, combustion-free future.

£75m
of funding to support Mini's plant in Oxford to transition production to build electric cars[2]

£381m
investment in EV charging points[3]

In parallel, consumer adoption began to rise as buyers increasingly understood the benefits of affordable Electric Vehicles (EVs) with lower associated environmental and health impacts. With BMW's brand and identity deeply intertwined with the internal combustion engine, pivoting to electric vehicles was risky, requiring massive investment and significant support from both governments and consumers.

* For the avoidance of doubt, no partnership or similar relationship exists between BAT and BMW and nothing in this section is intended to indicate otherwise. The BMW figures have not been independently verified and certain industry and market data relating to BMW have come from third party sources. Third party publications, studies and surveys generally state that the data contained therein have been obtained from sources believed to be reliable, but that there is no guarantee of accuracy or completeness of such data.

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In response, BMW transformed itself into a leader in electric mobility, starting with 'Project i' in 2008.[4] This came to fruition in 2013 with the launch of the pioneering BMW i3 all-electric city car, BMW's first mass-production zero-emissions vehicle. It captured ~12% of the nascent battery electric vehicle (BEV) market in its first full production year and won Car of the Year 2014.[5,6]

Strong sales were supported by government incentives such as the UK's £5,000 Plug-in Car grant scheme which helped EVs achieve pricing that was more competitive with incumbent petrol and diesel cars.[7] Today, BMW offers several electric models.[8]

Since the birth of Project i, government EV incentive schemes have been a catalyst for BMW's transformation. Schemes such as the U.S. $7,500 EV Tax Credit and China's ¥30,000 tax exemption for New Energy Vehicles, have made electric vehicles more affordable and accessible, driving up demand and accelerating the transition to sustainable mobility.[9,10]

In 2021 the European Commission began the European Battery Innovation Project, with BMW a direct beneficiary.[11] This project was declared an IPCEI (Important Project of Common European Interest) highlighting its importance.

More recently, the UK government announced £75m of funding to support Mini's plant in Oxford to transition production to build electric cars.[2] This came alongside the UK government's £381m investment in EV charging points, highlighting its support of the wider infrastructure enablers.[3]

> Electromobility needs holistic thinking and implementation. That is why we don't just offer our customers highly attractive electrified cars, we also make sure charging is easy and convenient.
>
> **Dr Andreas Aumann**
> BMW Group Head of Strategic Product Management[7]

~15%

In 2023, deliveries of BMW Electrified Vehicles equated to around 15% of BMW's total deliveries (vs. <6% in 2018)[13]

Consumer acceptance has been steadily increasing as fears over lack of infrastructure and battery range are being overcome. In 2022, 52% of consumers who intended buying a car in the following two years say they would choose an EV or hybrid model.[12]

This shift is reflected in increased annual delivery figures for BMW's EV ranges over the past five years. In 2023, BMW's annual EV delivery figures were more than two times greater than those in 2018 (~330,000 vs. ~140,000, respectively).[13] EV annual deliveries were expected to continue to increase with ~179,000 EV deliveries completed in the first half of 2024, a +34.1% increase compared to the same period in 2023.[14]

BMW's decade-long EV journey serves as a beacon for other automakers and industries seeking to drive sustainable transformation, exemplifying the necessity of decisive action to transition away from carbon-intensive fuels towards greener alternatives. BMW's journey also underscores the undeniable role of government and public acceptance in enabling sustainable change. When coupled with substantial investment and commitment to innovation, we believe that even the most deeply entrenched companies can embark on a path towards a cleaner future.

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How Ørsted Transformed into a Renewable Energy Titan: an Ørsted Case Study

Winds of Change

An example from a different industry that is transferring from a combustion business to a new, innovative non-combustion business. Through observing other businesses on their transformation journey, the initial solution may not be the optimal solution.*



AT A GLANCE

Ørsted's metamorphosis from coal-fired giant to renewable energy pioneer is a remarkable story of sustainable business transformation.

85%

In 2009, it adopted a transformative strategy, called the 85/15 vision, to transition its power generation mix from 85% fossil fuel-based to 85% renewables-based by 2040

86%

By 2019, Ørsted was generating 86% of its power from renewables. Its 30-year transformation journey had been completed in just under 10 years

Ørsted's metamorphosis from coal-fired giant to renewable energy pioneer is a remarkable story of sustainable business transformation. In 2009, the Danish company generated more than 85% of its heat and power from coal. After embarking on a journey to pivot to clean energy, by 2019, the company was generating more than 85% of its heat and power from renewables, a complete inversion from its fossil-fuelled past.[1,2]

Ørsted started trading as DONG Energy in 2006 (Dansk Olie og Naturgas, meaning Danish Oil and Natural Gas). It built a strong business based on procuring, producing, distributing, and trading in energy and related products and dominated its traditional energy market. The company relied almost entirely on coal for its heat and power production.[3] However, following scientific consensus on the health risks and climate impact of fossil fuels, public opinion and policy maker stances rapidly shifted against its unrestricted use. This placed the company's long-term future in jeopardy, despite its high level of profitability from fossil fuel energy.

During this time, global governments began prioritising sustainability to curb emissions. The Danish government started setting ambitious renewable energy targets and incentivised business to adapt.[4] In parallel, the government tightened air pollution regulations, raising costs for DONG Energy's fossil fuel facilities.

In 2009, it adopted a transformative strategy, called the 85/15 vision, to transition its power generation mix from 85% fossil fuel-based to 85% renewables-based by 2040.[1]

* For the avoidance of doubt, no partnership or similar relationship exists between BAT and Ørsted and nothing in this section is intended to indicate otherwise. The Ørsted figures have not been independently verified and certain industry and market data relating to Ørsted have come from third party sources. Third party publications, studies and surveys generally state that the data contained therein have been obtained from sources believed to be reliable, but that there is no guarantee of accuracy or completeness of such data.

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This shift was partly enabled by government support, both financially and commercially, through long-term supply contracts, which helped de-risk the transformation. Over the next decade, the company steadily built up its renewable energy portfolio, focusing especially on European offshore wind farms. It effectively leveraged its legacy capabilities in offshore energy while adapting them to renewable solutions. Aggressive investment in innovative technologies and strategic partnerships across the ecosystem were also key.[1]

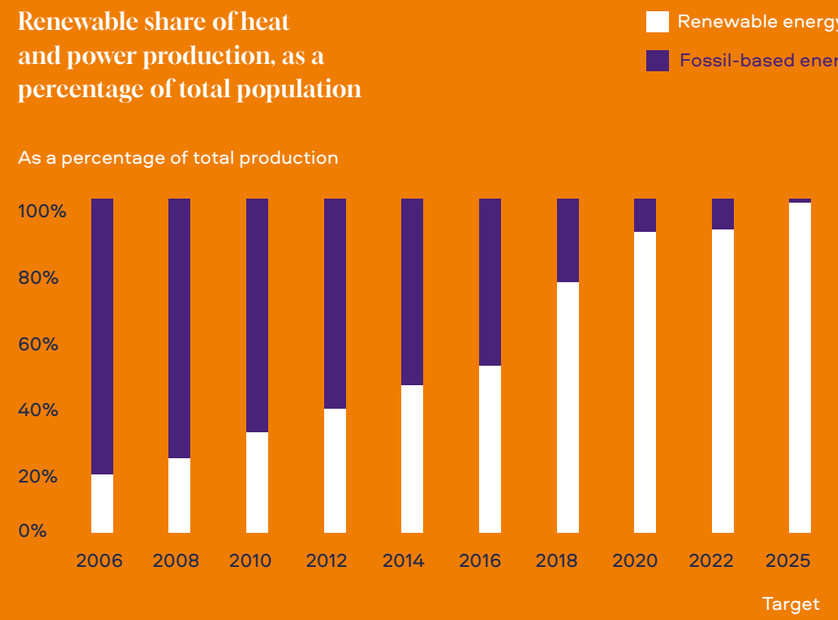
In parallel, the company was divesting its legacy businesses. It sold its oil and gas business in 2017 and committed to phase out all use of coal.^ It also changed its name to Ørsted, after the Danish scientist Hans Christian Ørsted, a pioneer in electrodynamics.[5]

By 2019, Ørsted was generating 86% of its power from renewables. Its 30-year transformation journey had been completed in just under 10 years. It had also become the world's largest developer of offshore wind power, with its committed green energy capacity rising from ~8 GW in 2018 to ~15 GW in 2023, working towards a target of ~50 GW by 2030.[6,7]



^ Ørsted's target is to phase out coal before 2025. However, the Danish authorities have ordered Ørsted to continue and resume the operation of three of its power station units which use coal and oil until 31 August 2024.

Renewable share of heat and power production, as a percentage of total population



+99%

In addition to completely phasing out coal usage,^ the company is now aiming for 99% renewable heat and power generation by 2025.[1]

Several factors enabled Ørsted's remarkable business transformation. Public acceptance of the need to shift from black to green energy catalysed social and political change. The sustained support and acceptance from the governments of Denmark and other countries provided visibility and facilitated access to long-term capital. The UK government, for example, partnered with Ørsted on several projects to help achieve its Net Zero ambitions.[8,9]

More recently, the U.S. Inflation Reduction Act allowed offshore wind projects to claim tax credits, supporting Ørsted's planned investments in that country.[10]

With its vision and ambition to build a combustion-free business, Ørsted succeeded in getting multiple stakeholders on board. The key lesson here is that firms deeply entrenched in legacy combustion businesses can commit to a cleaner, healthier future and make meaningful progress, especially in an environment with broader public and government acceptance.

Ørsted's transformation shows that incumbents can fundamentally change their core business and spearhead an industry-wide transition by leveraging their scale, resources, and capabilities. With courage and conviction, we believe that leaders can transform their companies from symbols of environmental harm into catalysts for a smoke-free future.

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02 The Big Questions



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Big Question 1

What is Tobacco Harm Reduction?

KEY SUMMARY POINTS

01

Tobacco Harm Reduction (THR) is a public health policy first described by the U.S. Institute of Medicine.

02

THR is achieved through adult smokers who would otherwise continue to smoke switching from harmful cigarettes to lower risk profile tobacco and nicotine products.

03

It is expected this reduction in, or elimination of, smoking will have a beneficial public health impact.

> A product is harm reducing if it lowers total tobacco-related mortality and morbidity even though use of that product may involve continued exposure to tobacco-related toxicants.
>
> **U.S.**
> Institute of Medicine (2001)[1]

Harm reduction, in general, refers to health policies, strategies and programmes that aim to reduce the harms and negative impacts (social and/or physical) associated with what are deemed 'risky' behaviours.

These approaches are founded on improving individual and public health and are supported by science and a strong body of evidence demonstrating that the interventions and practices are safe, practical and effective (economically, socially and culturally).

We also have harm reduction aims, programmes and strategies. The first is aligned with globally recognised public health authorities that the safest thing for a smoker is to quit.

However, as many people enjoy smoking and will not switch without a substitute alternative tobacco or nicotine product, the concept of Tobacco Harm Reduction (THR) was conceived. THR is a public health policy that aims to minimise the population level harm associated with using tobacco. Its purpose is to enable adult consumers who would otherwise continue to smoke to switch to alternative forms of tobacco and nicotine products that have a lower profile of risk as compared to cigarettes. (Figure 1).[2]

Figure 1. Tobacco Harm Reduction Equation

Tobacco Harm Reduction

=

Scientifically Substantiated Reduced-Risk*† Products

x

The Number of Adult Consumers Using Reduced-Risk*† Products Who Would Otherwise Smoke Cigarettes

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The history of THR

Efforts to reduce the risk of harm from combusted tobacco products date back to the 1950s. The concept of Tobacco Harm Reduction was first articulated by Professor Michael J. Russell, who advocated for the reduction of tar in cigarettes while maintaining levels of nicotine, as "[p]eople smoke for nicotine but they die from the tar."[3]

In 2001 the U.S. Institute of Medicine (IoM) - a governmental advisory body now called the National Academy of Science, Engineering and Medicine (NASEM) - outlined the principles behind THR in a publication called *Clearing the Smoke*. The IoM defined THR as: "decreasing total morbidity and mortality, without completely eliminating tobacco and nicotine use."[1]

The leading public health benefits of THR were realised in Sweden, where smoking has been largely replaced by Oral Tobacco Products for the last 70 years, which has resulted in the lowest smoking rates in Europe (5.6% relative to the EU average of 23% in 2023) and as a result has the lowest incidence of lung cancer mortality in Europe (29.1 deaths in 100,000 people relative to the EU average of 66.7 deaths in 100,000 people).[4]

THR today

It is now widely acknowledged that the cause of most of the serious health risks associated with conventional cigarettes is the exposure to toxicants in the smoke produced when tobacco is burned – and not the nicotine.[5,6] There exist today four global categories of Reduced-Risk*† Products (RRPs): Heated Products, Vapour Products, Oral Tobacco Products and Oral Nicotine Pouches. Organisations such as Public Health England** (PHE) are clear that vaping is likely to be much less risky than smoking traditional cigarettes when used as a complete substitute for continued cigarette smoking.[7] Similarly, Balfour et al. stated that: "vaping can benefit public health, given substantial evidence supporting the potential of vaping to reduce smoking's [death] toll."[8]

Today, it is estimated that there are more than 115 million Smokeless Product adult consumers, with around 10 million[9] adult consumers using Oral Nicotine Pouches, 40 million[10] using Heated Products, and 65 million[11] using the largest category, Vapour Products.



Our role in THR

Our role is to develop and market responsibly innovative products that support THR, propose solutions to address underage access to tobacco and nicotine products, and engage with regulators and policy makers to facilitate THR.

The U.S. Food and Drug Administration[12] and other leading public health scientists[13] have considered the role of THR and its potential benefit to society, as they believe that the risk of underage use of Smokeless Products must be balanced against the substantial THR benefit offered by these products.

In 2019, the Greek 'Ministry of Health'*** established a mechanism (Law 4715/2020) for the communication of risk related messages subject to a strict procedure of scientific assessment led by a specialised Committee.[14] Through this mechanism claims relating to a reduction in "[t]he concentration of chemical substances with known toxicity [...] compared to conventional smoking" were issued for Heated Products glo (BAT) and IQOS (Philip Morris International [PMI]).[15,16] These claims further emphasise that regulatory bodies are recognising the importance of informing adult smokers, who choose to continue to smoke, about alternative products that can benefit THR.

Figure 2 summarises our role in Tobacco Harm Reduction and how we will focus on both encouraging adult smokers who would otherwise continue to smoke towards exclusive use of Smokeless Products instead of cigarettes, and preventing the access of these products by the underaged.

Figure 2. Our Role in THR

Reducing the Number of Adult Smokers

- Support for evidence-based and proportionate public health initiatives to reduce smoking
- Commitment to Smokeless Products
- Scientific assessment and publication of risk profile of Smokeless Products
- Legal compliance with global regulations
- Support for adult-orientated flavours that encourage switching by adult smokers who would otherwise continue to smoke

Addressing Underage Access

- Support bans on flavours that are predominantly attractive to the underaged
- Support retail licensing and restrictions
- Support tougher enforcements of illicit products
- Support point of sale Underage Access Prevention (UAP) technology
- Introduction of novel, consumer-acceptable, product-based technologies that prevent underage access
- Adult-orientated product design and descriptions only

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

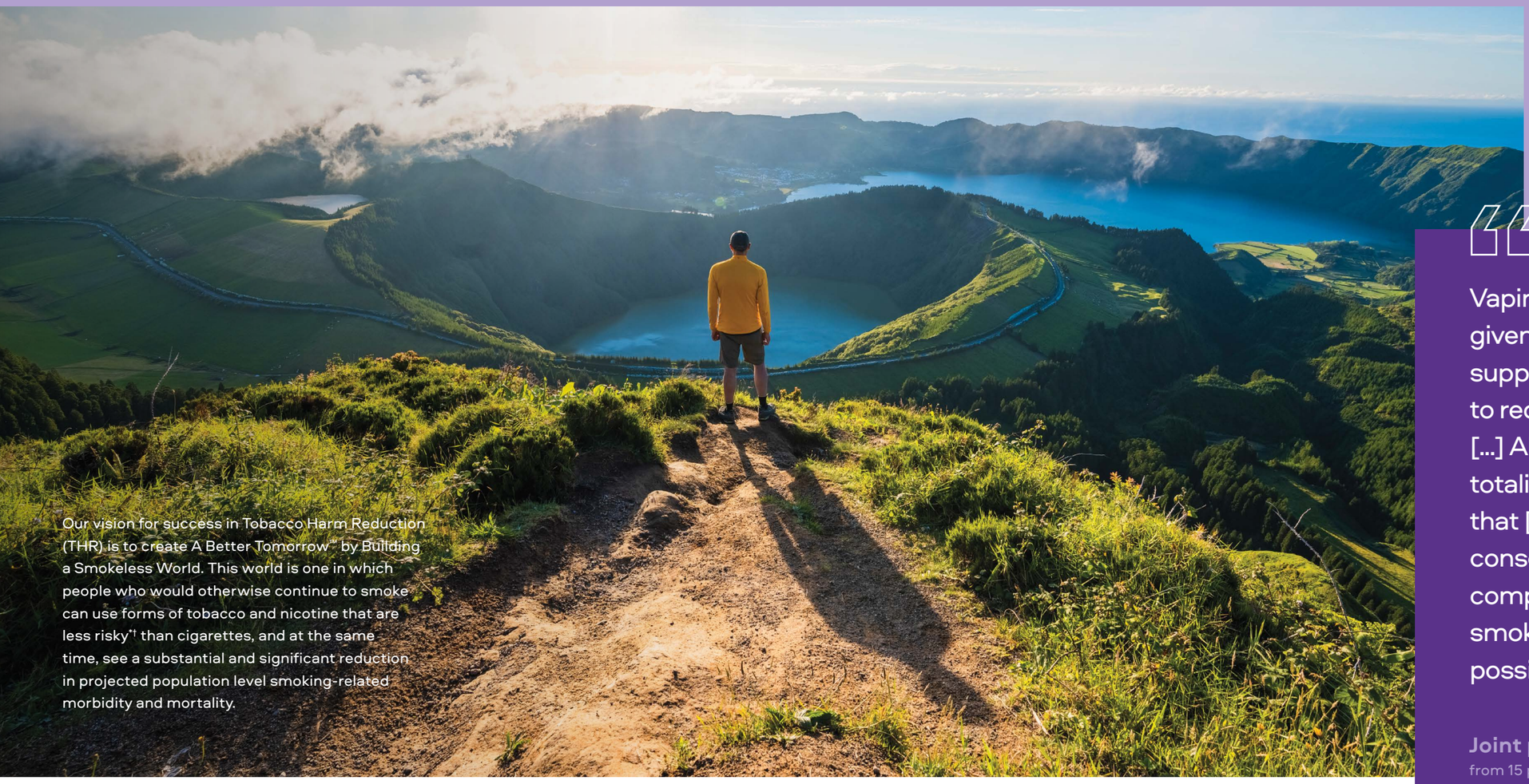
** Public Health England (PHE) was replaced in Oct 2021 by the UK Health Security Agency and Office for Health Improvement and Disparities

*** Hellenic Republic Ministry of Health General Directorate of Public Health & Life Quality Directorate of Dependencies Department B' - Other Dependencies

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Big Question 2

What are the Desired Outcomes of THR?



Our vision for success in Tobacco Harm Reduction (THR) is to create A Better Tomorrow™ by Building a Smokeless World. This world is one in which people who would otherwise continue to smoke can use forms of tobacco and nicotine that are less risky*† than cigarettes, and at the same time, see a substantial and significant reduction in projected population level smoking-related morbidity and mortality.

KEY SUMMARY POINTS

01

THR is aligned to the World Health Organization's plan and governmental public health strategies on tobacco to enable national smoking rates <5%.

02

THR is integral to these public health strategies as some adult consumers wish to continue using nicotine products.

03

Sweden is the vanguard THR country with the fewest adult smokers and lowest lung cancer deaths in Europe, driven by increased prevalence in lower risk tobacco and nicotine products use.

> Vaping can benefit public health, given substantial evidence supporting the potential of vaping to reduce smoking's [health] toll. [...] Although not the final word, the totality of the evidence indicates that [...] while the long-term health consequences are unknown, completely substituting vaping for smoking likely reduces health risks, possibly substantially.

Joint published statement
from 15 past Presidents of the Society of Research on Nicotine and Tobacco [1]

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We are aligned with the goals of governmental public health strategies on tobacco to achieve low national smoking rates. The World Health Organization (WHO) considers countries to be smoke-free when smoking prevalence is less than 5% of the population.[2]





What are our desired outcomes for THR?

We seek three main outcomes:

- Reduce the public health impact of our business through adult smokers who would otherwise continue to smoke increasingly choosing lower risk profile Smokeless Products instead of cigarettes.
- 50 million adult consumers# of Smokeless Products by 2030.
- At least 50% of our revenues in Smokeless Products by 2035, in markets where Smokeless Products are permitted.

Two sides of the discussion

THR has been the subject of a significant public discussion for the last two decades, with proponents stating its potential for a positive public health impact. Meanwhile, opponents seek the complete elimination of tobacco and nicotine from society.

In a 2020 editorial, U.S. tobacco research academics surmised that consensus could perhaps be achieved through a "strategic dialogue on harm reduction that is led by one of the governmental agencies, a scientific organisation and/or by respected scientists who are not strongly associated with one particular ideology. At this meeting, the current and evolving science, modeling that projects population health effects under different scenarios, identification of research gaps and consensus on a potential path towards a sensible and agreeable harm minimization approach can be developed. Keeping focus on how best to regulate combusted tobacco products and ANDS [Alternative Nicotine Delivery Systems] *and* allowing Tobacco Harm Reduction as a component of a comprehensive tobacco control program would be one such approach."[3]

The number of consumers of Smokeless Products is defined as the estimated number of Legal Age (minimum 18 years) consumers of the Group's Smokeless Products - which does not necessarily mean these consumers are solus consumers of these products. In markets where regular consumer tracking is in place, this estimate is obtained from adult consumer tracking studies conducted by third parties (including Kantar). In markets where regular consumer tracking is not in place, the number of consumers of Smokeless Products is derived from volume sales of consumables and devices in such markets, using consumption patterns obtained from other similar markets with adult consumer tracking (utilising studies conducted by third parties, including Kantar).

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While we do not agree with all of the views expressed by the authors, the editorial[3] summarised the discussion and a way forward as follows:

- The concern over THR is in part based on the experience with low-yield cigarettes.
- Balancing providing adult smokers with Reduced-Risk*† Products vs potentially addicting the underaged to these products.
- A future approach includes strong regulation of combusted and reduced-risk*† tobacco and nicotine products.



<5%

WHO considers countries to be smoke-free when smoking prevalence is less than 5%[2]

The future

THR is a journey toward profound potential public health benefits. As described in the opening letter from our Research & Science Director, the Swedish experience is the vanguard example of THR. If every EU country had the tobacco-related mortality rates of Sweden, 2.9 million premature deaths could have been averted between 2000-2019, according to a report by a global network of public health experts.[4] Going forward, similar improvements in tobacco-related mortality are within reach if THR policies are enacted.

We believe that our THR ambitions are bold but achievable. We currently have 23.9 million adult consumers of our Smokeless Products, and by 2030 we aspire to have 50 million#. This aspiration will require not just changes in consumer behaviour but also changes in society itself, particularly in terms of the policies of national and international regulatory and public health bodies, opening up markets that currently do not allow Smokeless Products, and general acceptance of a balanced view on THR.

If we can change the conversation around THR and Smokeless Products, we can change the future.

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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Big Question 3

What Current Progress is Being Made on Global THR?



KEY SUMMARY POINTS

01

There are one billion smokers and approximately >115 million adult consumers of Smokeless Products.[1-4]

02

Multiple regulatory and public health authorities recognise the public health potential of Tobacco Harm Reduction.

03

Population modelling postulates that if other countries had utilised THR to achieve lower smoking rates such as Sweden, the public health benefits would be profound (2.9 million tobacco-related premature deaths avoided in the EU between 2000-2019).[5]

Global progress on THR

Around the world we can see the changes that Tobacco Harm Reduction (THR) has brought. Where estimates may vary depending on source, globally, it is estimated that there are more than 115 million[1,2,3] adult consumers of Smokeless Products; however, one billion adult smokers still remain.[1] Breaking this down further, of the one billion adult smokers, nearly one third are in China.[6] In the rest of the world where we operate, which excludes China and a number of other markets, there are more than 700 million adult smokers. Our goal is to encourage those adult smokers who would otherwise continue to smoke to choose alternatives to cigarettes.

We have already discussed Sweden's forthcoming smoke-free status. Norway is set to follow suit with its smoking rate halved to 7% in the last 10 years.[7]

Across the U.S., smoking rates are at an all-time low, corresponding with increased use of Vapour Products.[8,9] Based on the most recent National Health Interview Survey from the U.S. Centers for Disease Control and Prevention (CDC), smoke-free status (defined as <5% smoking prevalence) has been essentially achieved for those aged 18-24 as smoking rates have dropped to around 5%, in part dispelling the assertion made by some public health authorities that vaping acts as a gateway to increased cigarette smoking.[8]

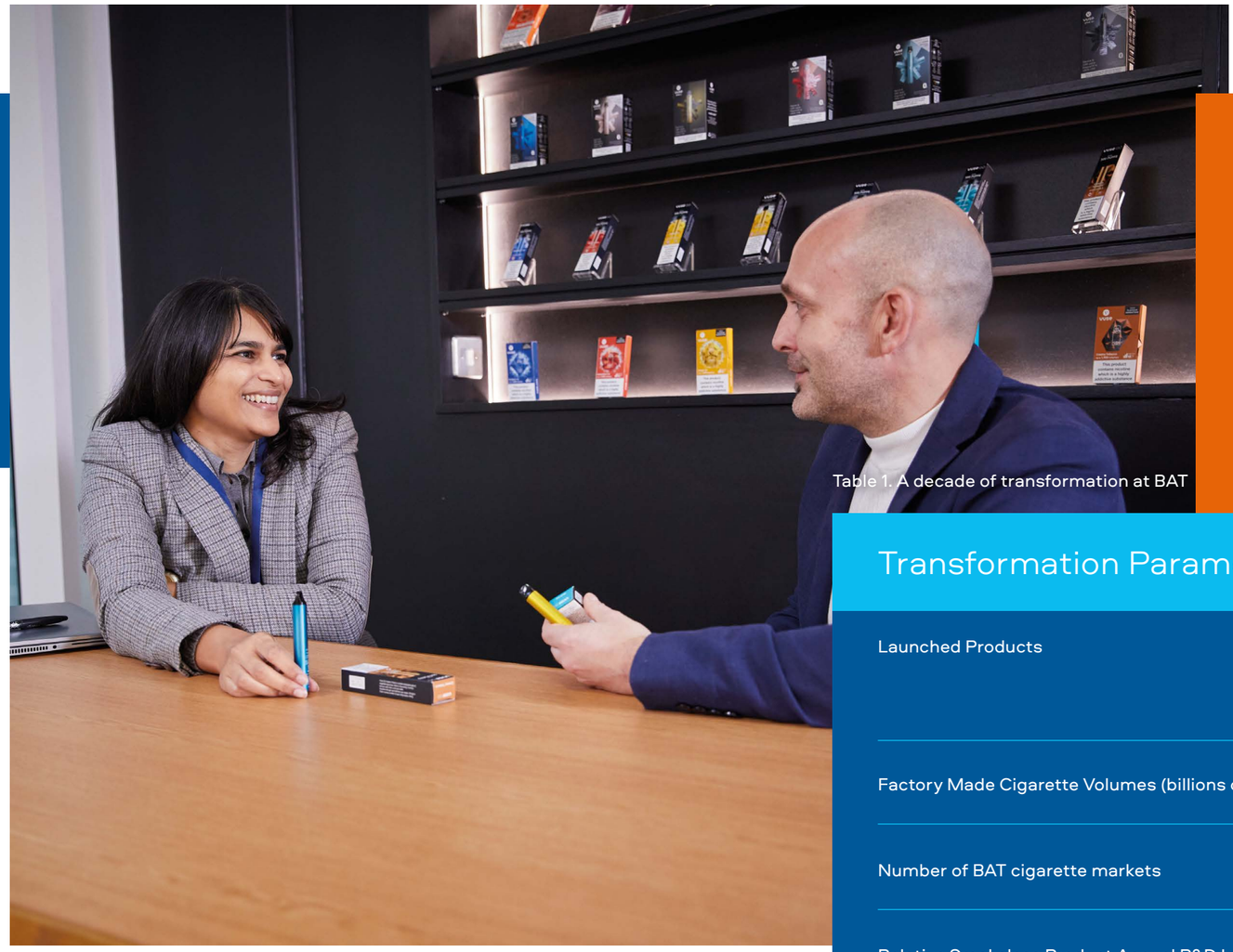
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> **Nicotine vaping is not risk-free, but it is substantially less harmful than smoking.**
>
> **UK National Health Service**
> 2023[10]

Similarly, positive changes are happening in the UK, where approximately 2.7 million former adult smokers have switched completely.[11] This follows the UK Government's explicit recognition of vaping's harm reduction potential.[10]

In Japan, smoking rates are at an all-time low, partly due to the fact that Heated Products (HPs) now account for >44% of the country's tobacco market.[12,13,14]

We have come a long way in our pursuit of THR, with significant progress being made in the last decade (Table 1).



Challenges and Opportunities

Since launching our first Vapour Products in 2013, we have undergone a transformational journey towards our goal to create A Better Tomorrow™ by Building a Smokeless World. Yet, while we have made significant progress, and in some of our markets we make 70% of our revenue from Smokeless Products, there are still some key global markets – Brazil, Mexico and Türkiye, for example – where the sale of Smokeless Products is currently prohibited.

Additionally, unintended consequences of not permitting the sale of Smokeless Products are that (i) smoking continues / increases and (ii) illicit and low quality Smokeless Products infiltrate the market. Our goal is to have deeper Smokeless Product penetration in the markets where they are permitted for sale.

>115m

Global, adult consumers of Smokeless Products[1,2,3]

Table 1. A decade of transformation at BAT

Transformation Parameter	2013	2023
Launched Products	Vuse Solo and Vype	Global multi-category portfolio
Factory Made Cigarette Volumes (billions of cigarettes)	676	570
Number of BAT cigarette markets	200	145
Relative Smokeless Product Annual R&D Investment	1x	2.5x
THR Scientific Evidence	Foundational	Comprehensive
Number of BAT Smokeless Product markets	2	82
Number of global Smokeless Product adult consumers	1000's	23.9 million
Global Smokeless Product revenues	£Ks	£3.4bn
Countries where Smokeless Product revenues >30% total BAT revenue	0	25

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Learnings to be applied globally

Displacing traditional cigarettes with Smokeless Products requires a multi-faceted approach that addresses aspects of the market, public perception, regulation, and consumer behaviour. Significant progress on these factors would accelerate Global THR (Figure 1), which could translate into a substantial and significant global public health benefit.

Figure 1. Accelerating progress in global THR

BAT Led

Stakeholder Led

Affordability and Accessibility

Appropriate pricing is of critical importance to encourage adult smokers who would otherwise continue to smoke to switch.

Accessibility for adult smokers is possible through various retail channels.

Product Innovation

A diverse range of Smokeless Products that can cater to different consumer preferences.

Ongoing innovation is key to BAT's improved product quality, flavours and technology, making them more appealing to adult smokers.

Marketing Principles

BAT markets to adult tobacco and nicotine consumers only, encouraging the switch to Smokeless Products.

Marketing that targets underage populations should not be permitted.

Scientific THR Evidence

Comprehensive studies evaluating the impact of Smokeless Products on public health, tobacco consumption patterns, and smoking-related diseases is crucial.

Evidence accessible to policy makers and public health experts.

Smokeless Product Misperception

Public perception of the risk profile of Smokeless Products plays a significant role in their adoption.

Science based education campaigns would give accurate information on the reduced-risk*† potential of Smokeless Products.

Post-Market Monitoring and Enforcement

Post-market surveillance would identify potential safety or non-compliance product issues.

Multi-Stakeholder Collaboration

Stakeholder collaboration is vital to develop coherent regulatory strategies and communications on THR, the risk profile of Smokeless Products and the benefit of quitting or switching to Smokeless Products.

Regulatory Environment

Development of regulations that differentiate Smokeless Products from cigarettes making them accessible to adult consumers, while ensuring they meet safety and quality standards, is critical for the realisation of the benefits of THR.

Public Health Support of THR

The science of THR should be made available for public health stakeholders including doctors, pharmacists and public health practitioners, to help inform them of the potential public health benefits, which can then be communicated to adult smokers.

Nicotine Misperception

Public misperception of the risk profile of nicotine plays a significant role in relation to THR.

Science-based education campaigns would give accurate information on the true risk profile of nicotine.

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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Big Question 4

Why is THR Important to BAT?



KEY SUMMARY POINTS

01 There are approximately 115 million adult consumers of Smokeless Products, with Vapour Products the biggest contributor.[1,2,3]

02 In 25 of our global markets we have >30% of our business in Smokeless Products.

03 Heated Products, Vapour Products, Oral Tobacco Products, and Oral Nicotine Pouches can deliver our commercially sustainable future.

> The tobacco and nicotine industry has undergone a seismic shift in recent years. Increasing numbers of adult smokers are migrating to Smokeless Products like Vapour Products, Heated Products, and Oral Nicotine Pouches. With an increasing amount of scientific research behind these products, they represent an opportunity for Tobacco Harm Reduction on a global scale.
>
> **Kingsley Wheaton**
> Chief Strategy & Growth Officer

THR is not only beneficial for public health, but a business opportunity for BAT. We aim to avoid mistakes of the type that led to the restructuring of Kodak, which once dominated the world market for consumer film and film processing. Kodak failed to appreciate that digital imaging would make film obsolete and did not evolve its business and product line accordingly.

"The downfall of such a titan was not just a business failure; it was emblematic of the perils that await companies that rest on their laurels. In the modern business landscape, where adaptability is king and innovation its queen, Kodak's story serves as a stark reminder. It underscores the significance of staying ahead of the curve, of recognising emerging trends, and of the dire consequences that can befall those who become complacent."[4]

Innovation drives the human race forward, whether it be to climb the highest mountains, descend to the depths of our oceans, travel to the moon, or split the atom. While books have been published and degree courses offered on innovation, it typically boils down to three core principles:

- Value: solving a problem or an unmet need generating a benefit or return
- Novelty: creation of something bespoke and new to the world
- Process: a continuous activity that takes incremental steps or exponential leaps

For a company founded in 1902, BAT could not have imagined the disruption that would occur in the tobacco industry in the early 2010s, with the advent of Smokeless Products, and we did not want to have our own 'Kodak moment'.

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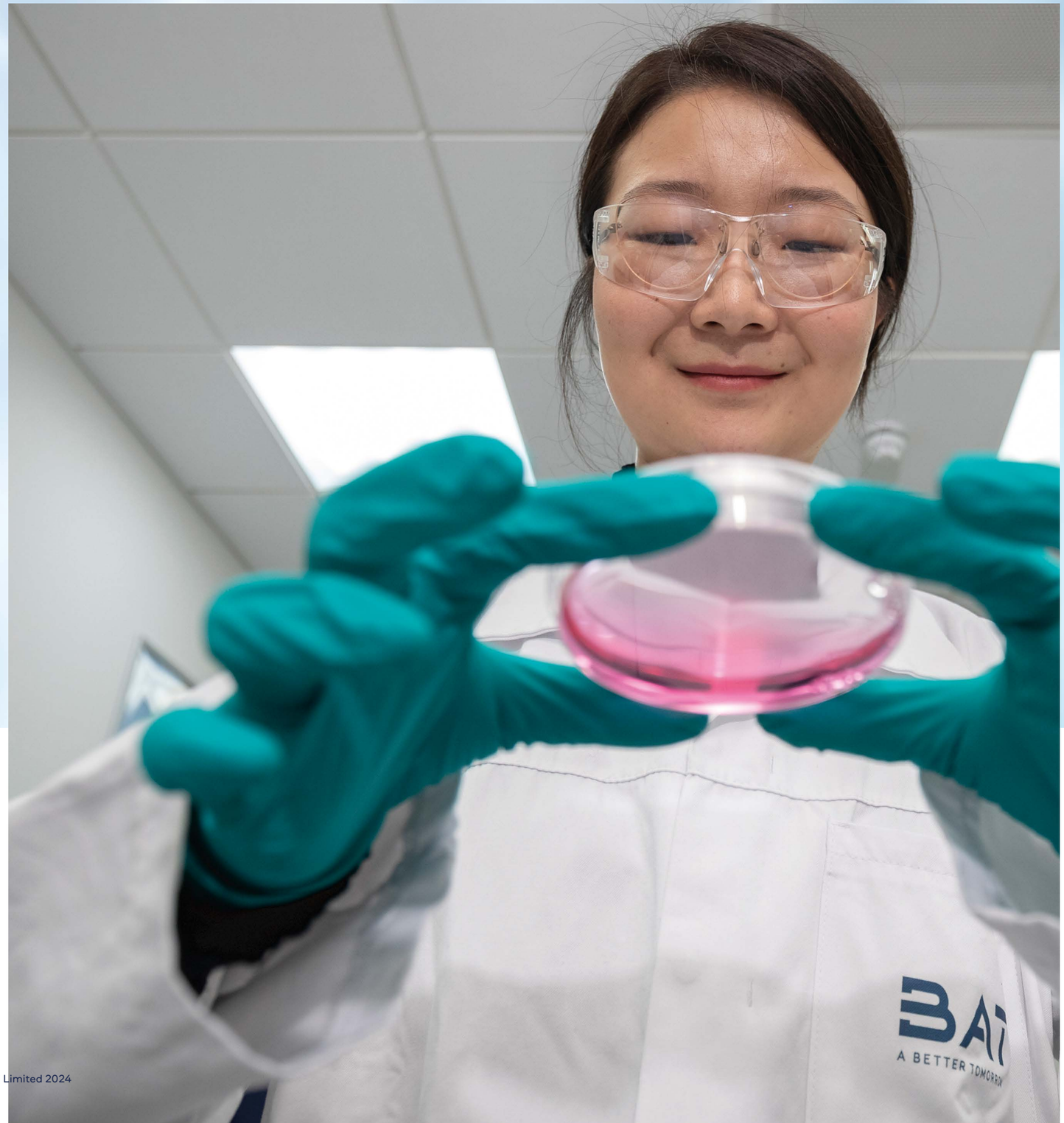
A 'win win win' scenario

Since the seminal publication of the UK British Doctors' Study on smoking and health in the 1950s identified major health risks of smoking,[5] we have conducted extensive research into the issues related to smoking and health, and developed technologies that could reduce the levels of harmful chemicals in cigarette smoke, in essence to develop a 'safer cigarette' and reduce the public health burden of smoking. We spent more than 40 years pursuing multiple avenues of research, including conducting R&D activities into developing and scientifically assessing a Reduced Toxicant Prototype (RTP) cigarette.

In our view an ideal business would:

- Offer reduced-risk*† and enjoyable tobacco and nicotine products to reduce the public health impact of smoking;
- Offer reduced-risk*† and enjoyable tobacco and nicotine products that adult smokers, who would otherwise continue to smoke, would choose to use; and
- Create a sustainable business based on lower risk, consumer relevant, commercially relevant products.

While this undertaking proved to be unachievable with respect to cigarettes, a 'win win win' scenario arrived with the advent of Vapour Products in the early 2010s, and a new chapter began for BAT.



THR: enabling the transformation of BAT

As stated in the Research & Science Director's opening statement, our belief is that there are three dimensions that are enabling the transformation of BAT through THR:

- Smokeless Products are increasingly being accepted as scientifically substantiated lower risk*† relative to cigarettes.
- Today we have 23.9 million adult consumers of our Smokeless Products.
- Smokeless Products can ultimately create sustainable value for our shareholders.

Three commercial misconceptions about Smokeless Products:

- The number of consumers of Smokeless Products has stalled.
- Smokeless Products are not commercially sustainable.
- Smokeless Products make up a fraction of tobacco companies' business.

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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The number of consumers of Smokeless Products is increasing

We decided on a multi-category approach to Smokeless Products as adult consumers' preferences vary across the globe, and no single product category would be sufficient to transition adult smokers who would otherwise continue to smoke. Where estimates vary depending on source, year on year. We have observed growth in each category (Figure 1) as more and more adult smokers transition, with Vapour Products being the largest category globally, followed by Heated Products and then Oral Nicotine Pouches.

Smokeless Products offer commercial sustainability

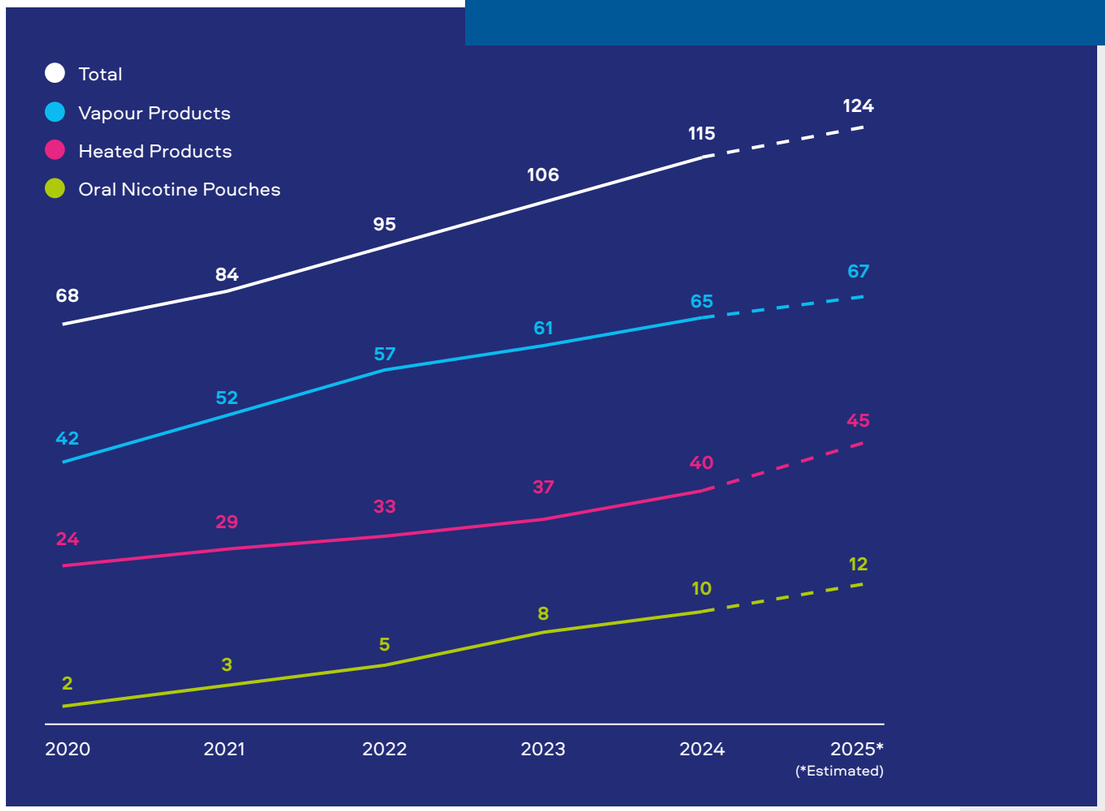
We are now in our second decade of our Smokeless Products business. In 2023, we exited with £3.35bn revenues from our Smokeless Products business and became profitable two years ahead of guidance.

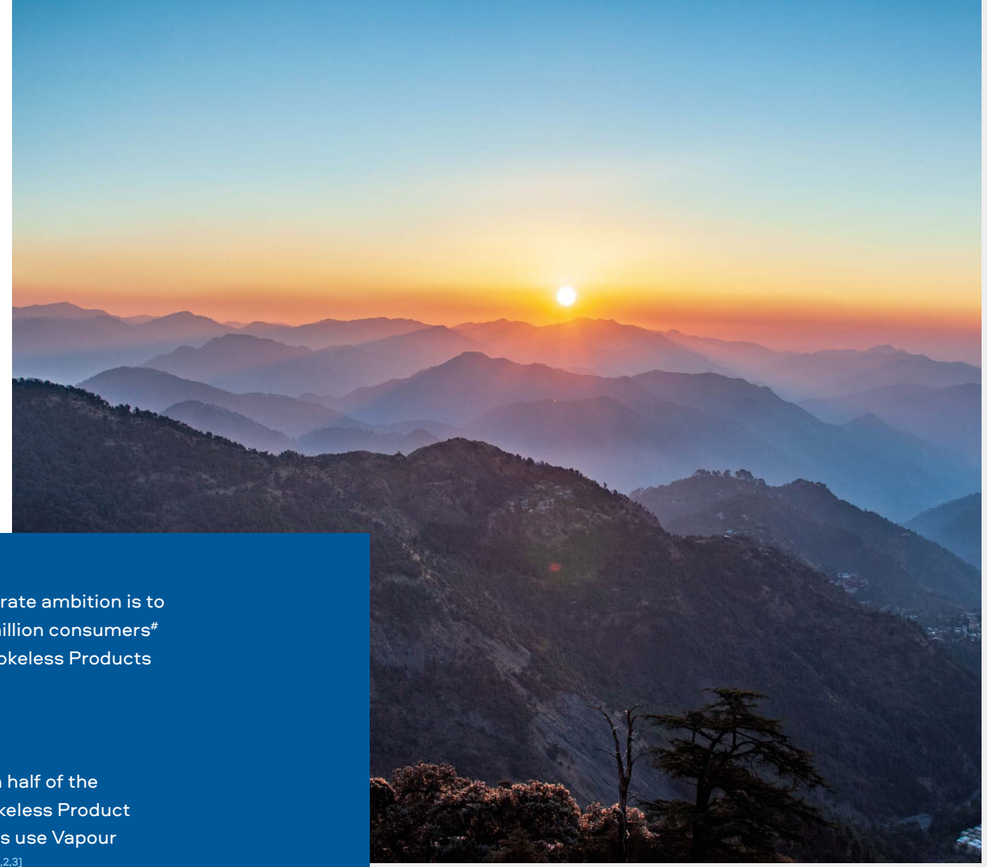
While this is an important milestone, it tells only half the story as we have several markets around the world which are advancing extremely well on their profitability journey.

50m Our corporate ambition is to have 50 million consumers# of our Smokeless Products by 2030

>55% More than half of the total Smokeless Product consumers use Vapour Products[1,2,3]

Figure 1. Longitudinal growth of Smokeless Products (Total Adult Consumers, millions)[1,2,3]





Smokeless Products make up an increasing share of our business

Aligned to our corporate ambition of having at least 50% of our revenues in Smokeless Products by 2035 we have 25 markets which are on their way to meeting this target (Figure 2).

While 45 out of 72 key markets allow the sale of our full portfolio of Smokeless Products (Heated Products, Vapour Products, and Oral Nicotine Pouches), we believe there are two significant impediments to accelerating Tobacco Harm Reduction (THR) on a global scale:

- 38% of markets restrict one or more Smokeless Products.
- More importantly, there are still markets where consumers cannot access any reduced-risk alternatives (e.g., Brazil).

We will continue working with governmental regulators and stakeholders to enable the opening of these categories and markets. Open markets with regulatory compliance and enforcement of non-compliant products and manufacturers are key to creating A Better Tomorrow™ by Building a Smokeless World.

Figure 2. Global BAT markets which have Smokeless Product revenues^ greater than 30%

>30%
- South Korea
- Latvia
- Slovenia
- Ireland
- Portugal
- Denmark
- Channel Islands

>40%
- Japan
- Kazakhstan
- Czech Republic
- Italy
- Guadeloupe

>50%
- Poland
- Estonia
- Lithuania
- Austria
- UK
- Greece
- Norway
- Dominican Republic

>70%
- UAE
- Slovakia
- Finland
- Sweden
- Iceland

^Revenue from Smokeless Products as a % of total revenue in each respective market as per 2024 Half-Year Results

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

The number of consumers of Smokeless Products is defined as the estimated number of Legal Age (minimum 18 years) consumers of the Group's Smokeless Products - which does not necessarily mean these consumers are solus consumers of these products. In markets where regular consumer tracking is in place, this estimate is obtained from adult consumer tracking studies conducted by third parties (including Kantar). In markets where regular consumer tracking is not in place, the number of consumers of Smokeless Products is derived from volume sales of consumables and devices in such markets, using consumption patterns obtained from other similar markets with adult consumer tracking (utilising studies conducted by third parties, including Kantar).

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Big Question 5

What is BAT Doing to Address Underage Access to Tobacco and Nicotine Products?

KEY SUMMARY POINTS

01

No one underage should use tobacco or nicotine products.

02

Tobacco and nicotine products are for adults only and our marketing is targeted to adult tobacco and nicotine consumers only.

03

Technology and innovation can play a role at retail or on product to further prevent underage access and usage.



> Vaping is not for children and young people.
>
> **UK NHS**
> Young people and vaping[1]

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We do not want anyone underage ever to use any of our tobacco or nicotine products.

A fundamental tenet of our efforts to Build a Smokeless World by advancing Tobacco Harm Reduction (THR) is identifying and supporting solutions that address underage access to tobacco and nicotine products.

While underage access to tobacco and nicotine products is a multi-stakeholder issue, BAT remains committed to preventing the underaged from accessing our products, including through appropriate retail controls, collaborating with business partners and responsible marketing.

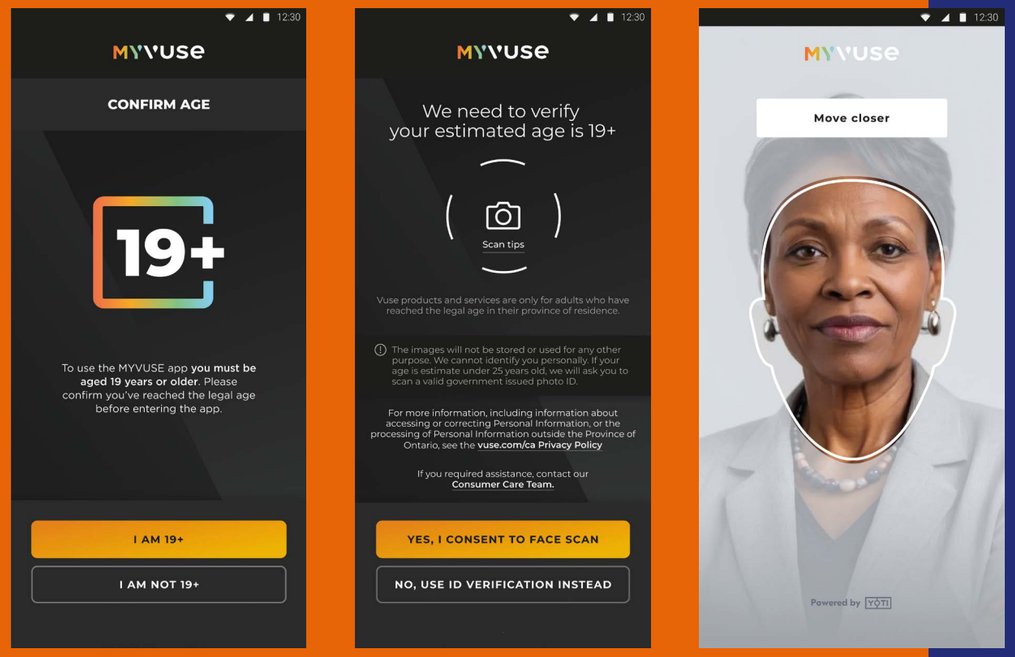
Legislative and Other Initiatives

The first laws establishing a minimum age of legal access to tobacco products began to appear across the U.S. in the 1880s,[2] and in the UK in 1908.[3] As decades passed, these age restrictions evolved in parallel with the wider landscape of tobacco-related science, information, and policy – arriving at the contemporary national minimums of 21 (U.S.) and 18 (UK) years old.

Alongside these legislative controls are various non-legislative initiatives that employ educational resources, advertising campaigns, and retailer programmes to discourage tobacco usage – often focusing on underage usage in particular.

We fully support laws and regulations that prohibit the sale of tobacco and nicotine products to anyone under the legal minimum age and the adoption of a minimum legal age of 18 when none exists. We also believe that enforcement and penalties for breaking such laws must be sufficient to discourage anyone from selling to people who are underage.

Figure 1. Age verification features of our 'MyVuse' app (currently available in Canada) will vary per country depending on local requirements



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> Examples of potential safeguards [...]: Using age-verification technology to better restrict access to the manufacturer's website, such as through independent, third-party age- and identity-verification services that compare customer information against third-party data sources...

FDA
Enforcement Priorities for Electronic Nicotine Delivery Systems (ENDS) and Other Deemed Products on the Market Without Premarket Authorization (Revised), 2020[4]

Responsible Marketing

Responsible marketing is central to our values and crucial to our vision of Building a Smokeless World. At BAT, we follow strict Responsible Marketing Principles (RMP).[5] The foundation of our Responsible Marketing Principles is that our marketing must be responsible, accurate and targeted to adult consumers.

In coordination with the RMP, our markets also are expected to adhere to our Responsible Marketing Code (RMC),[6] a set of standards to which we hold ourselves accountable, and which guide our decision-making process. These guidelines include various provisions addressing underage access. We will uphold the same high standards in every market in which we operate, even when they are stricter than applicable local laws.

Among other requirements, any material advertising or promoting our products must:

- Be targeted to adult consumers, which BAT defines as adult tobacco and nicotine users
- Feature only adults
- Only appear in publications or on digital channels for which the audience is predominantly adult
- Not appear in close proximity to areas primarily occupied by the underaged

The RMC applies to our tobacco and nicotine products and brands and covers all elements of marketing from product design through sales. Our RMP and RMC are also underpinned by detailed guidelines and toolkits to help ensure they are applied consistently.[5,6] We maintain a robust material review and approval process to ensure that labelling, advertising, marketing, and promotional materials conform to these standards. In addition, employees are trained on the importance of our commitment to effective underage access prevention (UAP).



Retail Controls

BAT has in place UAP and age verification programmes to help prevent our products from being accessed by or sold to the underaged, whether through BAT or any third-party business entity with whom we have a customer relationship.

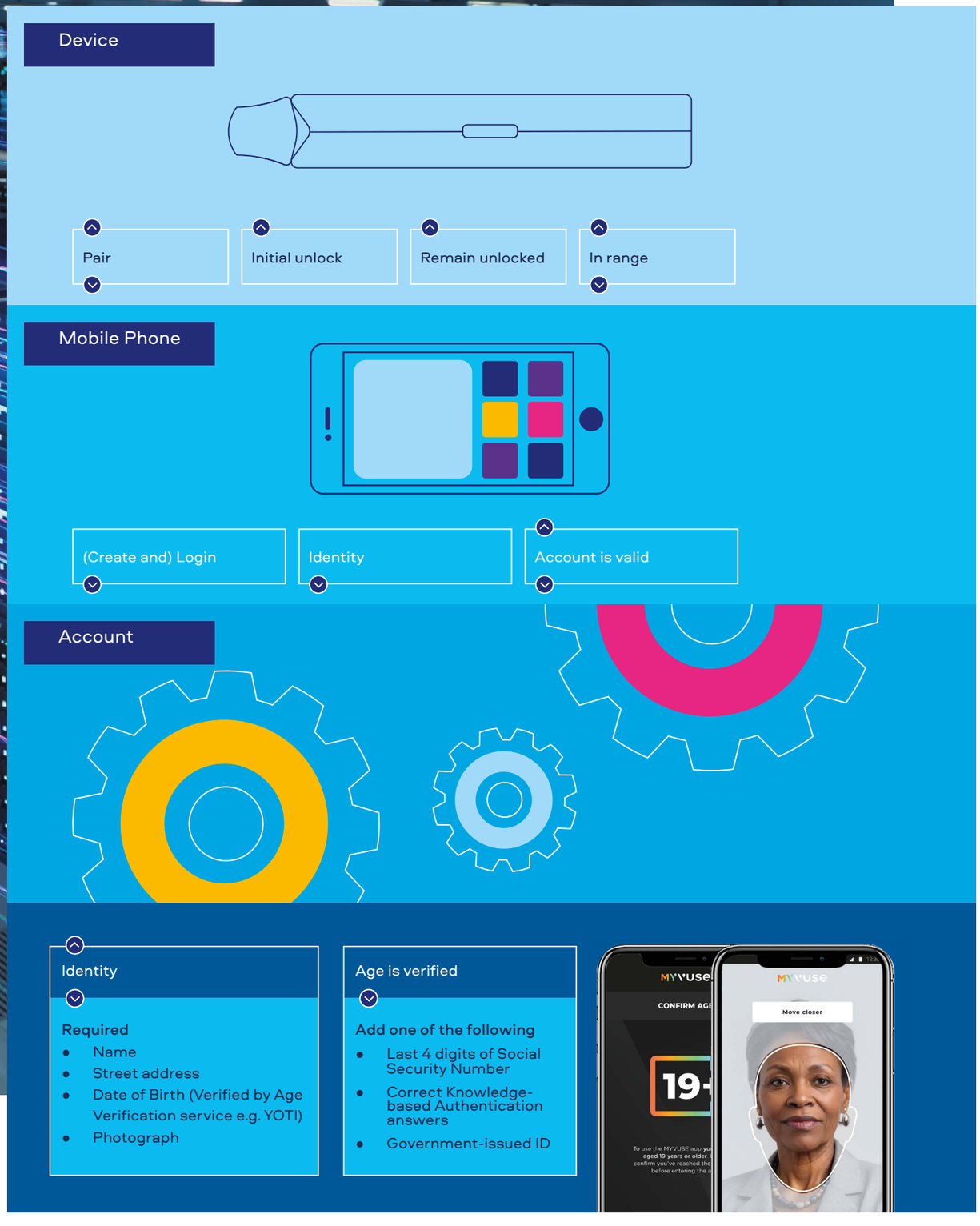
In the U.S., we were founding sponsors of the *We Card*™ programme, a national non-profit organisation which for nearly 30 years has provided education, training and point-of-sale resources to help retailers comply with federal and state laws while limiting underage access to age-restricted products.[7] We recently partnered with the National Association of Convenience Stores and Conexxus, an organisation focused on the development of standards and innovative technologies for retailers, to support access to and use of TruAge™, a new digital solution that enhances current age-verification systems while protecting consumer privacy.[8] This age-verification programme is free to retailers to assist them in compliance with our contractual age verification requirements to restrict underage access to our products at the point of sale.

Future point-of-sale solutions may include retail licensing and facial recognition technologies. We will continue to work collaboratively with our partners to evaluate practical and technological solutions to limit underage access to tobacco and nicotine products.

> **A register of tobacco and nicotine retailers should be established along with requiring age verification and meaningful sanctions for breaching the law, with the aim of limiting access to young people.**
>
> **Royal College of Physicians**
> 'E-cigarettes and harm reduction: An evidence review', a response to the government's consultation on creating a smokefree generation and tackling underage vaping, 2024[9]

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Age-Protected Device: Verification Process



Technological Solutions

We believe that a number of technologies have strong potential to address underage access and usage, particularly on-device technology and functionality.

The U.S. Food and Drug Administration (FDA) has acknowledged these technology-enabled opportunities, stating that device access restrictions would be considered among the 'mitigation efforts that aim to reduce the risk of underage initiation and tobacco use.'[4] In the language surrounding these comments, it is clear that the FDA has been contemplating control strategies related to both age and identity.

From a technology-selection standpoint, contemporary consumer electronics already demonstrate various means to confirm identity, i.e. via biometrics. An additional set of challenges appears when considering an approach that would first verify age and then sustain control via identity. As yet, an onboard (i.e. self-contained in the product), economical, and robust technological solution has not been identified. So a product must instead contain provisions to communicate with equipment or processes outside of itself.

Our current vision for 'Sustained Control' Underage Access Prevention (UAP) – as applied to an electronic Smokeless Product platform – will create a connected ecosystem across the regulated product (specifically, the device or power unit); the adult consumer's phone (or tablet, etc.), and their age-verified account.

Five key points serve as the foundation for this ecosystem

01 The device can be unlocked only by using the application (i.e. phone app)

02 The application can be utilised only with a valid account (i.e. Vuse web account)

03 The account is valid only when the Age Verification process is completed successfully

04 The device contains 'auto-lock functionality' for sustained control (vs a one-time unlock)

05 Pods intended for the subject device are incompatible with legacy, non-age-verified devices

Recognising that, compared to current products, such an ecosystem requires additional interaction from a consumer, practical implementations must seek a balance that maximises the burden of sustained-use among unauthorised persons while minimising the incremental burden for age-verified Adult Vapour Consumers (AVCs).

The time-and-proximity-based 'AutoLock' functionality is the cornerstone of this balance. AutoLock is intended to be invisible for the authorised consumer after initial setup (age verification), because it enables the product to remain unlocked if it regularly comes into range of the AVC's phone (identity proxy).

Were an unauthorised person to take possession of the product, the connected ecosystem creates difficulty in keeping the product from locking automatically, disrupting sustained use. Further, this ecosystem's constant reliance on the AVC's phone and credentials creates substantial transferability hurdles that do not exist in contemporary marketed products.

In conclusion, this example of a technology-led ecosystem demonstrates how product innovation can be employed to supplement existing controls (i.e. point-of-sale) and meaningfully advance UAP downstream of sale, without also applying an objectionable burden to AVCs.

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Big Question 6

What is the Risk of Using Smokeless Products Compared to Smoking?

> I'm fully aware of the misperceptions that are out there and aren't consistent with the known science. We do know that e-cigarettes – as a general class – have markedly less risk than a combustible cigarette.

Dr Brian King
Director, Center for Tobacco Products, FDA[1]

KEY SUMMARY POINTS

01

Scientific evidence confirms that Smokeless Products emit fewer and lower levels of harmful chemicals than cigarettes.

02

Fewer and lower levels of harmful chemicals in Smokeless Product emissions means lower levels of exposure for consumers, compared to smoking.

03

While Smokeless Products have a lower risk profile than smoking, they are not risk free.

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The Omni™ summarises the public health impact of smoking in Chapter 3, and the scientific evidence behind our Smokeless Products in Chapter 4.

In terms of epidemiology (the study and analysis of the distribution, patterns and determinants of health and disease conditions in a defined population), we know that when people smoke cigarettes, their risk of smoking-related diseases increases. While quitting is beneficial at any age, people who quit smoking by age 40 will largely see their relative risks of smoking-related disease return to those of 'never smokers'.[2]
We also know that while oral smokeless tobacco products are not risk free, people who use them have a disease risk level substantially lower than that of adult smokers.

A continuum of risk

Scientific research has demonstrated that Smokeless Products produce fewer and lower levels of harmful chemicals, compared to cigarettes, and expose Smokeless Product consumers to lower levels of harmful chemicals, compared to smoking. We have built a 'weight of evidence' for each category - Heated Products, Oral Nicotine Pouches, Oral Tobacco Products and Vapour Products - based on the scientific assessment of emissions (what comes out of the product), exposure (what consumers take in) and potential comparative health risks at both an individual and population level.

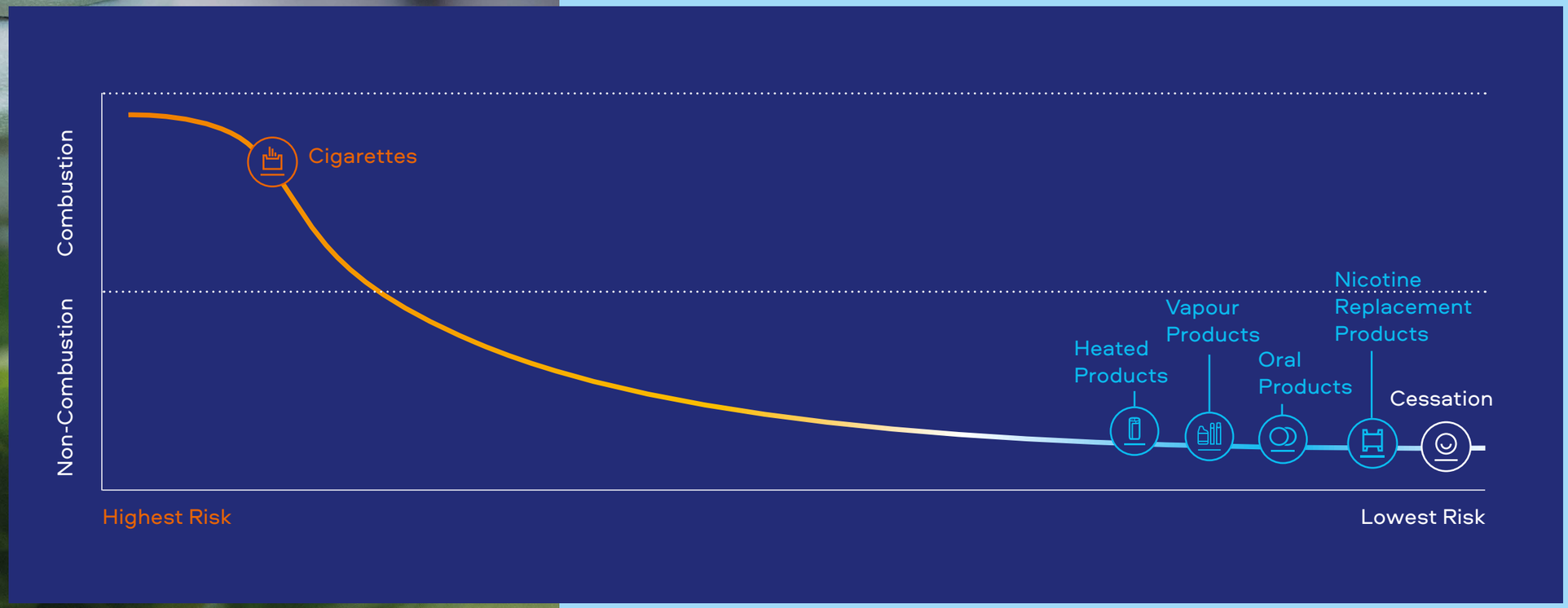
A seminal study was conducted by Professor David Nutt using an international expert panel convened by the Independent Scientific Committee on Drugs that developed a multi-criteria decision analysis model of the relative importance of different types of harm related to the use of nicotine-containing products.[3]

Different types of tobacco and nicotine products were then placed on a continuum of risk relative to cigarettes (the most risky form of tobacco use) and cessation (the measure that most effectively avoids harm from tobacco or nicotine use), Figure 1. The U.S. FDA has similarly recognised such a continuum of risk, noting the importance of making the public aware that: "The available scientific evidence indicates that tobacco products exist on a continuum of risk, with cigarettes being the most harmful."[4]

The future

As the relevant science evolves, new clinical and population assessment methodologies will further advance our knowledge, to give us even deeper insights into the impact of Smokeless Products on disease-relevant harm reduction.

Figure 1. A model continuum of risk of tobacco and nicotine products



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THR Evidence: Global Perspectives

Stakeholders including regulators, public health and academic researchers have published studies and opinion pieces on Tobacco Harm Reduction (THR). This summary provides a snapshot into global 3rd party scientists' views on THR.



Canada

Government of Canada

Centre for Addiction and Mental Health

Canadian Cancer Society

United Kingdom

Public Health England / Office for Health Improvement and Disparities in the Department of Health and Social Care

UK Action on Smoking and Health

UK National Health Service

UK Committee on Toxicology

Cochrane

Royal College of Physicians

National Institute for Health and Care Excellence (NICE)

U.S.

U.S. Food and Drug Administration

U.S. Centers for Disease Control and Prevention

U.S. National Academy of Science, Engineering and Medicine

Europe

Dutch National Institute for Public Health and the Environment (RIVM)

German Federal Institute for Risk Assessment

Académie Nationale de Médecine, France

Superior Health Council of Belgium

National Institute of Cancer, France

Hellenic Republic Ministry of Health General Directorate of Public Health & Life Quality Directorate of Dependencies Department B' - Other Dependencies

Asia Pacific

The Royal Australian College of General Practitioners

Royal Australian and New Zealand College of Psychiatrists

Department of Epidemiology and Prevention, National Center for Global Health and Medicine, Japan

New Zealand Ministry of Health

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Table 1. Summary of evidence supporting the reduced risk profile of Smokeless Products relative to smoking

2014

Australia

The Royal Australian College of General Practitioners

"[I]f used as a substitute rather than an addition, e-cigarettes are much less harmful than continuing to smoke."[5]

2015

UK

Public Health England

"In a nutshell, best estimates show e-cigarettes are 95% less harmful to your health than normal cigarettes..."[6]

Netherlands

National Institute for Public Health and the Environment (RIVM)

"It may be concluded that the health risks associated with smoking conventional cigarettes are considerably higher than those associated with using e-cigarettes, based on the findings described in RIVM report 2014-143 (Visser W 2015) (subsections 10.3.2.1 and 10.3.2.2). That conclusion assumes comparable usage patterns (a similar number of inhalations over a comparable period). The health risks are strongly dependent on individual vaping and smoking habits. Nevertheless, daily use of e-cigarettes is not without health risks."[7]

2016

U.S.

U.S. Academia

"Although it is difficult to estimate the precise difference in harmful exposure of vaping compared to smoking, experts have concluded that Electronic Nicotine Delivery Systems (ENDS) are substantially less harmful than cigarettes and toxicant exposures are derived both from far fewer chemicals and at much lower levels or trace levels, estimated to be one fourth to one ninety-fifth those of cigarette smoke."[8]

2017

UK

Royal College of Physicians

"Although it is not possible to quantify the long-term health risks associated with e-cigarettes precisely, the available data suggest that they are unlikely to exceed 5% of those associated with smoked tobacco products, and may well be substantially lower than this figure."[9]

The Committee on Toxicity

"The exposure to compounds of concern in using heat-not-burn tobacco products is reduced compared to that from conventional cigarette smoke. It is likely that there is a reduction in overall risk to health for conventional smokers who switch to heat-not-burn tobacco products."[10]

New Zealand

New Zealand Academia

"This study leads to two conclusions: that the use of ECs [electronic cigarettes] presents a lower risk to health than the use of CCs [conventional cigarettes], and that ECs are likely to be of low health risk to the user."[11]

2018

UK

Public Health England

"Vaping poses only a small fraction of the risks of smoking and switching completely from smoking to vaping conveys substantial health benefits over continued smoking. Based on current knowledge, stating that vaping is at least 95% less harmful than smoking remains a good way to communicate the large difference in relative risk unambiguously so that more smokers are encouraged to make the switch from smoking to vaping. It should be noted that this does not mean e-cigarettes are safe."[12]

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2018 continued

UK

Public Health England

"Compared with cigarette smoke, heated tobacco products are likely to expose users and bystanders to lower levels of particulate matter and harmful and potentially harmful compounds. The extent of the reduction found varies between studies."[12]

"The available evidence suggests that heated tobacco products may be considerably less harmful than tobacco cigarettes and more harmful than e-cigarettes."[12]

U.S.

National Academy of Science, Engineering and Medicine

"In other circumstances, namely regular combustible tobacco cigarette smokers [...] e-cigarettes may represent an opportunity to reduce smoking-related illness. For these reasons, e-cigarette regulation that merely considers whether to be restrictive or permissive to the marketing, manufacture, and sales of all e-cigarettes for all populations is unlikely to maximize benefits and minimize the risks."[13]

Germany

German Federal Institute for Risk Assessment (BfR)

"Our study confirms that levels of major carcinogens are markedly reduced in the emissions of the analysed HNB [heat-not-burn] product in relation to conventional tobacco cigarettes and that monitoring these emissions using standardized machine smoking procedures generates reliable and reproducible data which provide a useful basis to assess exposure and human health risks."[14]

Italy

Italian Academia

"In relation to the wider implications of this study, it is our opinion that non-combustible nicotine sources - that are significantly less harmful than conventional cigarettes - can be a viable solution for those who, for whatever reason, cannot or do not want to give up nicotine..."[15]

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2019

UK

UK Academia

"HnB [heat-not-burn] exposed users and bystanders to toxicants, although at substantially lower levels than cigarettes."[16]

France

Académie Nationale de Médecine

"Il est établi que la vaporette est moins dangereuse que la cigarette: Comme l'a indiqué l'Académie nationale de médecine dès 2015, il est donc préférable pour un fumeur de vapoter."[17]

Translation: It is established that vaping is less dangerous than cigarettes: as indicated by the National Academy of Medicine in 2015, it is therefore preferable for a smoker to vape.

U.S.

U.S. Food and Drug Administration

"Following a rigorous science-based review through the premarket tobacco product application (PMTA) pathway, the agency determined that authorizing these products for the U.S. market is appropriate for the protection of the public health because, among several key considerations, the products produce fewer or lower levels of some toxins than combustible cigarettes. The products authorized for sale include the IQOS device, Marlboro Heatsticks, Marlboro Smooth Menthol Heatsticks and Marlboro Fresh Menthol Heatsticks"[18]

2020

UK

Public Health England

"Vaping regulated nicotine products has a small fraction of the risks of smoking, but this does not mean it is safe."[19]

The Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment

"The use of E(N)NDS products, produced according to appropriate manufacturing standards and used as recommended, as a replacement for CC smoking, is likely to be associated with a reduction in overall risk of adverse health effects, although the magnitude of the decrease will depend on the effect in question."[20]

Belgium

The Superior Health Council of Belgium (SHC)

"The use of heated tobacco products could contribute to reducing health risks to the extent that the absence of combustion is accompanied by an overall reduction in harmful and potentially harmful constituents in inhaled aerosols compared to those emitted by conventional cigarettes and other combustion-based tobacco products."[21]

Netherlands

Dutch National Institute for Public Health and the Environment (RIVM)

"Overall, the conclusion seems to be warranted that consuming HTPs [heated tobacco products] instead of cigarettes will be associated with a substantial increase in life expectancy, for the subgroup of smokers who would die from cancer."

"...we found that the [change in cumulative exposure (CCE)] most likely amounts to a factor between 10 and 25 when comparing a leading variant of HTPs with cigarettes, and that even the lower bound of this uncertainty range would be associated with a substantial health impact in favour of HTP. Obviously, the health impact will be greatest for habitual smokers when they switch to HTP at a young age."[22]

U.S.

U.S. Food and Drug Administration

"Data submitted by the company shows that marketing [IQOS] with the authorised information could help addicted adult smokers transition away from combusted cigarettes and reduce their exposure to harmful chemicals, but only if they completely switch."[23]

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Canada

Government of Canada

"To estimate the potential adverse health effects [from vaping], the model assumes that the mortality and morbidity risks associated with vaping are 20% of the mortality and morbidity impacts of cigarette use. This assumption was developed in consultation with members of an expert panel composed of five academics in tobacco control that were previously consulted on exploratory work related to a nicotine standard."[24]

Germany

German Federal Institute for Risk Assessment (BfR)

"According to current knowledge, the vapour of e-cigarettes contains significantly smaller amounts of carcinogenic or other harmful substances compared to the smoke of tobacco cigarettes. This applies to the intended use. However, vaping can be associated with health risks."[25]

2021

UK

Action on Smoking and Health

"Vaping an e-cigarette is much less harmful than smoking a tobacco cigarette because tobacco smoke is not inhaled. Most of the toxins in tobacco smoke are not found in the vapour of e-cigarettes and those that are present are at much lower levels – mostly below 1%."

"E-cigarettes are not completely safe. But compared to tobacco products, they are clearly the safer choice. For example, the lifetime cancer risk of vaping has been assessed to be under 0.5% of the risk of smoking."[26]

National Institute for Health and Care Excellence (NICE)

"[A]ny smoking is harmful, so people using e-cigarettes should stop smoking tobacco completely."

"There is not enough evidence to know whether there are long-term harms from e-cigarette use"[27]

Spain

Spanish Academia

"[B]ased on the studies carried out so far, it seems that e-cigarette consumption is less toxic than tobacco smoking. This does not necessarily mean, however, that e-cigarettes are free from hazardous effects. Indeed, studies investigating their long-term effects on human health are urgently required."[28]

Netherlands

Dutch National Institute for Public Health and the Environment (RIVM)

"Er zijn geen aanwijzingen dat nicotine mutagene of kankerverwekkende eigenschappen heeft."

Translation: There is no evidence that nicotine has mutagenic or carcinogenic properties.

"Voor gebruikers van tabaksproducten zijn nicotinezakjes waarschijnlijk een minder schadelijk alternatief,"[29]

Translation: For users of tobacco products, nicotine pouches are probably a less harmful alternative.

2021 continued

U.S.

U.S. Food and Drug Administration

"These [Vuse] products were found to meet this standard because, among several key considerations, the agency determined that study participants who used only the authorised products were exposed to fewer harmful and potentially harmful constituents (HPHCs) from aerosols compared to users of combusted cigarettes"[30]

U.S. Academia

"While ENDS [electronic nicotine delivery systems] are not harmless, they are most likely much less harmful than cigarette smoking. If smokers used ENDS to quit smoking, even if they continued to use ENDS, we expect that there would be an enormous benefit to public health."[31]

U.S. & UK Academia

"Many scientists have concluded that vaping is likely substantially less dangerous than smoking [...] However, questions remain. Ongoing research will lend further insight into the products' absolute and relative dangers."[32]

Innovation and IP Rights Advocate

"Countries that embrace vaping, such as France, the UK, New Zealand and Canada have witnessed a decrease in smoking rates that is twice as fast as the global average. Although the regulations in these countries can always improve, the effects of this flexible approach to date are very positive and should be mirrored."[33]

Indonesia

Indonesian Academia

"The results showed that all 9 HPHCs [harmful or potentially harmful constituents] recommended for reduction (nine TobReg priority constituents) were shown to be 90% lower in HTP compared to conventional cigarettes."[34]

Canada

Centre for Addiction and Mental Health

"Using tobacco in forms that don't burn, like smokeless tobacco or heat-not-burn products, will reduce your exposure to harmful combusted chemicals, including carbon monoxide. Further reduce your risk by switching to products that don't have tobacco, like NRT or e-cigarettes."[35]

2022

UK

Office for Health Improvement and Disparities in the Department of Health and Social Care

"[V]aping is not risk-free, particularly for people who have never smoked"

"Based on the reviewed evidence, we believe that the "at least 95% less harmful" estimate remains broadly accurate, at least over short term and medium term periods. However, it might now be more appropriate and unifying to summarise our findings using our other firm statement: that vaping poses only a small fraction of the risks of smoking. As we have also previously stated and reiterate, this does not mean vaping is risk-free, particularly for people who have never smoked."[36]

Germany

German Federal Institute for Risk Assessment (BfR)

"Switching from cigarettes to nicotine pouches could represent a reduction in health risks for a person who smokes."[37]

U.S.

U.S. Food and Drug Administration

"Therefore, these [Vuse] products have the potential to benefit adult smokers who switch completely or significantly reduce their cigarette consumption."[38]

Japan

Department of Epidemiology and Prevention, National Center for Global Health and Medicine, Tokyo, Japan

"In this large population-based study, users of only HTPs had lower HDL-C concentrations than never-smokers, although higher than exclusive cigarette smokers. Individuals who used both HTPs and cigarettes had HDL-C concentrations similar to those of exclusive cigarette smokers. Further studies should investigate whether switching from conventional cigarettes to HTPs decreases CVD risk."[39]

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2023

UK

UK Academia

"[E]xclusive EC [electronic cigarette] use was associated with lower levels of biomarkers of harm than exclusive use of combustible tobacco or than dual use. This is consistent with other studies and broad scientific consensus that the greatest improvements in health come from ceasing combustible tobacco use in its entirety and that, although not completely without risk, EC are a reduced-risk alternative."[40]

Greece

Hellenic Republic Ministry of Health General Directorate of Public Health & Life Quality, Directorate of Dependencies Department B' - Other Dependencies

Authorises a reduced chemical / toxicity claim for glo Classic Tobacco: "The concentration of chemical substances with known toxicity that are produced with the use of glo™ neo classic tobacco is less compared to conventional cigarette smoking. glo™ neo classic tobacco contains nicotine and other dangerous chemicals. This tobacco product harms health and is addictive." (Translated from Greek)[41]

Authorises a reduced chemical / toxicity claim for IQOS with HEETS AMBER: "The concentration of chemical substances with known toxicity produced when using IQOS with HEETS AMBER tobacco sticks is lower compared to conventional smoking. A reduction in the concentration of chemical substances with known toxicity does not mean a corresponding reduction in risk for health. The aerosol of this tobacco product contains nicotine and other hazardous chemicals. This tobacco product harms your health and is addictive. The best choice is to quit tobacco and nicotine use altogether." (Translated from Greek)[42]

Australia

Royal Australian and New Zealand College of Psychiatrists (RANZCP)

"The RANZCP recognises that NVPs [nicotine vaping products] reduce the harms associated with smoking tobacco and using other tobacco containing products. Evidence suggests that long-term use of e-cigarettes is significantly less risky to an individual's health than smoking regular cigarettes."[43]

U.S.

U.S. Food and Drug Administration

"Tobacco products that are not smoked generally contain lower levels of harmful chemicals linked to cancer. For example, e-cigarette aerosol contains fewer numbers and lower levels of most toxicants than smoke from cigarettes. Bottom Line: While e-cigarette aerosol generally contains lower levels of harmful chemicals than cigarette smoke, no tobacco products are safe."[44]

France

Institut National Du Cancer

"Mais les cancers liés au tabac sont dus à de nombreuses substances cancérigènes (benzène, l'arsenic, le chrome, etc.), tandis que le monoxyde de carbone et les particules fines produits par la fumée sont les principaux responsables des maladies cardiovasculaires et que les particules solides présentes dans cette fumée jouent un rôle important dans la survenue d'une insuffisance respiratoire. Ces produits n'existent pas à des taux significatifs dans les systèmes électroniques de délivrance de la nicotine (SEDEN).

Si les connaissances progressent rapidement sur ce produit, il existe encore des incertitudes concernant ses effets sur la santé. Toutefois, les effets irritants et/ou toxiques des composants des SEDEN semblent moins élevés que ceux du tabac."[45]

Translation: But tobacco-related cancers are due to many carcinogenic substances (benzene, arsenic, chromium, etc.), while carbon monoxide and fine particles produced by smoke are the main culprits of cardiovascular disease and the solid particles present in this smoke play an important role in the occurrence of respiratory failure. These products do not exist at significant rates in electronic nicotine delivery systems (SEDENs). While knowledge is progressing rapidly about this product, there are still uncertainties regarding its effects on health. However, the irritant and/or toxic effects of the components of SEDEN appear to be lower than those of tobacco.

Canada

Government of Canada

"Though vaping products are relatively new and research into their long-term effects is ongoing, researchers have already established that switching completely to vaping nicotine is less harmful than continuing to smoke."

"Vaping aerosol is significantly different than tobacco smoke. Vaping products produce only a small fraction of the 7000+ chemicals found in tobacco smoke, as well as lower levels of the potentially harmful ones. Unlike cigarettes, vaping products do not produce tar or carbon monoxide, among many other chemicals. While there are risks associated with nicotine, such as addiction and/or physical dependence, nicotine itself is not known to cause cancer. In contrast, cigarette smoke contains many disease-causing chemicals, including many that cause cancer, as well as heart and lung diseases."[46]



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2024

UK

UK National Health Service

"Evidence shows that vaping is substantially less harmful than smoking. Vaping exposes users to far fewer toxins and at lower levels than smoking cigarettes. Switching to vaping significantly reduces your exposure to toxins that can cause cancer, lung disease, and diseases of the heart and circulation, like heart attack and stroke. These diseases are not caused by nicotine, which is relatively harmless to health."[47]

Royal College of Physicians

"Nicotine-containing products include combusted tobacco products, non-combusted tobacco products and non-tobacco nicotine products. There is a spectrum of potentially harmful exposures associated with the use of each product – combustible tobacco products generating the greatest toxic exposure and medicinal nicotine products the least. It is likely that e-cigarettes and oral nicotine products fall close to the lower end of this spectrum."[48]

UK Academia

"We found that nicotine does not appear to be an independent cause of poor lung function, lung cancer, chronic obstructive pulmonary disease, or coronary heart disease, but does increase heart rate. These results support previous evidence which suggests that nicotine on its own does not directly cause poor health outcomes, with the exception of increasing heart rate."[49]

U.S.

U.S. Centers for Disease Control and Prevention

"E-cigarettes should not be used by youth, young adults, or people who are pregnant. E-cigarettes may have the potential to benefit adults who smoke and are not pregnant if used as a complete substitute for all smoked tobacco products."[50]

U.S. and Canadian Academia

"ONPs [Oral Nicotine Pouches] appear to be less toxic than cigarettes and deliver comparable nicotine, presenting an alternative for combustible product users, although key data are mainly available from industry-funded studies. Data from independent research is critically needed."[51]

Switzerland

Swiss Academia

"The addition of e-cigarettes to standard smoking-cessation counseling resulted in greater abstinence from tobacco use among smokers than smoking-cessation counseling alone."[52]

New Zealand

New Zealand Ministry of Health

"Vaping is less harmful than smoking."[53]

New Zealand Academia

"The focus must remain on the central public health problem—the damaging health effects of tobacco consumption. Reducing cigarette smoking is the most effective way to prevent tobacco-related deaths and Tobacco Harm Reduction is the fastest and fairest way to lower smoking prevalence. WHO needs to embrace these innovations in nicotine delivery. Countries that are reaping the benefit of Tobacco Harm Reduction, such as New Zealand, Sweden, Norway, England, and Japan, should encourage participating countries at COP10 to support proposals that will quickly reduce smoking rates."[54]

Canada

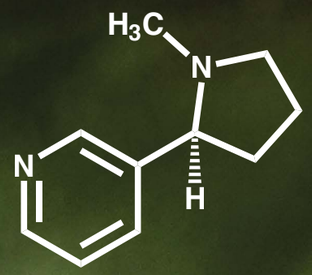
Canadian Cancer Society

"While e-cigarettes are less harmful than conventional cigarettes, they still cause harm. Studies on the long-term risks of e-cigarettes have not yet been done."[55]

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Big Question 7

What is Nicotine?



KEY SUMMARY POINTS

01 Nicotine is addictive – it is now widely acknowledged that the cause of most of the serious health risks associated with combustible cigarettes is the toxicants in the smoke produced when tobacco is burned – and not the nicotine.

02 The risk profile of nicotine itself has been widely researched and is not carcinogenic.

03 Nicotine should be used by adults only.



> Fact: although nicotine is addictive, it is relatively harmless to health.
>
> It is the many other toxic chemicals contained in tobacco smoke that cause almost all the harm from smoking.
>
> Nicotine itself does not cause cancer, lung disease, heart disease or stroke and has been used safely for many years in medicines to help people stop smoking.

NHS
"Vaping myths and the facts"[1]

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Nicotine is a naturally occurring organic compound found in its highest levels in tobacco plants, but it can also be found at much lower levels in other natural sources, including potatoes and tomatoes.[2]

The critical questions

For decades, consumer exposure to nicotine has mostly occurred via cigarette smoking. That is why the effects of smoking and nicotine tend to be conflated in many scientific studies, and in people's minds. For example, surveys show more than half of U.S. adult smokers mistakenly think that nicotine as a substance causes cancer; a further 20-30% are unsure.[3,4] Research indicates that 80% of physicians in the U.S. also hold substantial misperceptions about the risks of nicotine.[5] Utilising published science literature alongside regulatory and medical guidance we sought to answer the critical questions on nicotine:

- Is nicotine addictive?
- What is nicotine's risk profile?
- What are the effects of nicotine?
- Does nicotine cause cancer?
- What are the long-term health effects of nicotine use?
- Are nicotine effects different with different product formats or product categories?

Is nicotine addictive?

Yes, and this information is printed on the packaging of BAT's smokeless nicotine-containing products.

While not the primary cause of smoking-related disease, nicotine is addictive.

While nicotine is addictive, adult consumers can quit nicotine when motivated to do so. Any withdrawal symptoms upon cessation of smoking or nicotine use are typically mild and do not require medical attention.



80%

of physicians in the U.S. have been reported to hold substantial misperceptions about the risks of nicotine[14]

What is nicotine's risk profile?

As part of the UK's National Health Service (NHS) 'Vaping myths and facts', the NHS states that "[a]lthough nicotine is addictive, it is relatively harmless to health." The NHS acknowledge that "[i]t is the many other toxic chemicals contained in tobacco smoke that cause almost all the harm from smoking", and "[n]icotine itself does not cause cancer, lung disease, heart disease or stroke and has been used safely for many years in medicines to help people stop smoking."[1]

The U.S. Food and Drug Administration (FDA) state that "Nicotine is what keeps people using tobacco products. However, it's the thousands of chemicals contained in tobacco and tobacco smoke that make tobacco use so deadly. Some of these chemicals, known to cause lung damage, are also found in some e-cigarette aerosols. This toxic mix of chemicals—not nicotine—cause the serious health effects among those who use tobacco products, including fatal lung diseases, like chronic obstructive pulmonary disease (COPD) and cancer."[6]

What are the effects of nicotine?

Nicotine adult consumers have reported a variety of desired and rewarding effects, such as relaxation; increased alertness; cognitive improvements, and sustained attention to tasks.[7] However, there are also known acute adverse effects caused by nicotine.[8]



UK Government acknowledges that "[…] the greatest obstacle we face is the widespread misconception amongst adult smokers and health professionals that most of the harm of smoking comes from the nicotine."[15]

The effect that a certain amount of nicotine can have on a person depends on whether they are a regular consumer of nicotine, as well as standard variables such as body weight, age and health status. The immediate (acute) cardiovascular effects of nicotine include an increase in blood pressure and heart rate, as well as blood vessel constriction.

While these acute effects are transitory and do not pose health hazards by themselves for the vast majority of regular nicotine users, such physiological responses can lead to adverse effects in adult consumers with certain underlying health conditions. This is particularly so in people with pre-existing cardiovascular disease and diabetes.

Nicotine overdoses in recreational users are inherently self-limiting, as initial symptoms such as dizziness and nausea typically cause immediate cessation of use and the prompt resolution of such symptoms.

Does nicotine cause cancer?

A common misconception is that nicotine, as a substance, is the cause of smoking-related diseases. The primary cause of smoking-related disease is not exposure to nicotine, but to the 150 toxicants among the over 7,500 distinct compounds created by the burning of tobacco.[9,10,11] This lack of understanding is not surprising.

The World Health Organization (WHO) does not classify nicotine as carcinogenic[12] and many other national health authorities[1] recognise that nicotine, while addictive, does not directly cause cancer.

What are the long-term health effects of nicotine use?

Nicotine, when removed from cigarette smoking, is not a driver of smoking-related disease. Kim et al. concluded in a 2021 systematic review that there were no significant differences between nicotine and non-nicotine groups for the risk of arrhythmia, nonfatal myocardial infarction, nonfatal stroke, or cardiovascular death.[13]

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Figure 1. Nicotine: Science and Guidance

Nicotine: Clear Science

Nicotine's risk profile
"Although nicotine is addictive, it is relatively harmless to health."[1] - NHS 'Vaping myths and facts'
"However, it's the thousands of chemicals contained in tobacco and tobacco smoke that make tobacco use so deadly. Some of these chemicals, known to cause lung damage, are also found in some e-cigarette aerosols. This toxic mix of chemicals—not nicotine—cause the serious health effects among those who use tobacco products..."[6] - FDA 'The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General.'

Nicotine can have contraindications and adverse acute effects
Cautions (e.g. inhalators not to be used with chronic throat disease, or gum by people with dentures).
Acute adverse effects (e.g. nausea, dizziness, skin irritation).

Nicotine is not the cause of cancer
"It is inherently unlikely that nicotine inhalation itself contributes significantly to the mortality or morbidity caused by smoking. The main culprit is smoke and, if nicotine could be delivered effectively and acceptably to adult smokers without smoke, most if not all of the harm of smoking could probably be avoided."[16] - Royal College of Physicians. 'Nicotine without smoke: Tobacco harm reduction.'

Nicotine is addictive
Nicotine has been classified as being addictive by several regulatory and public health authorities.[6,17]

Nicotine delivery is different with different product formats and categories
Typically, inhalation products (Heated Tobacco and Vapour Products) deliver nicotine rapidly like cigarettes, whereas oral products (Oral Tobacco Products, and Oral Nicotine Pouches) deliver nicotine more slowly.

Nicotine: Clear Guidance from NICE[8]

Nicotine is for adult smokers only
Health Warnings on risks of usage of tobacco and nicotine products comply with local regulations.

Nicotine is NOT for the underaged
No one underage should use tobacco or nicotine products.
Legality: national regulations limit the legal age to purchase tobacco and nicotine products.

Nicotine is NOT for pregnant women
Not intended for use by persons who are pregnant, or breastfeeding.

Nicotine is NOT for people with contraindications
Not to be used by people with:

- Heart conditions, severe hypertension,
- Diabetes,
- History of epilepsy and seizures.



Are nicotine effects different with different product formats or product categories?

No, the effect of nicotine is not different with different products. However, there are differences in the rate at which nicotine is absorbed into the body with different products.

For adult cigarette smokers, nicotine is absorbed into the body relatively quickly via inhalation and this can be measured using clinical Pharmacokinetic (PK) studies.

To facilitate adult smokers switching to lower risk profile products, a similar delivery profile of nicotine is useful for consumer acceptability. Studies have shown that other inhalation products (Heated Products and Vapour Products) can match the nicotine delivery of cigarettes, which is one of the reasons that tens of millions of adult smokers have switched to these types of products and found them acceptable and enjoyable alternatives to cigarettes.

Oral Tobacco Products, and Oral Nicotine Pouches deliver nicotine differently. In this case, the nicotine is delivered through the buccal mucosa (cheek walls, gums) and into the bloodstream typically over a much slower timeframe.

Clear guidance on who should not use nicotine

Nicotine is addictive and for adults only. The safest option is not to use tobacco products or nicotine. For those adult smokers who would otherwise continue to smoke, they should switch completely to a lower risk profile Smokeless Product.

Our Responsible Marketing Principles[18] and Code[19] are very clear and aligned with regulators and public health bodies that nicotine should not be used by the underaged and is not appropriate for use by pregnant or lactating females nor people with known health contraindications.

Nicotine: The future

Nicotine is integral to Tobacco Harm Reduction (THR). For adult smokers who would otherwise continue to smoke, having a choice of lower risk profile tobacco and nicotine products to completely switch to is important.

Think of it this way: while nicotine is addictive, with smoking, it is the carrier (smoke) that leads to the causes of smoke-related diseases, not the active molecule (nicotine). This is the opposite of, for example, alcohol, which has an inert carrier (typically water) while the active alcohol (ethanol) has been defined as a Group 1 carcinogen.[20]

This 'carrier versus active' distinction is important when it comes to educating people about the true risk profile of nicotine and the causes of smoking-related disease. It is also fundamental when it comes to research around THR and the creation of lower risk profile products that can deliver nicotine in a relatively inert carrier with a lower risk profile compared to a cigarette smoke carrier.

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Big Question 8

Are Smokeless Products a Gateway to Cigarette Smoking?



> We do believe, however, that causal claims about a strong gateway effect from e-cigarettes to smoking are unlikely to hold, while it remains too early to preclude other smaller or opposing effects.

Prof L Shahab
University College London[1]

KEY SUMMARY POINTS

01 The gateway effect proposes that Smokeless Product use leads to cigarette smoking.

02 Methodologies to assess gateway must reflect real world usage and have biochemical verification.

03 While Smokeless Product usage has increased, smoking rates have reduced to an all-time low suggesting the opposite of the gateway effect is occurring.

Measuring the gateway effect

Today there are several studies and review articles of longitudinal questionnaire-based studies with multiple time points, assessing levels of cigarette and Vapour Product usage at an initial time point with later time point follow-ups, again assessing levels of tobacco product usage. Typically, the questionnaires classify participants as a 'user' if they had taken one puff in the past 30 days. If a study participant had indicated they were a Vapour Product user at the initial time point and then indicated they were a smoker at a follow-up time point, the conclusion would be that the Vapour Product had acted as a 'gateway' to the participant being a smoker.

What the data on gateway say today

With respect to gateway, one article has stated that: "There was strong evidence for an association between e-cigarette use among non-smokers and later smoking (OR: 4.59, 95% CI: 3.60 to 5.85) when the results were meta-analysed in a random-effects model. However, there was high heterogeneity (I^2=88%)." The authors further concluded in the review: "However, the results do not provide strong evidence of a gateway effect."[2]

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An expert roundtable discussion funded by Cancer Research UK came to the following conclusion on gateway: "The group felt that there was no convincing evidence in the UK to support the premise that e-cigarettes are acting as a gateway product in either adult or youth populations. Data have shown that only a small percentage of adult never smokers (0.3%) and youth never smokers (0.5%) are current daily vapers."

One delegate pointed out that if e-cigarettes were in fact a gateway product, one would surely see a rise in the overall population smoking rates since the introduction of e-cigarettes. However, many studies have shown the opposite to be true, with current smoking rates in England declining from 19.9% of adults over the age of 18 in 2010 to 15.5% in 2016.[3]

Furthermore, Cancer Research UK has concluded as follows: "And the good news is that smoking rates and the perceptions around the acceptability of smoking have declined in young people, even since the introduction of e-cigarettes. So, it doesn't seem like e-cigarettes have interfered with the promising drop in levels of smoking in young people."[4]

A recent analysis in Belgium of annual survey data showing an increase in the use of e-cigarettes examined the link between vaping and smoking amongst Flemish youth.[5]

The survey data, collected by the Vlaams expertisecentrum Alcohol en andere Drugs (VAD) in 2021-2022, was analysed in collaboration with the Vlaams Instituut Gezond Leven.

The analysis reached the following main conclusions:

- Vaping among the underaged who have never smoked is low, with 91.2% of those who have never smoked reporting that they also have never vaped;
- The use of e-cigarettes by those who reported never smoking is temporary or occasional;
- Those who report regular vaping are mainly those who currently smoke or have done so previously; and
- E-cigarette use by the underaged is strongly linked to the smoking behaviour of their parents.

In a news release on the analysis, Vlaams Instituut Gezond Leven's tobacco expert concluded that underaged vaping "is a nuanced story, in which two parameters are very important: the frequency of use and the link with (previous) smoking."[6]

Recommendations for future study design to assess gateway effect

- Usage classification should reflect more representative real world user behaviours (e.g. is one puff in the last 30 days a true measure of a smoker or a vaper?)
- Questionnaires should include biochemical verification with nicotine or N-(2 cyanoethyl) valine, CEVal, being two useful markers to assess nicotine usage and cigarette usage respectively
- Negative controls would confirm if associations were causal
- Include specific product information (e.g. nicotine strength/flavours used in product) from the study participants to enable mechanisms of association to be confirmed



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Big Question 9

What is the Role of Flavours in Smokeless Products and THR?

Giving adult smokers, who would otherwise continue to smoke, access to acceptable and enjoyable Smokeless Products can be achieved while preventing underage access and usage of these products.

KEY SUMMARY POINTS

01 Menthol and fruit flavours are fundamental for adult smokers switching to Smokeless Products with **>70%** of use in these flavours.[1,2]

02 Flavours, packaging and descriptors that predominantly appeal to the underaged should be banned.

03 Retail enforcement and education is key to ensure the underaged can neither access these products nor use them through social sharing.

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Flavours play a role in all consumer goods products from food through beverages, and tobacco and nicotine products are no different. The flavours in Smokeless Products are used for differentiation to meet different adult consumers' preferences and to provide sensorial satisfaction.

We believe there is a clear pathway forward to use flavours that further encourage adult smokers to switch and that do not predominantly appeal to the underaged[4]:

- Flavours must be adult orientated (Figure 1)
- Flavours must be safe for consumption
- Flavours must have factual-style, adult-orientated descriptors
- Flavours must have adult-orientated packaging
- Retail enforcement is required to prevent underage access

Flavours must be adult orientated

Flavours that have no relevance to adult smokers do not belong in Smokeless Products, especially flavours with predominant appeal to the underaged. The flavours used by adult Vapour Product consumers in the UK in 2023 were assessed by Action on Smoking and Health (ASH) which found that approximately 80% of adults use Fruit, Mint / Menthol, and Tobacco flavours.[2] That's why we propose limiting flavours to adult-orientated flavours and support an outright ban on Smokeless Product flavours such as confectionery, candy-like, desserts or soft drink brands.

This approach recognises the role of flavours as an important driver of adoption for adult smokers seeking alternatives, while ensuring the removal of specific flavours that appeal predominantly to anyone underage.

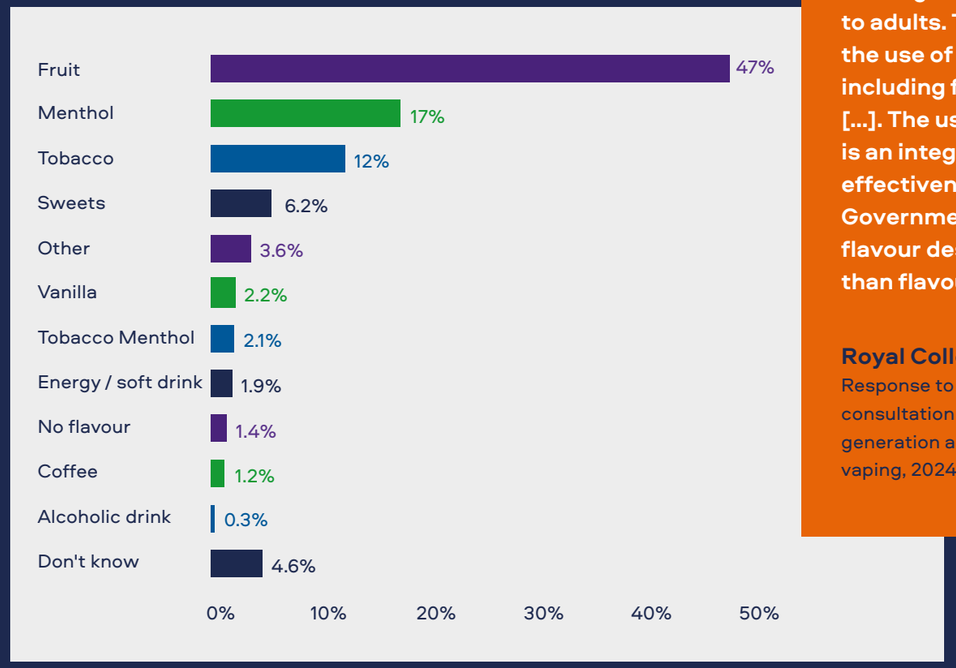
Toxicological assessment of our flavours

Our product stewardship process includes a scientific assessment of flavours. We assess our flavours in both consumables (Heated Product consumables, Vapour e-liquids and Oral Nicotine Pouches) and product aerosols (Heated and Vapour Products) to understand the impact on these ingredients the aerosolisation process has.

Scientific evidence underscores the importance of flavours to adult smokers making the switch

Vapour Products, which entered the market in Europe in 2006 and the U.S. in 2007, are available with a wide array of e-liquid flavours.

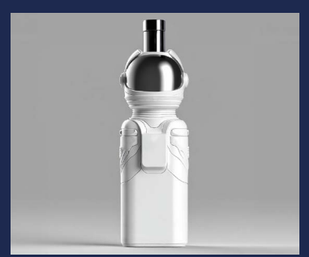
Figure 1. Flavour used by adults in the UK



ASH Smokefree GB Adult Surveys 2023. Unweighted base: Adults who currently use e-cigarettes=1,079 [2]

> **The [Royal College of Physicians] does not recommend the wholesale limiting of flavours accessible to adults. The RCP supports the use of a range of flavours, including fruit flavours [...]. The use of flavours [...] is an integral part of the effectiveness of vaping [...]. Government should restrict flavour descriptors rather than flavours themselves.**
>
> **Royal College of Physicians**
> Response to the government's consultation on creating a smokefree generation and tackling underage vaping, 2024[3]

Figure 2. A framework for flavours in Tobacco Harm Reduction

	Proposed Regulatory Framework	Market Reality Without Regulatory Enforcement
Flavours	• Tobacco • Menthol • Mint • Fruits • And other adult-orientated flavours	• Energy / Soft Drink • Sweets • Dessert • Underage attracting
Flavours Safety Assessment	• Risk-assessed flavour ingredients • Tested in liquids and aerosols • Toxicological assessment of flavours	• No safety background for ingredients • Not tested in either liquids or aerosols • Unassessed Carcinogens, Mutagens, Reproductive (CMR) toxicants
Science Supporting Switching	Clear scientific evidence highlighting which flavours encourage adult smokers switching	Limited evidence that flavours will encourage adult smokers to switch
Adult-Orientated Descriptors		 *Pictured example
Adult-Orientated Packaging		 *Pictured example
Retail Enforcement	• Retail licencing (subject to market conditions) • Punitive penalties and sanctions	• Limited regulatory oversight at retail • Meaningless enforcement or unenforced penalties

A review of U.S. flavour usage was conducted by Mok et al., who ranked an order of 'mint/menthol', 'other flavours' (e.g. Fruit), and 'unflavoured / tobacco' flavour in terms of transitioning away from smoking. This research illustrates the benefit of Vapour Products and flavours in reducing smoking.[5]

Flavours must have adult-orientated flavour descriptors

Descriptors for flavours should describe the particular flavour that is in the product in a factual style.

Flavours must have adult-orientated packaging

Packaging that looks like sweets or toys doesn't belong on tobacco or nicotine products. That's why our packaging is adult-orientated and simplistic in its design, so that it does not appeal to the underaged.

Retail enforcement is required to prevent underage access

We support restrictions on where and how tobacco and nicotine products are sold in the UK like the ones used to restrict the sale of alcohol. This would require those who sell vapes, for example, to have a retail licence which would be revoked if they were found to be selling to anyone underage. Retailers would also have to demonstrate to Trading Standards that they observe either Challenge 25 protocols or fit new technologies at point-of-sale locations which verify age, such as facial recognition cameras.

Recommendations and steps forward

We recognise that flavours in tobacco products have been a topic of public discussion for many decades. This attention is exacerbated by the growing popularity of Vapour Products, specifically in terms of the wide variety of e-liquid flavours available. We believe that it is essential for regulation to strike a clear balance between providing options to suit adult preferences, and ensuring we have responsible marketing practices and technologies to safeguard against underage use.

Flavours play a critical role in ensuring adult consumers have a suitable alternative to more harmful tobacco products, such as combustible cigarettes.

Adult-orientated flavours can be instrumental in harm reduction strategies by further encouraging adult smokers who would otherwise continue to smoke to switch to alternatives. Partnered with a successful Underage Access Prevention (UAP) technology and campaign, as well as regulatory oversight, flavours should be recognised as a means to encourage adult tobacco consumers to move down the risk continuum and be considered as part of an holistic Tobacco Harm Reduction approach.



> Use of fruit [...] flavored e-liquids is positively related to smokers' transition away from cigarettes
>
> **Researchers from Australia, U.S., Canada, and UK universities**[6]

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Big Question 10

Are Smokeless Products Associated with Reductions in Smoking?

KEY SUMMARY POINTS

01

Cigarette consumption has declined dramatically over the past decade, during which time the number of adult consumers of Smokeless Products has grown to an estimated 115 million.[1,2,3]

02

Smokeless Product use has increased with the global number of adult consumers, growing by approximately 70% between 2020-2024.[1,2,3]

03

In those countries where smoking rates have declined the most dramatically, the availability and use of Smokeless Products is increasing and displacing cigarettes.



Tobacco has been in use since 6000 BCE, when Native Americans began cultivating and using the tobacco plant.[4] Today, the World Health Organization (WHO) estimates that one billion people smoke globally.[5] Despite long-standing and widespread public awareness of serious health risks, people continue to smoke.

20%

reduction in cigarette consumption between 2012-2023.[6]

> My vision for BAT is that by 2035, at least 50% of our revenues will be in Smokeless Products.
>
> **Tadeu Marroco**
> Chief Executive

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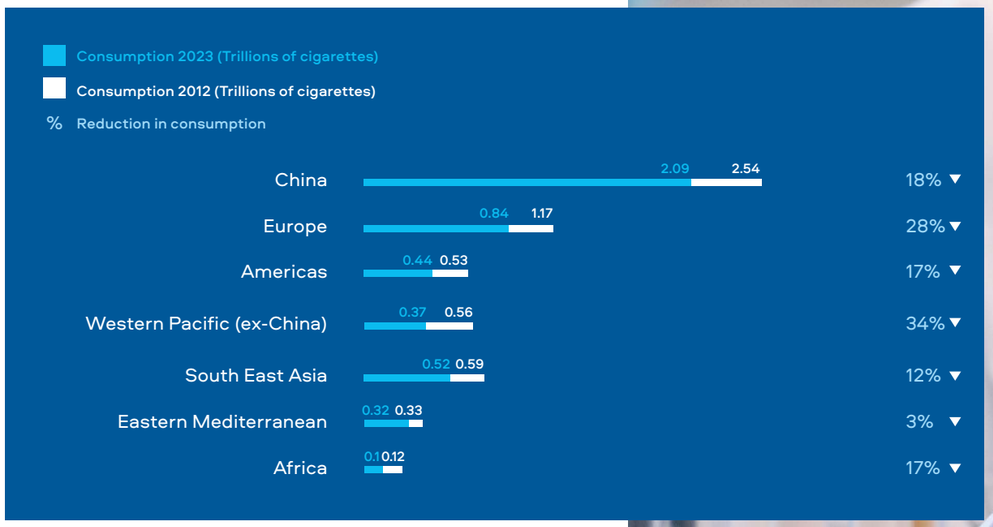


Figure 2. Summary of cigarette consumption 2012-2023[6]

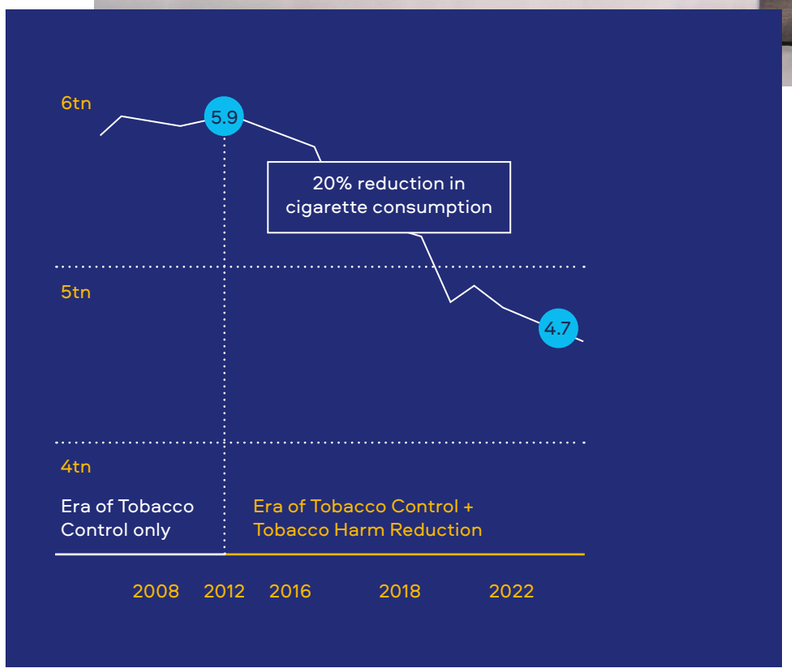


Figure 1. Time-course plot of global cigarette consumption [6]

Global Cigarette Consumption is Declining

Global cigarette consumption has declined significantly over the past decade and is now at its lowest point in many years. A significant reduction in cigarette consumption, of approximately 20%, was observed since 2012 (Figure 1).[6] By region, Western Pacific (excluding China) and Europe have shown the greatest reduction in cigarette consumption, whereas Eastern Mediterranean has shown the smallest reduction (Figure 2).[6]

To understand the drivers of such a significant reduction, we need to look at the annual longitudinal reduction and contextualise it relative to tobacco control measures and Tobacco Harm Reduction (THR). We observed that from 2008 to 2012, in the era of extensive tobacco control measures only, cigarette consumption remained relatively stable at around 5.8-5.9 trillion cigarettes per year, underscoring that tobacco control regulation alone is not a sufficient tool to reduce smoking prevalence.



However, post 2012 when companies started to launch Vapour Products, then Heated Products and Oral Nicotine Pouches, alongside tobacco control measures, cigarette consumption dropped dramatically annually, to the current 4.7 trillion consumed cigarettes per year.[6] To continue to realise this rate of reduction in cigarette consumption, effective and responsible tobacco control measures and Tobacco Harm Reduction should be jointly adopted by governments and public health bodies across the world.

Stakeholders often have diametrically opposed opinions on the issue of driving down global cigarette consumption. But a common thread exists in that all stakeholders are seeking an improvement in public health while minimising unintended consequences. In terms of the prohibitionary nature of certain strategies, there are a number of likely unintended consequences such as (i) an increase in illicit trade and (ii) unregulated alternative products on the market that do not comply with product safety and quality standards such as regulated products from accountable manufacturers.

Smokeless Product use is growing

In the past five years, Smokeless Product use has increased with the global number of adult consumers growing by approximately 70% (68 million Smokeless Product consumers in 2020 to 115 million Smokeless Product consumers in 2024).[1,2,3] With approximately one billion adult smokers globally,[5] this equates to around 11.5% of today's smoking population.

However, not all the world's adult smokers have legal access to Smokeless Products. If we consider India and Brazil, two countries that have banned the sale of Smokeless Products, their smoking prevalence is approximately 7% and 11%,^[5] respectively. This equates to approximately 120 million adult smokers^^ who did not have legal access to Smokeless Products. Therefore, the total number of global Smokeless Product consumers in comparison to global smokers is >13%^^^ (115 million out of 880 million).

^ 2019 population figures: India = 1.38 billion[7], Brazil = 0.212 billion[8]
^^ Only 2019 figures available
^^^ Globally, there are more markets that do not allow the sale of Smokeless Products

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However, when access to Smokeless Products is looked at in the top 15 countries in the world by population (Table 1), it's clear that much more can be done to give adult smokers within these countries access to lower risk profile products.

We believe that tobacco control measures and THR can work in concert to reduce cigarette consumption and encourage adults who would otherwise smoke to switch completely to lower risk*† alternative tobacco and nicotine products. This is aligned with the ambitions of all stakeholders in improving future public health outcomes.

Access to Smokeless Products = Greater Smoking Prevalence Reductions

The impact of vaping on the incidence of smoking can be seen in countries where vaping products have become widely available compared to the global average. The chart illustrates decreases in smoking prevalence in the UK, France, Canada and New Zealand compared to a global average, in the period 2012 to 2018 (Figure 3).[9] It shows that while the global average percentage point reduction was 1.5% over this period, the average percentage point reduction in smoking prevalence for these four countries was 3.6% overall. By contrast, in Brazil, where Smokeless Products were unavailable, smoking prevalence declined at a slower rate from 2015 to 2019.[10]

Table 1. Access to Smokeless Products in the world's most populous countries

Country	Population (2024)[11]	Heated Products	Vapour Products	Oral Nicotine Products
India	1.45bn	✗	✗	✗
China	1.42bn	We do not sell Smokeless Products in China		
U.S.	0.34bn	✓	✓	✓
Indonesia	0.28bn	✓	✓	✓
Pakistan	0.25bn	✓	✓	✓
Nigeria	0.23bn	✗	✗	✗
Brazil	0.21bn	✗	✗	✗
Bangladesh	0.17bn	✓	✓	✓
Russia	0.14bn	We do not trade in Russia		
Mexico	0.13bn	✗	✗	✗
Ethiopia	0.13bn	✗	✗	✗
Japan	0.12bn	✓	✗	✓
Philippines	0.12bn	✓	✓	✓
Egypt	0.11bn	✓	✓	✓
DRC	0.10bn	✗	✗	✗
Total	**5.2bn**	**7 out of 15 markets accessible**	**6 out of 15 markets accessible**	**7 out of 15 markets accessible**

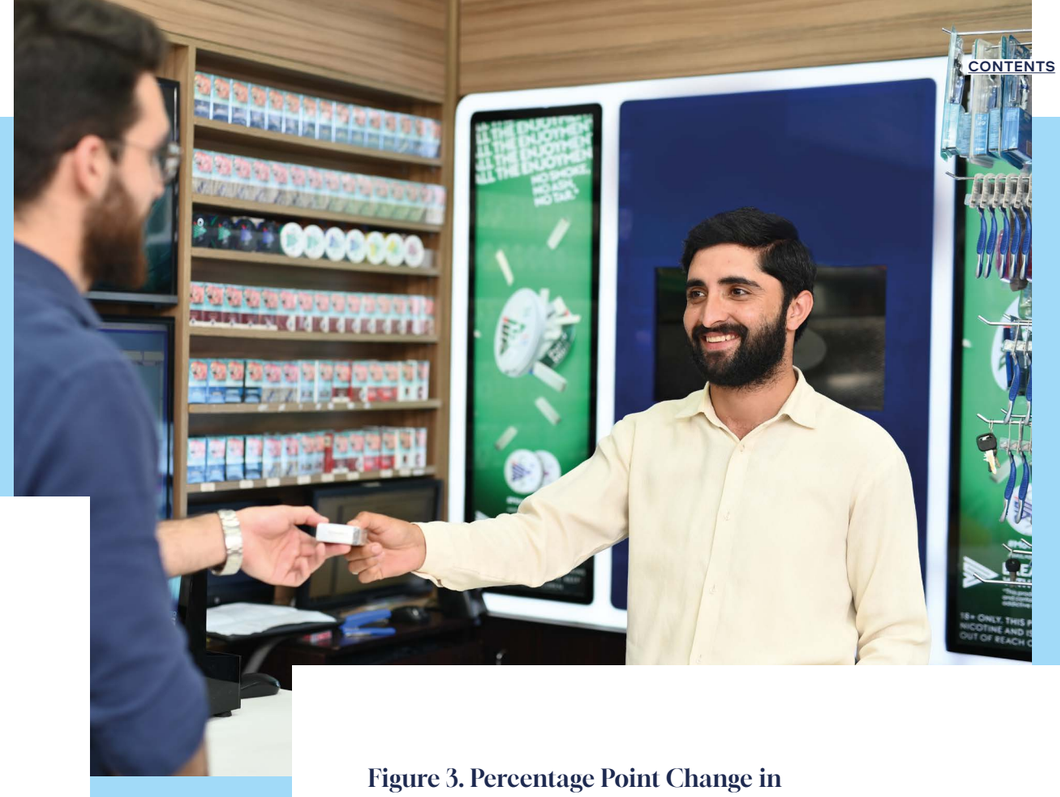
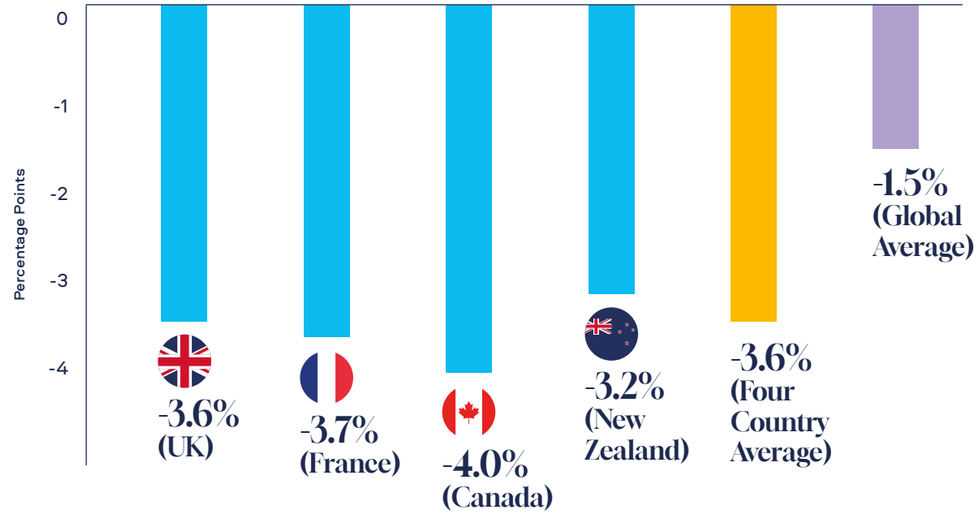


Figure 3. Percentage Point Change in Smoking Prevalence 2012-2018[9]



* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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03

Impact of Smoking

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Smoking: A Global Overview

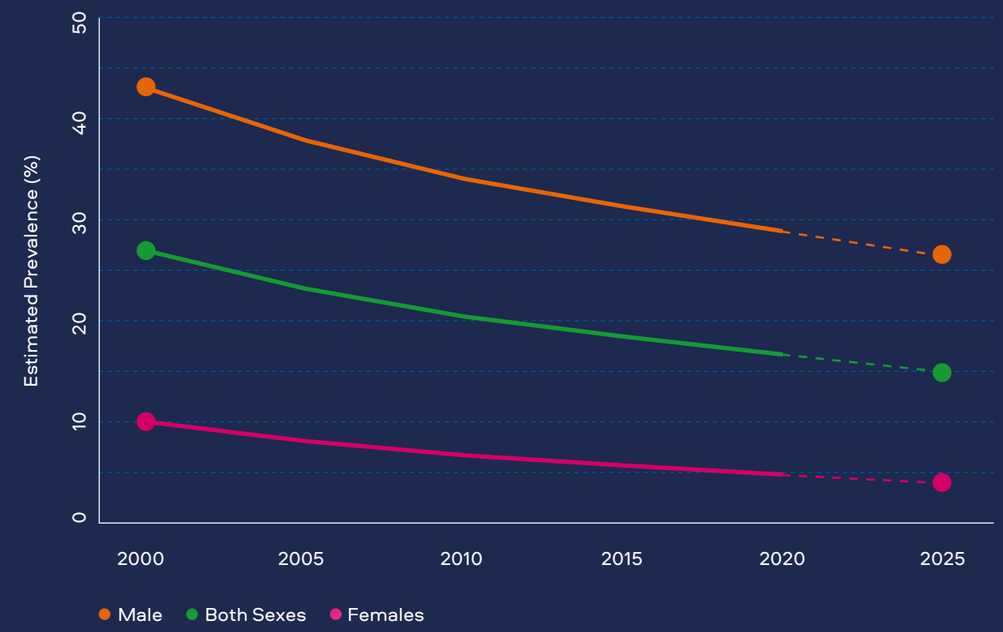
Humankind has been using tobacco for millennia, and today there are one billion adult smokers across the globe.[1] Global smoking rates are at their lowest in decades and the volume of cigarettes consumed globally on an annual basis has reduced by 18% over the last decade.

In 2020, according to the World Health Organization (WHO), 21.7% of the world's population aged 15 years or older used tobacco: 35.5% of men and 7.9% of women. Projections to 2030 see further reductions in tobacco use rates. However, WHO predicts that around 18.1% of the world's population will still use tobacco.[2]

Prevalence of tobacco use amongst men and women has changed over the past two decades. In 2000, the proportion of males using any form of tobacco was three times greater than the proportion of female consumers. The decline in prevalence among female adult smokers has been greater than males. By 2022 the rate for males was more than four times the rate for females (Figure 1).

By 2022 the smoking prevalence rate for males was more than four times the rate for females

Figure 1. Global tobacco smoking prevalence has declined continually since 2000[2]



1 billion
adult smokers across the globe[1]

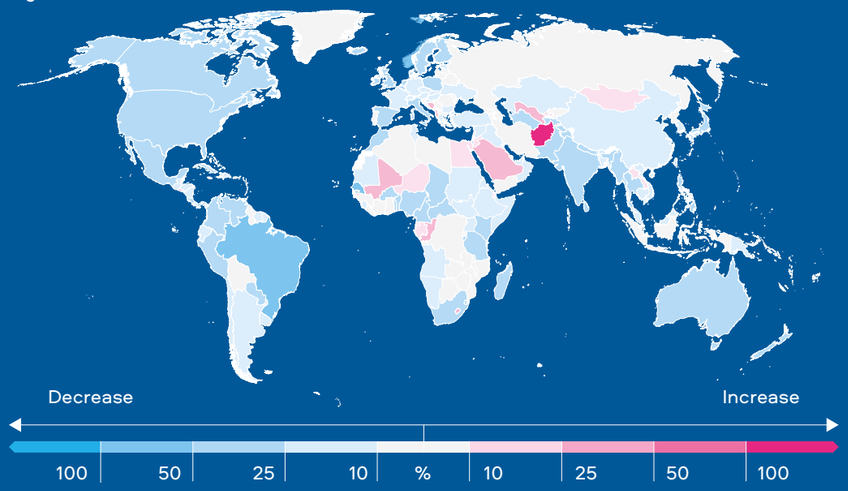
>70%
of global tobacco use is cigarette smoking

20%
of tobacco is consumed as Oral Tobacco Products

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Change in prevalence by country, 1990-2019

Figure 2.



While the proportion of the global smoking population is declining, the total number of adult smokers has remained at around one billion smokers since 1990,[1,3] due to an overall rise in the global population. China and countries in both Africa and the Western Pacific regions have seen the greatest increases in the number of adult smokers over the last three decades (Figure 2).[3]

Now over 80% of the 1 billion adult smokers live in low- and middle-income countries.

The most common form of tobacco use is cigarette smoking at 71.5% of total tobacco use. Other smoking products (cigars, pipes, shisha, bidis, kreteks and other locally smoked tobacco products) represent a further 8.5% of the total. The remaining 20% of tobacco is consumed as Oral Tobacco Products (chewing tobacco, snus).[2]

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Reasons People Like Smoking

The motivations for smoking can be grouped into three types:

- **Nicotine Pharmacology:** the pleasurable and Central Nervous System (CNS) effects of nicotine.
- **Sensorial:** the olfactory and gustatory characteristics of the product, inclusive of mechanical aspects.
- **Ritual:** the behaviours and practices surrounding product usage.

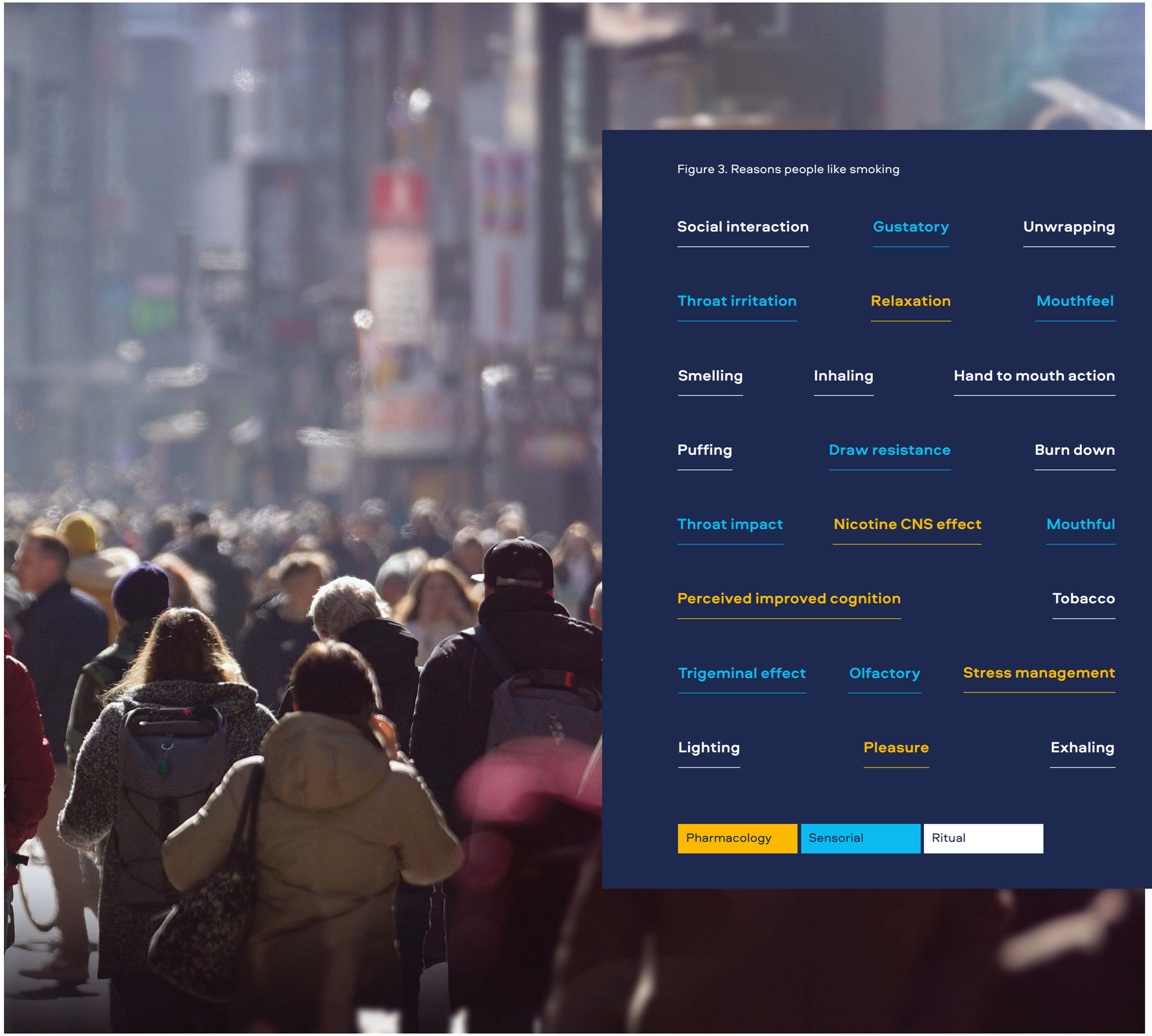


Figure 3. Reasons people like smoking

Social interaction	Gustatory	Unwrapping
Throat irritation	Relaxation	Mouthfeel
Smelling	Inhaling	Hand to mouth action
Puffing	Draw resistance	Burn down
Throat impact	Nicotine CNS effect	Mouthful
Perceived improved cognition		Tobacco
Trigeminal effect	Olfactory	Stress management
Lighting	Pleasure	Exhaling

Pharmacology | Sensorial | Ritual

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Combusting Tobacco and Cigarette Smoke



Puffing Parameter	ISO Regime [1]	Massachusetts Regime	HCI Regime [2]
Puff Volume (mL)	35	45	55
Puff Duration (s)	2	2	2
Puff Frequency (s)	60	30	30
Ventilation Blocking (%)	0	50	100

Table 1. Internationally-standardised puffing parameters

Under the 2001 EU Tobacco Products Directive maximum yields for cigarettes were set for tar (10mg/cigarette), carbon monoxide (10mg/cigarette), and nicotine (1mg/cigarette).

We measure our cigarette smoking yields using automated smoking machines, following internationally-standardised puffing parameters (Table 1). These puffing parameters ensure quantitative measurements of cigarette smoke are carried out consistently.

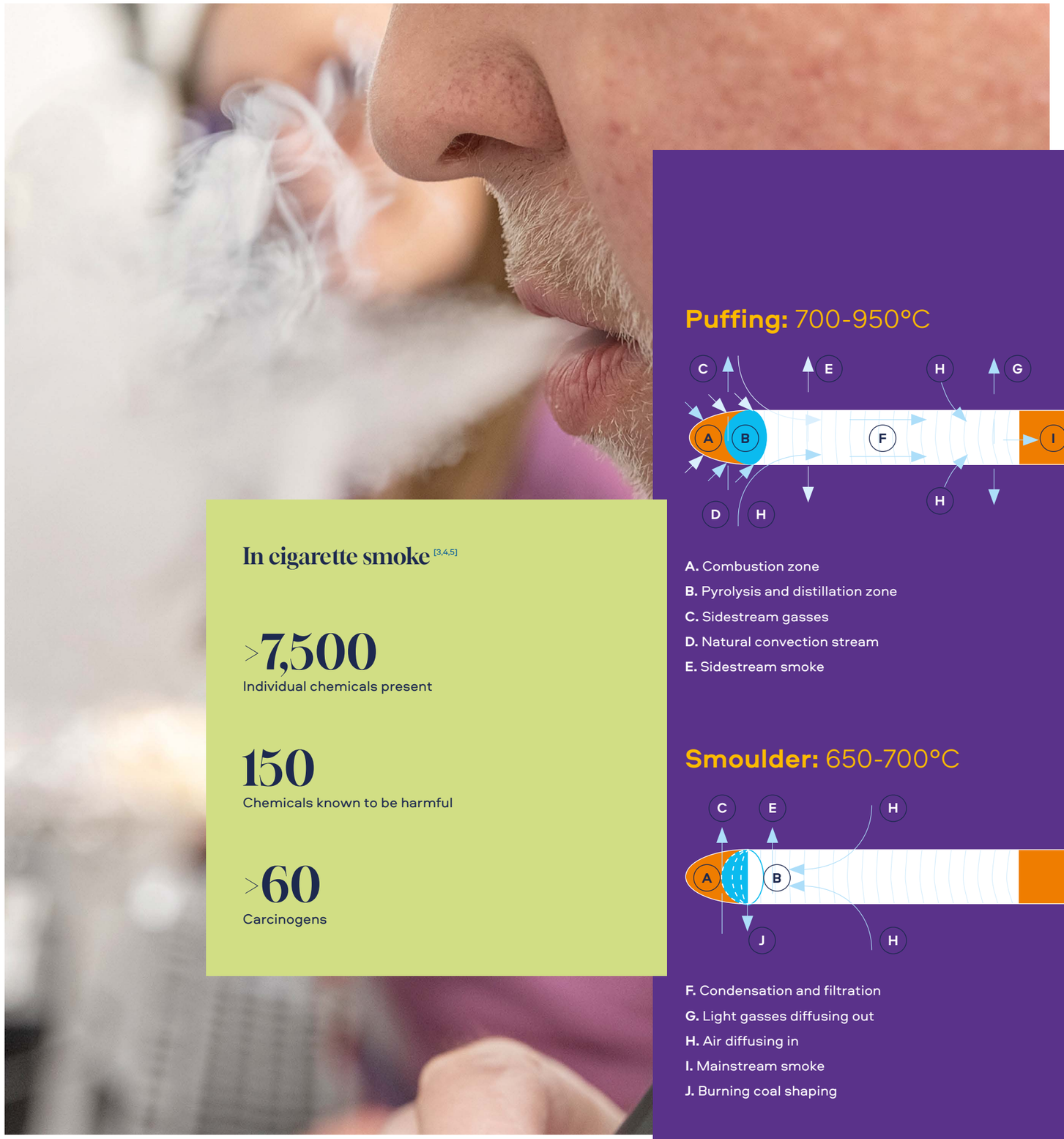
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Upon being lit, the tip of a cigarette becomes so hot that, at its peak, it reaches a temperature of around 950°C.[6] The resulting combustion leads to the tobacco breaking down into thousands of chemicals, many of which are not present in the unburnt material.

At these temperatures, oxygen from the air reacts with carbonised tobacco producing simple gases such as carbon monoxide, carbon dioxide and hydrogen.[7] Many of the toxicants found in smoke are formed by the high temperature degradation of tobacco, both through combustion and through pyrolysis (the decomposition of a substance by heat).[8] This is where many of the organic chemicals, including many of the toxicants, found in smoke but not present in the original tobacco are formed.[9]

Some toxicants, such as heavy metals present in tobacco, are not changed by heat and will be either carried in the smoke or will remain in the ash that is produced.

At lower temperatures, typically below 200°C, volatile chemicals in the tobacco, flavour compounds used as ingredients, and nicotine are released into the smoke in a process called distillation.[10]



In cigarette smoke [3,4,5]

>7,500
Individual chemicals present

150
Chemicals known to be harmful

>60
Carcinogens

Puffing: 700-950°C

A. Combustion zone
B. Pyrolysis and distillation zone
C. Sidestream gasses
D. Natural convection stream
E. Sidestream smoke

Smoulder: 650-700°C

F. Condensation and filtration
G. Light gasses diffusing out
H. Air diffusing in
I. Mainstream smoke
J. Burning coal shaping

Mainstream and sidestream cigarette smoke

The chemical composition of mainstream smoke (the smoke inhaled by a smoker) is different from that of sidestream smoke (the smoke emitted into the environment at the lit end of a cigarette) because of the difference in the temperatures involved in producing the two types of smoke.

Mainstream smoke consists of more than 7,500 individually-identified chemicals. Many of these originate from the tobacco plant, and the amounts of some of them will vary depending on the variety of tobacco used, the soil conditions during growing, and the tobacco curing process.

Sidestream smoke is released at the lit end of a cigarette in a plume and is the main contributor to environmental tobacco smoke. It is mainly formed between puffs at lower temperatures, and under lower oxygen levels than during the combustion that occurs during a puff. Some of its constituents are higher than in mainstream smoke; others lower, and some occur in different phases. For example, in mainstream smoke, nicotine occurs both in the particulate and vapour phases of smoke. In sidestream smoke, nicotine primarily occurs in the vapour phase.[11,12]

An understanding of these processes helps to explain why emissions of Smokeless Products such as Heated Products and Vapour Products are expected to produce aerosols with substantially fewer and lower levels of toxicants than cigarette smoke.

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Health Impacts of Smoking

Smoking is one of the leading preventable causes of disease and avoidable premature deaths, globally.

The risks of smoking tobacco are well documented.[1] Through the process of combustion, more than 7,500 individual chemicals (150 chemicals known to be harmful and 60 chemicals known to be carcinogens) are produced in cigarette smoke. It is these chemicals produced through combustion that cause disease and death.[2,3,4]

Smoking attributable diseases

Smoking can cause numerous diseases and cancers. According to the American Lung Association, the four major smoking-related diseases are chronic obstructive pulmonary disease (COPD), heart disease and stroke, which are cardiovascular diseases (CVD), and cancer (specifically lung).[5]

Chronic obstructive pulmonary disease (COPD)

COPD is a collection of underlying conditions including chronic bronchitis and emphysema.[6]

Chronic bronchitis is a persistent cough, occurring as a result of increased production of mucus in the airways. The condition is made worse by the loss of hair like structures which normally transport dust and mucus out of the lungs. This is exacerbated due to swelling and constriction of the airways further impacting on the ability of air to move freely in and out of the lungs.

Emphysema is a destructive disease affecting the alveoli (air sacs) within the lungs. These air sacs form the surface where oxygen enters the body. In emphysema, inflammatory processes lead to the destruction of the scaffolding of the lungs. As such, the air sacs, which usually resemble bunches of grapes, merge into larger structures. This dramatically reduces the lung surface area, rendering the individual patient unable to breathe well as more and more of the lung becomes affected.



Causes of COPD

COPD can be caused by any chronic exposure to a lung irritant, smoke, dust, noxious gases, smoke from fires, and metal particles.

Cardiovascular disease (CVD)

CVD is a condition affecting the blood vessels resulting in the reduction in blood flow to organs or tissues such as the limbs, brain, or the heart itself. The reduction in blood flow occurs due to narrowing and hardening of the oxygen carrying arteries.[7]

The narrowing of the blood vessels or atherosclerosis occurs due to fat deposition. Irritation makes the vessel stickier to the white blood cells which enter the vessel walls to ingest the deposited fat. The narrower part of blood vessel can become damaged as blood must pass more quickly through the smaller gap and a clot may form, further reducing blood flow. Reduction in blood flow will prevent sufficient blood, and therefore oxygen getting to organ or tissue leading to pain, such as angina in the case of the heart. Severe blockage can occur suddenly if pieces of a clot are dislodged causing downstream blockages which leads to heart attack or a stroke if the brain is affected.

Causes of CVD

Causes of CVD include smoking, diet, obesity, diabetes, physical inactivity, genetic susceptibility to high cholesterol, raised alcohol consumption and blood pressure.

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Cancer

Cancer is a term that describes a group of diseases that occur as the result of unregulated growth of abnormal cells and ultimately critical damage to the body's tissues and organs.[8] The damage from a cancer is not limited to the initial site of growth, as it may move to elsewhere in the body. Normally all cells within the body are strictly controlled by the instructions preserved in the DNA within our genes.

If these genes are changed by direct damage to DNA or other mechanisms, and those changes give the affected cells a selective advantage over their surrounding normal cells within the tissue, these cells can grow and reproduce uncontrollably and give rise to a tumour. Damage to the DNA happens all the time at a low rate within our bodies because of exposure to environmental agents and due to endogenous processes. The cells in the body can usually identify and correct these mistakes or eliminate the damaged cells. Cancer can occur if damage to the DNA is too rapid to fix or if the correction process is prevented.





Causes of cancer

Several environmental factors are strongly linked with various types of cancer. Risk factors for cancer include smoking, alcohol consumption, diet, physical inactivity and exposure to environmental pollution and radiation.

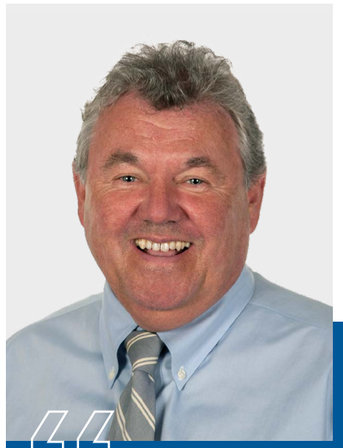
Cigarette smoke is a source of chemicals which both directly damage the DNA within the cells of the body and also hamper its repair. Cigarette smoke enters the body via the mouth and lungs, and adult smokers have a highly elevated risk of developing lung cancer. The chemicals from the inhaled smoke are also carried around the body by the blood, and smoking has been associated with cancers in most organs of the body. Cancer Research UK states that smoking causes at least 15 different types of cancer.[9]

Smoking attributable mortality

According to the World Health Organization (WHO), smoking is the leading preventable cause of premature death.[10] The prevalence of smoking is declining worldwide; however, the absolute number of adult smokers has increased over the past 30 years.[11] Quitting smoking reduces the relative risk of numerous smoking-related diseases and increases life expectancy for former adult smokers.[12]

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Our Historical Efforts to Reduce the Risks of Smoking



In the 1950s, tobacco product manufacturers began Research and Development (R&D) into the impact of tobacco use, following seminal research by Doll and Hill on lung cancer.[1]

BAT's R&D facility opened in Southampton, UK in 1956. Initial research focused on trying to understand the issues surrounding smoking and health.

> **In the late 2000s we developed a prototype cigarette for scientific assessment.**
>
> **Dr Chris Proctor**
> Former BAT Chief Scientific Officer

When tobacco is combusted at around 950°C, it produces smoke comprising more than 7,500 compounds, of which around 150 are known toxicants.[2,3,4]

Over the decades, research expanded into novel technologies to reduce toxicants in cigarette smoke emissions.

These technologies can be split into five areas:

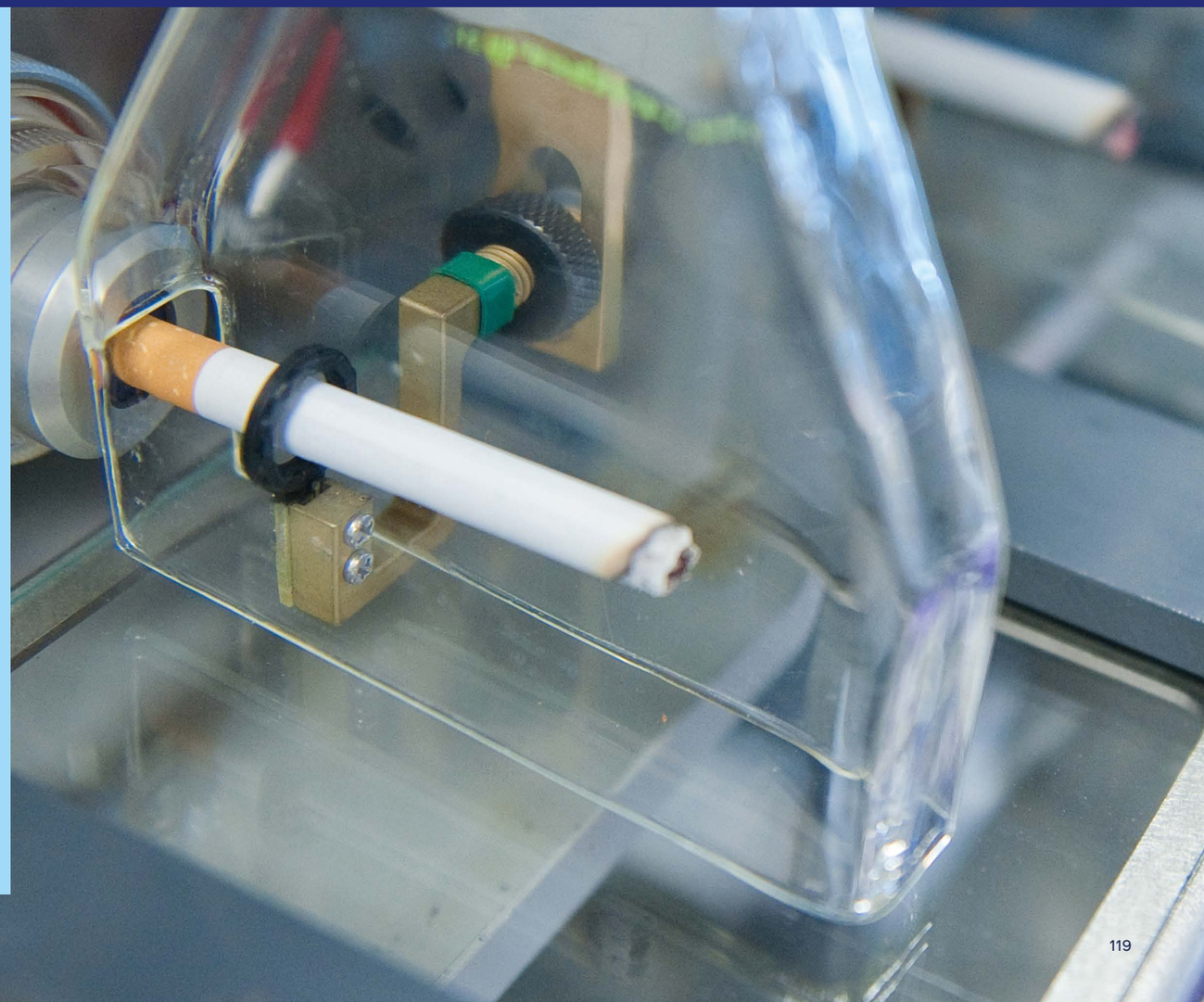
01 Tobacco selection with low levels of toxicants and pre-cursors

02 An enzyme treated novel tobacco with lower levels of toxicants

03 Non-tobacco dilution technologies that could be blended with tobacco

04 Filtration technologies that could reduce vapour phase toxicants

05 Filtration technologies that could remove specific toxicants



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Historically, certain cigarettes were developed that used treated tobacco or carbon filters to potentially reduce exposure to the carcinogens found in cigarette smoke.[5,6] Ultimately, due to lack of consumer interest and acceptability, some of these cigarettes were removed from the market.[7]

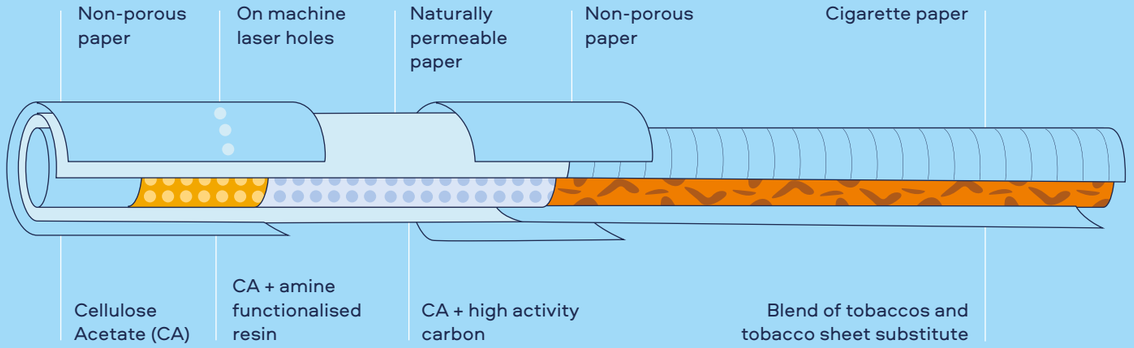
In the late 2000s, we developed a prototype cigarette for scientific assessment using a combination of these technologies – the Reduced Toxicant Prototype (RTP) cigarette. It was assessed to measure and understand the emissions, exposure, and potential risk, relative to smoking a conventional cigarette (Figure 1).

After extensive research, the toxicant levels of emissions from the RTP cigarette and its subsequent toxicological impact were reduced when compared to conventional cigarette smoke.[8,9] However, clinical results showed that adult smokers who used the RTP cigarette had the same levels in Biomarkers of Potential Harm# (BoPHs) as adult smokers of conventional cigarettes.[10]

It was concluded that the RTP cigarette was not a reduced-risk product. We published our data in a series of papers to show that, when tobacco was combusted in a cigarette, the technologies in the RTP cigarette would facilitate lower levels of toxicants, with lower toxicological impact, exposing adult smokers to lower levels of toxicants. However, crucially, these changes did not translate into a likely reduction in risk.

This conclusion, along with our historical research, formed the basis of the re-articulation of our THR strategy in 2013, which pivoted from combustible to non-combustible (smokeless) tobacco and nicotine products, and resulted in the launch of our first Vapour Product in July 2013.

Figure 1. Overview of the design and scientific assessment of the Reduced Toxicant Prototype (RTP) Cigarette



Reduced emissions

Overall changes in RTP toxicant yields compared to a conventional commercial cigarette[8,10]

		Favourable Change
Crotonaldehyde	90% ▼	Yes
NNN	86% ▼	Yes
Acrylonitrile	95% ▼	Yes
NNK	62% ▼	Yes
Acrolein	94% ▼	Yes
3-ABP	44% ▼	Yes
1,3-Butadiene	87% ▼	Yes
CO	19% ▼	Yes
4-ABP	17% ▼	Yes

Emissions

Reduced exposure

Overall changes in biomarkers of exposure in RTP adult smokers[10]

		Favourable Change
HMPMA	75% ▼	Yes
Total NNN	65% ▼	Yes
CEMA	57% ▼	Yes
Total NNAL	39% ▼	Yes
HPMA	34% ▼	Yes
3-ABP	31% ▼	Yes
MHBMA	31% ▼	Yes
CO	19% ▼	Yes
4-ABP	17% ▼	Yes

Biomarkers of Exposure

Reduction in BoPH

Overall changes in biomarkers of potential harm in RTP adult smokers[10]

		Favourable Change
11-dh-TXB	19% ▼	Yes
8-iso-PGF2 Type III	3% ▲	No
8-iso-PGF2 Type VI	6% ▼	Yes
White Blood Cell Count	0%	No Change
sICAM	60% ▲	No
HDL	8% ▼	Yes

Biomarkers of Potential Harm

Biomarkers of Potential Harm are markers of physiological processes in the body such as inflammation, oxidative stress, and DNA damage. (see Clinical: Individual Risk, Pages 190-193)

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Epidemiology of Cessation



Benefits of Smoking Cessation

Quitting smoking reduces the relative risk of numerous smoking-related diseases and increases life expectancy for former adult smokers.

In a 2020 report by the U.S. Surgeon General, it was concluded that there was sufficient evidence to infer that smoking cessation reduces the relative risk of numerous cancers including lung, oral, oesophageal, liver, stomach, pancreatic, kidney, bladder, colorectal, cervical, and acute myeloid leukaemia.[1]

Smoking cessation also improves cardiovascular outcomes. Levels of high-density lipoprotein cholesterol (HDL-C, sometimes called 'good' cholesterol) rapidly improve. Additionally, risks associated with disease and death from cardiovascular disease, coronary heart disease and stroke are reduced over time when compared with those who continue to smoke.

For adult smokers already diagnosed with coronary heart disease, quitting smoking can reduce the risk of premature death, death from heart disease, and the risk of having a first or another heart attack.[1]

Inclusive of cardiovascular benefits, stopping smoking can afford respiratory health benefits. The relative risk of developing Chronic Obstructive Pulmonary Disease (COPD) is reduced, and for adult smokers already diagnosed with COPD, its progression and the rate of loss of lung function is reduced. Other respiratory symptoms (e.g. cough, phlegm production, wheezing) and infections (e.g. bronchitis, pneumonia) are also reduced. Lung function for adult smokers who quit can improve as early as two weeks after smoking cessation.[1]

According to the U.S. Surgeon General, some of the benefits occur almost immediately after quitting, while some accumulate with time. For example, a few days after quitting, the carbon monoxide level in a person's blood drops to normal. Fifteen years after quitting, a person's risk of coronary heart disease is close to that of a non-smoker.[1]

Life expectancy benefits in comparison with those who continue[2]

A 50-year epidemiological study on male British doctors has shown the impact of quitting smoking at certain ages can gain years on a smoker's life:

+10 years

Stop at 30

Gain up to 10 years

+9 years

Stop at 40

Gain up to 9 years

+6 years

Stop at 50

Gain up to 6 years

+3 years

Stop at 60

Gain up to 3 years

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The Benefits of Smoking Cessation According to a Report by the Surgeon General[3]

> Although the benefits of quitting are greater the earlier in life that an individual quits [...]. Even persons who have smoked for many years or who have smoked heavily can realize health and financial benefits from quitting smoking.
>
> **Robert R. Redfield, M.D.**
>
> Former Director of the U.S. Centers for Disease Control and Prevention (2018-2020)[1]

20 minutes after quitting

Your heart rate and blood pressure return to normal

12-24 hours after quitting

The level of carbon monoxide in your blood drops to normal

2 weeks to 3 months after quitting

Your circulation improves, your lung function increases and your risk of having a heart attack decreases

1 to 12 months after quitting

Coughing and shortness of breath decrease. Tiny hair-like structures (called cilia) that move mucus out of the lungs start to regain normal function, increasing their ability to handle mucus, clean the lungs, and reduce the risk of infection

1 year after quitting

Your added risk of coronary heart disease is half of that of a smoker's

5-15 years after quitting

Your risk of having a stroke is reduced to that of a non-smoker's, and your risk of getting cancer of the mouth, throat, or oesophagus is half that of a smoker's

10 years after quitting

Your risk of dying from lung cancer is about half that of a smoker's. Your risk of getting cancer of the bladder, cervix, larynx, kidney or pancreas decreases

15 years after quitting

Your risk of coronary heart disease is the same as that of a non-smoker

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Nicotine Replacement Therapies

We believe the best option for adult smokers is to quit. Nicotine Replacement Therapies (NRTs) are a part of the solution.

Smoking cessation

The best way for adult smokers to achieve risk reduction is to quit. Data from 2021 indicate that in the U.S., 66.5% of adults who were ever established smokers had quit smoking.[1] In Great Britain as of 2019, 62.5% of those who had ever smoked had quit.[2]

Quitting smoking can be difficult, but any smoker can quit if sufficiently motivated to do so.[3,4,5] Adult smokers use various approaches to quit, although the majority use no support (referred to as 'cold turkey'), despite the availability of many medications and behavioural support options.

Principles of NRTs

Nicotine Replacement Therapies (NRTs), particularly nicotine gum and patches, have been widely available for more than 30 years. NRTs typically use nicotine extracted from tobacco. Designed to replace some of the nicotine obtained from smoking, they help reduce cravings and withdrawal symptoms.

A Timeline of Smoking Cessation Aids

1970s
First NRT prototypes developed

1978 - 84
NRT gum authorised

1996
NRT available 'over the counter' (OTC)

2006
Chantix/Champix authorised by EMA/FDA[7]

2009
WHO places NRT on Essential Medicines List[8]

2011
Clinical study shows one year safety usage of NRT[9]

2013
FDA extends usage period of NRT to six months[10]

2021
WHO places Varenicline and Bupropion on the Essential Medicines List[11]

2024
WHO guideline for tobacco cessation in adults published[12]

> "Smoking-cessation products represent a standard [...] as a comparison product, because these products pose very few, if any, risks to health. [...] In principle, the closer the risks and exposures from the [modified risk tobacco product] are to cessation products, the more confident a regulator can be in the chances for net public health benefit."
>
> **Institute of Medicine**
> Scientific Standards for Studies on Modified Risk Tobacco Products, 2012 [6]

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Smoking Cessation Aids and Nicotine Replacement Therapies

Gum

The first NRT made available to adult consumers. Used orally, it is intermittently chewed for around 30 minutes, as needed, to release nicotine. It delivers nicotine polacrilex which absorbs through the buccal mucosa (inner lining of the cheek) to enter the blood stream. It is available in 2-6mg of nicotine.

Patch

Applied to the skin, nicotine is delivered at a relatively steady rate. Patches are generally placed on the upper chest, upper arm, shoulder, back, or inner arm and worn for 16 to 24 hours. Available in a range of dosages, they can deliver between 7-21mg of nicotine over a 24-hour period.

Inhaler

Vapourised nicotine is inhaled from a plastic cartridge and mouthpiece. Frequent, short, and shallow puffs are taken. Nicotine is delivered to the oral cavity (36%) and oesophagus and stomach (36%). Lung delivery is minimal (4%). Cartridges are available in 10mg and 15mg of nicotine strengths.

Mouth spray

Sprayed directly into the mouth, nicotine is absorbed into the bloodstream through the buccal mucosa. Approximately 1mg of nicotine per spray with around 150 sprays per bottle. Nicotine mouth sprays have been shown to deliver nicotine to the blood stream faster than other NRT formulations of the same strength.

Lozenge

Placed in the mouth between the gums and cheek, the lozenge dissolves in approximately 30 minutes. Nicotine is absorbed through the buccal mucosa slowly. Available in 2mg and 4mg nicotine formulations. Nicotine lozenges can be used every 1-2 hours up to 20 pieces per day.

Nasal spray

An aerosol of nicotine is sprayed into the nose through a pump-mechanised bottle with nozzle. Nicotine is absorbed relatively rapidly compared to other NRT systems. Approximately 1mg of nicotine is delivered in two sprays, one per nostril. Users can use up to a maximum of 40 doses per day.

Micro tabs

Designed to be held under the tongue where it slowly dissolves over approximately 30 minutes. Nicotine is absorbed sublingually. Each microtab contains 2mg of nicotine.

Varenicline (Chantix/Champix)

A pill that does not contain nicotine. Varenicline is a selective nicotinic receptor partial agonist, which acts to block nicotine from binding to specific receptors in the body. This inhibits its effect. It is licensed as a prescription-only treatment for smoking cessation in the U.S. and Europe. The standard regimen is 1mg twice a day for 12 weeks.

Cytisine

A pill that does not contain nicotine. Cytisine is a selective nicotinic receptor partial agonist, which acts to block nicotine from binding to specific receptors in the body. This inhibits its effect. Cytisine is available in many countries throughout the world. The standard regimen is a 25-day course.

Bupropion (Zyban)

A pill that does not contain nicotine. Developed as an antidepressant, it is also used to aid smoking cessation. A nicotinic receptor antagonist, it blocks nicotinic acetylcholine receptors inhibiting the effect of nicotine. It is licensed for smoking cessation in the U.S., UK and Europe. The treatment course with Bupropion usually lasts from 7 to 12 weeks.



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E-Cigarettes and Smoking Prevalence

AT A GLANCE

2X

Reduction in smoking prevalence in countries that embrace vaping, such as France, the United Kingdom, New Zealand, and Canada, compared to the global average[1]

88

Scientific studies have contributed to the following Cochrane review conclusion: "There is a high certainty that nicotine EC [e-cigarettes] increases quit rates compared to nicotine replacement therapy (NRT)."[2]

BAT's Smokeless Products (apart from Zonnic) are neither licensed nor marketed as smoking cessation products.

From a public health perspective, to be most effective, e-cigarettes should be both substantially less risky than cigarettes and provide an experience that encourages adult smokers, who would otherwise continue to smoke, to switch completely.

Availability of e-cigarettes can lead to greater reductions in smoking prevalence

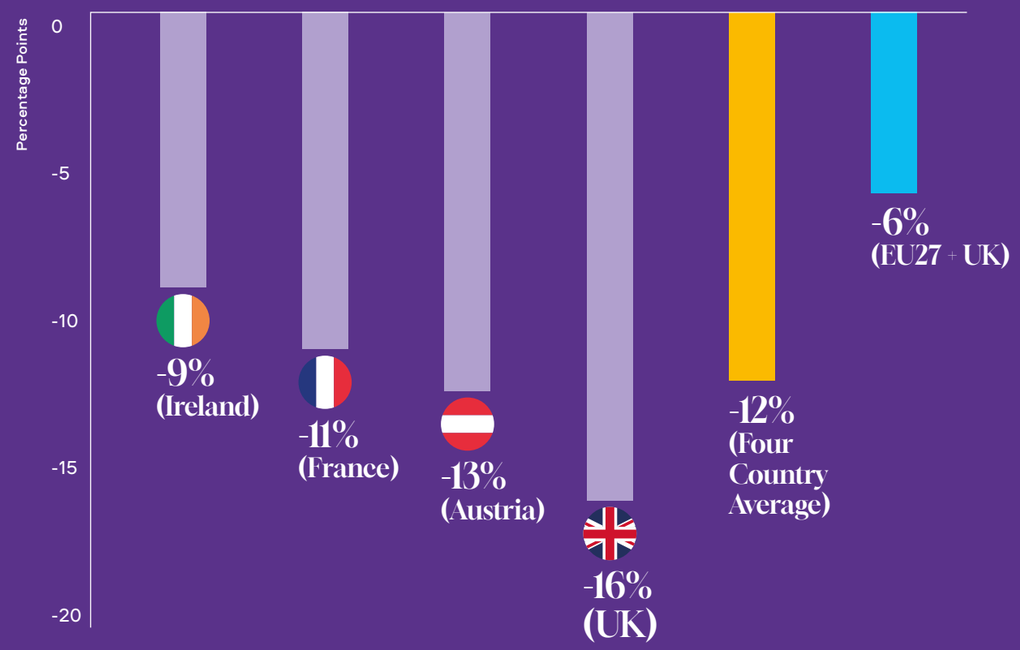
The impact of e-cigarettes on the prevalence of smoking can be seen in countries where vaping products have become widely available. Within the European Union, according to the Special Eurobarometer 506 survey report, Ireland (7%), France (6%), Austria (4%) and the UK (4%) have the highest rates of current e-cigarette use.[3]

These four countries showed significant declines in smoking prevalence between 2009 and 2020 (9 percentage points; 11 percentage points; 13 percentage points; and 16 percentage points, respectively). These declines were markedly above the EU27 + UK average of a 6-percentage point decline for the same period (Figure 1).

The UK Annual Population Survey 2021 showed that the percentage of adult smokers was only 13.3% of the population.[4] The UK Annual Population Survey 2021 report noted that "[v]aping devices such as e-cigarettes have played a major role in the decrease in smoking prevalence in the UK."

Outside of Europe, Canada and New Zealand are two additional countries where e-cigarettes are widely available. From 2012 to 2018, the smoking prevalence in Canada and New Zealand was reduced by four and three percentage points, respectively.[1] These reductions were double the global average percentage point reduction over this period (1.5%).

Figure 1. Smoking Prevalence Change 2009-2020



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Cochrane Review of Vapour Products

While not marketed or licensed as smoking cessation aids, independent public health research has concluded that e-cigarettes can be more effective than certain traditional nicotine replacement therapies.

The Cochrane Database of Systematic Reviews is the leading database used to evaluate existing data for a wide range of healthcare issues.[5] Cochrane reviews on the effectiveness of vaping products in smoking cessation were completed in 2014, 2016, 2020, 2021, 2022 and 2024. These reviews give health providers the informational tools they need to base decisions on whether to use vaping products as part of smoking cessation programmes.

The 2024 Cochrane review considered 88 studies, totalling more than 27,000 participants, and concluded that there is high certainty that nicotine-containing e-cigarettes increase quit rates compared to nicotine replacement therapy.[2]

> Vaping devices such as e-cigarettes have played a major role in the decrease in smoking prevalence in the UK.
>
> **Office for National Statistics, UK 2021** [4]

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04 Our Smokeless Science



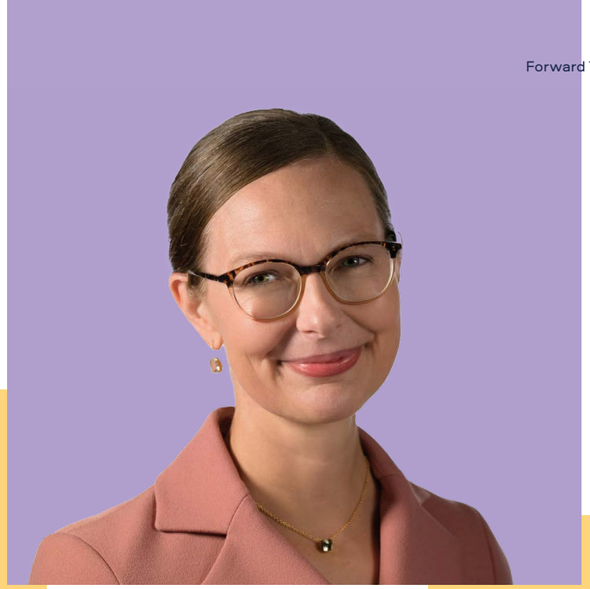
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Our Science & Innovation Leaders

We have created a leadership group that personifies our values and leads our 1750-strong integrated technical community in our eight locations across the globe. The team comprises technical leaders who blend expertise from our legacy businesses alongside new world class expertise and capabilities recruited from Food, Pharmaceutical and Consumer Packaged Goods industries. Our aim is to create compelling, innovative adult consumer inspired products, substantiated by public health relevant science to deliver our ambition of A Better Tomorrow™.

Dr James Murphy
Director, Research & Science



Dr Elaine Round

Group Head of Life Sciences

Career experience

2022-2023
Global Head of Toxicology

2021-2022
Vice President Scientific & Regulatory Engagement – Vapour and Oral

Degree(s)/qualifications

PhD
Genetics
University of Washington, Seattle

BA
Biology
Washington University in St. Louis



Dr James Murphy

Director, Research & Science

Career experience

2020-2023
EVP Scientific Research & Development, Reynolds American

2019-2020
Group Head of Reduced Risk Substantiation

Degree(s)/qualifications

PhD
Organic Chemistry
University of Edinburgh

BSc
Chemistry
Queen's University of Belfast



Tim Nestor

Executive Vice President, U.S. R&D, RAI Services Company

Career experience

2021-2023
Senior Vice President U.S. Product Deploy

2018-2021
Vice President R&D Global Modern Oral & U.S. Traditional Oral

Degree(s)/qualifications

BSc
Physics
Appalachian State University

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Patrick Doyle

Chief Executive Officer,
KBio Inc.

Career experience

2017-2021
CEO & BoD member, Stelexis

2016-2017
CEO & BoD member, SynthorX

Degree(s)/qualifications

LLM Master of Laws
Law
University of London

BSc
Pharmacology
University of Sunderland



Danni Tower

Group Head of Scientific & Regulatory Affairs

Career experience

2022-2023
Head of Liquids Discovery & Development and Flavour Centre of Excellence

2019-2022
Head of Vapour Product Development, Next Generation Devices & Liquids

Degree(s)/qualifications

MEng
Chemical Engineering
Imperial College of Science, Technology & Medicine



Dr Ryan Potts

Senior Vice President,
U.S. Scientific & Regulatory Affairs,
RAI Services Company

Career experience

2022-2023
Group Head of Scientific & Regulatory Capabilities

2020-2022
Head of Consumer Product Safety

Degree(s)/qualifications

PhD
Toxicology
University of Bath

MS
Toxicology
University of London

BSc
Pharmacology & Physiology
University of Manchester



Dr Allen Griffiths

Head of Science Discovery

Career experience

2019-2022
Head of Modified Risk Tobacco Product Capabilities

2016-2018
Head of Plant Biotechnology – Global Leaf R&D

Degree(s)/qualifications

PhD
Plant Physiology & Biochemistry
University College North Wales Bangor

BSc
Biochemistry
University College North Wales Bangor

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Dr Summer Hanna

Head of Scientific Regulation

Career experience

2021-2023
Head of Scientific Regulatory Engagement, Legal & External Affairs

2019-2021
Principal Cannabinoid Science Manager

Degree(s)/qualifications

PhD
Analytical Chemistry
Wake Forest University, North Carolina

BSc
Chemistry
Winthrop University, South Carolina



Ed Forsdike

Head of R&D, Wellbeing & Stimulation

Career experience

2020-2022
Head of Global Vapour R&D

2018-2022
Group Head of Strategic Science & Technology

Degree(s)/qualifications

MEng
Mechanical Engineering
Durham University

For more than 15 years our R&D centre in the UK has operated a 12-month undergraduate placement scheme, fostering future talent in STEM subjects, while also recruiting a diversity of technical backgrounds and cultures. In the past four years our intake of female scientists and engineers has risen (from 20% intake in 2020 to 40% in 2024). Nurturing early talent in STEM, especially female talent, supports our gender equity agenda. Currently, 53% of our Research & Science Director's Leadership Team are women.



Dr Hugo Tan

Global Medical Safety Officer

Career experience

2022-2024
Regional Head of Scientific Engagement, APMEA

2019-2022
Medical and Regulatory Director, AstraZeneca Hong Kong & Macau

Degree(s)/qualifications

MBBS
International Medical University, Malaysia

MBA
Manchester Business School



Luigi Giucca

Group Head of New Categories R&D

Career experience

2021-2023
Global Head of Supply Network Operations

2016-2021
Group Head of Supply Chain

Degree(s)/qualifications

BSc
Engineering & Chemical Engineering
Sapienza Università di Roma

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A Global R&D Network

Owensboro, U.S.
R&D Centre
KBio Inc.



Trieste, Italy
Innovation Centre
BAT Trieste S.p.A.



Winston-Salem, U.S.
R&D Centre
RAI Services Company



Cachoeirinha, Brazil
R&D Centre
Souza Cruz Ltda.



Southampton, UK
Innovation Centre
British American Tobacco (Investments) Limited



Southampton, UK
R&D Centre
British American Tobacco (Investments) Limited



Malang, Indonesia
Product Centre
PT Bentoel Prima



Shenzhen, China
Innovation Centre
Nicoventures Technical (Shenzhen) Co. Ltd.



Kuala Lumpur, Malaysia
Product Centre
BAT ASPAC Service Centre Sdn Bhd.



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A Global R&D Network



Owensboro, U.S.
R&D Centre
KBio Inc.

Launched in 2022, KBio is our new biotech company that has a pharmaceutical development and protein manufacturing focus with facilities in Owensboro, KY and San Diego, CA. The company researches the use of plant biotechnology and bioprocessing techniques to produce plant-made proteins for bioindustrial and pharmaceutical applications. Included within the facilities are automated, environmentally controlled plant growth spaces as well as current Good Manufacturing Practice (cGMP) clean room suites for product manufacturing.

Winston-Salem, U.S.
R&D Centre
RAI Services Company

The Bowman Gray Technical Center (BGTC) hosts approximately 250 scientists, product, and regulatory experts trained in a variety of disciplines, including chemistry, engineering, toxicology, preclinical biology, clinical research, behavioural science, and statistics & modelling. BGTC's analytical testing labs are ISO 17025:2017 accredited, Good Laboratory Practice (GLP) and Good Manufacturing Practice (GMP) compliant, and run 128 routine analytical methods in support of our regulatory submissions, product deployment activities, and manufacturing operations. Additional capabilities include a 140,000 square foot pilot plant and multiple product development labs supporting U.S.-specific development and deployment for Reynolds' product portfolio.

Trieste, Italy
Innovation Centre
BAT Trieste S.p.A.

Our Innovation Centre in Trieste hosts a new manufacturing site for our Smokeless Products, a digital boutique, innovation lab and centre of excellence for digital transformation and digital marketing. It is dedicated to research, development and production of Smokeless Products. The building is constructed to minimise its environmental impact with the objective of being carbon neutral, with a particular focus on energy efficiency and the use of renewable sources.

Cachoeirinha, Brazil
R&D Centre
Souza Cruz Ltda.

Brazil's R&D Centre integrates multiple R&D functions in a single location, creating a perfect environment for synergies and innovation. The site proudly stands as the second-largest analytical capability laboratory in South America, providing services for BAT operations around the world. It houses extensive Analytical Services laboratories, Sensory, Flavour Development, Prototyping Hub, Data Management, Product Regulatory Compliance, Product and Packaging Development, as well as Global Leaf Agronomy that forges tools and strategies through Data Science for all R&D.

Southampton, UK
Innovation Centre
British American Tobacco (Investments) Limited

First there was Shenzhen, then there was Trieste... now we have our latest BAT Innovation Centre. The £30 million state-of-the-art facility will help accelerate development of our next generation Smokeless Products as we strive to achieve our vision of A Smokeless World. Inside our new laboratories, colleagues will carry out research for:

- Oral Nicotine Pouches
- Liquids and flavours for Vapour Products
- Heated Products
- Wellbeing and Stimulation - Beyond Nicotine.

The Centre will also support work on packaging, engineering, innovation development and system integration

Southampton, UK
R&D Centre
British American Tobacco (Investments) Limited

Established in 1956, Southampton has been the central home of our R&D for almost 70 years. Initially a centre of excellence for chemistry, our capabilities have grown significantly over the decades with growth in biology, toxicology, consumer behaviour, clinical studies, and mechanical/electrical engineering, that have helped advance our understanding towards developing and establishing our multi-category smokeless portfolio.

Malang, Indonesia
Product Centre
PT Bentoel Prima

Indonesia's Product Centre is a focused hub with capabilities that work in synergy, where the Product Development team can use the Prototyping Hub for smaller-scale testing of their products, as well as several analyses in Analytical Services Laboratories. This centre is strategically positioned within our global R&D network, contributing valuable information to enhance our product portfolio and meet evolving business needs.

Shenzhen, China
Innovation Centre
Nicoventures Technical (Shenzhen) Co. Ltd.

First established as a joint venture with BAT Operations, BAT R&D entered China in 2019 with a focus on establishing a technical hub for device development. Since 2019, the Shenzhen Innovation Centre has grown significantly and has a wide range of experts who have rich experiences in mechanical and electrical engineering, industrial design, device safety, compliance, validation, and certification. Our R&D presence in China enables us to develop strategic partnerships in a region that is home to around 90% of the world's smokeless device suppliers.

Kuala Lumpur, Malaysia
Product Centre
BAT ASPAC Service Centre Sdn Bhd.

Kuala Lumpur is a hub for Combustibles Product Portfolio, Other Tobacco Products (OTP), Packaging Innovations, Heated Products Deployment, Leaf Sourcing and Product Regulatory Compliance. The team based here manage combustibles and Heated Products deployment for markets within the APMEA region and for OTP development globally.

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A Global R&D Network

Number of people

>1750

Gender

42%
Female

58%
Male

Age

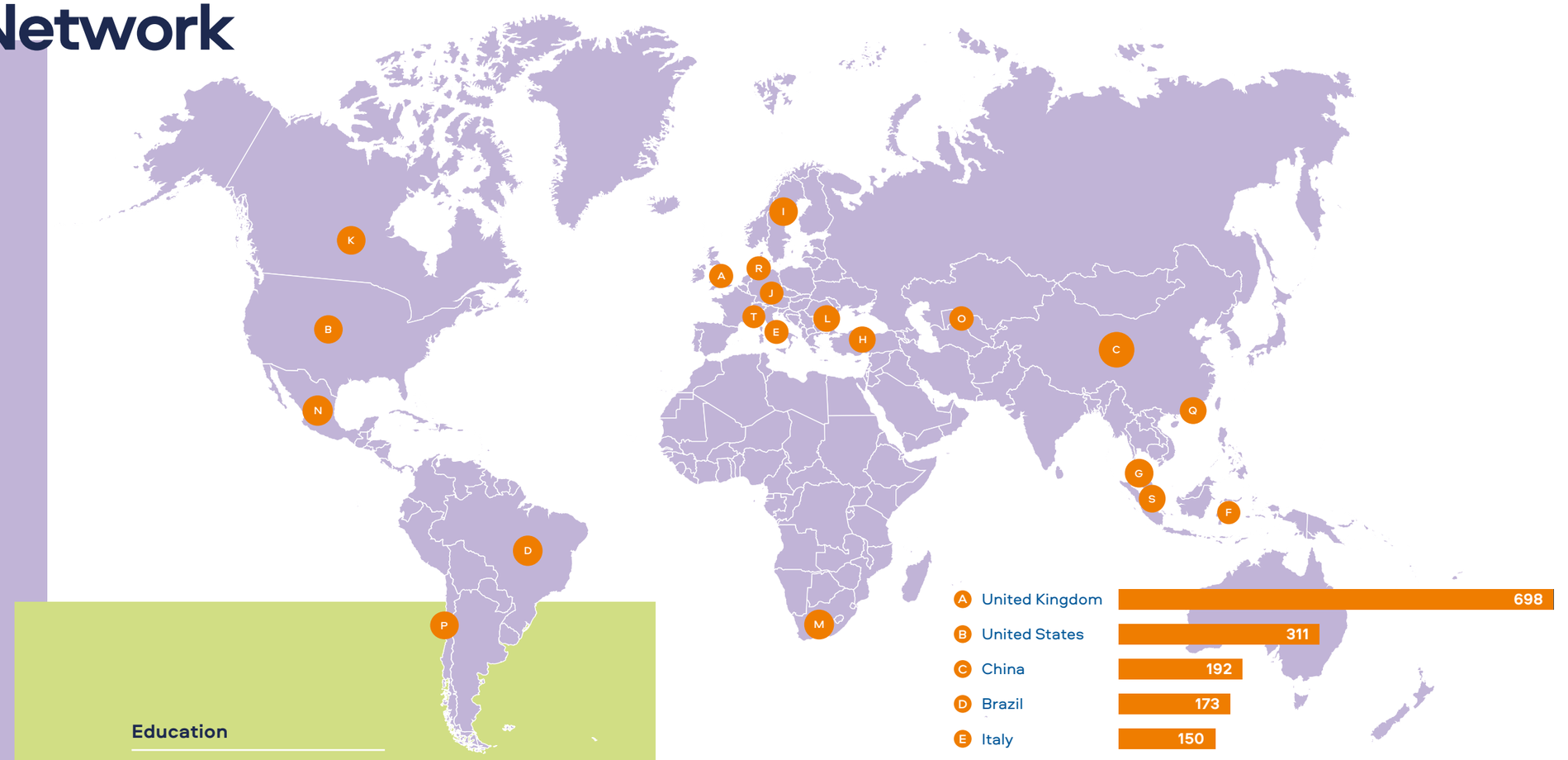
65+
Oldest member

18
Youngest member

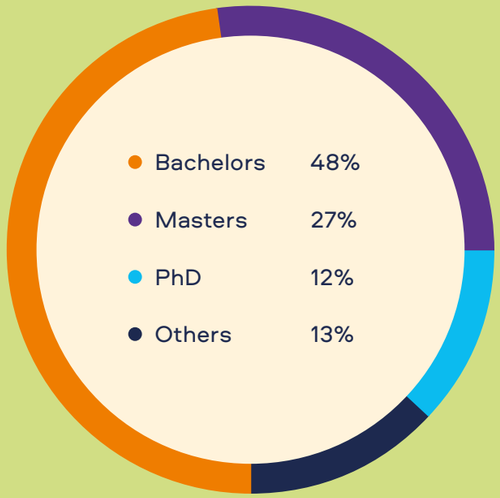
Length of service

> 40 years
Longest serving

< 12 months
Newest member



Education



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Our employees are at the heart of our success. Together we continue to build an inclusive culture where difference is valued, where employees from diverse backgrounds and experiences feel that they belong, are at their best and inspired by our vision of A Better Tomorrow™.

Lucy Evara
Human Resources - Scientific Research & Development



Nationalities

Nationalities	Number
American	311
Argentine	7
Armenian	1
Australian	2
Bangladeshi	3
Belgian	1
Bosnian	3
Brazilian	208
British	409
Bulgarian	1
Cameroonian	4
Canadian	4
Chilean	4
Chinese	191
Colombian	1
Costa Rican	1
Croatian	5
Cuban	1
Cypriot	3
Czech	4
Danish	1
Dutch	6
Egyptian	2

Nationalities	Number
Estonian	1
Ethiopian	1
Filipino	3
Finnish	1
French	6
German	8
Ghanaian	1
Greek	9
Honduran	2
Hong Konger	4
Hungarian	5
Indian	28
Indonesian	90
Iranian	2
Irish	11
Italian	143
Kenyan	1
Laotian	1
Latvian	1
Lithuanian	3
Malaysian	36
Mexican	5
Nepalese	2

Nationalities	Number
New Zealander	3
Nigerian	4
Norwegian	1
Palestinian	1
Pakistani	15
Polish	25
Portuguese	9
Puerto Rican	1
Romanian	17
Russian	7
Serbian	7
Singaporean	1
Slovakian	1
Slovenian	1
South African	20
South Korean	10
Spanish	11
Sri Lankan	1
Swedish	11
Swiss	2
Taiwanese	5
Trinidadian	1
Tunisian	1

Nationalities	Number
Turkish	44
Ugandan	1
Ukrainian	3
Uzbekistani	6
Venezuelan	4
Vietnamese	1
Zimbabwean	4

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Our Capabilities

Our transformation is underpinned by our purpose of reducing the health impact of our business.

To enable our transformation, we strive to encourage adult smokers, who would otherwise continue to smoke, to switch to reduced-risk*† Smokeless Products. Our focus continues to be on finding and developing new innovations and products and establishing data-based insights that evolve our innovation strategy to create products that could reduce the burden on global public health.

We are dedicated to innovation through every thread of the company, and we believe that success and longevity will be achieved through a science-based transformation.

Over the last decade, we have embedded the innovation of Smokeless Products in our organisation. This ensures the correct behaviours, structures and practices are in place to enable innovation to thrive. Added to that has been the evolution of our technical capabilities to enable the development of consumer loved products and the increased capabilities to scientifically assess their impact on public health.

We are in our eighth decade of research and development having established R&D sites in the U.S. and UK in the 1950s. Back then, when BAT principally sold cigarettes, the focus was predominantly on the chemical and toxicological evaluation of cigarette smoke. With the advent of improved analytical techniques, novel spectroscopic methods enabled the accurate identification of individual compounds in cigarette smoke, even those present at very low (micro-or nano-gram) levels.

Biology advanced with the creation of novel laboratory methodologies that could assess the toxicological impact of cigarette smoke while in parallel, biotechnology and specifically molecular biology techniques were applied to mapping the tobacco genome. The first clinical studies were conducted in the 1980s and 1990s to assess the pharmacokinetics and pharmacodynamics of novel tobacco products and with the advent of novel Tobacco Heating products, more sophisticated clinical studies were conducted to enable the measurement of Biomarkers of Exposure.

A glimpse of our science through time



1953

Reynolds R&D established



1956

Southampton R&D established



1960s

Chemistry dominates



1970s

Greater focus on smoking behaviour and biology



1980s

Biotechnology embraced



1990s

Increasingly sophisticated analytical techniques to measure smoke constituents



2000

Advances in biology: biomarkers, diverse cell and tissue systems

2010s

Major focus on reduced-risk products



2011

BAT and Reynolds R&Ds begin to collaborate

2017

BAT acquires the remaining share of Reynolds in 2017

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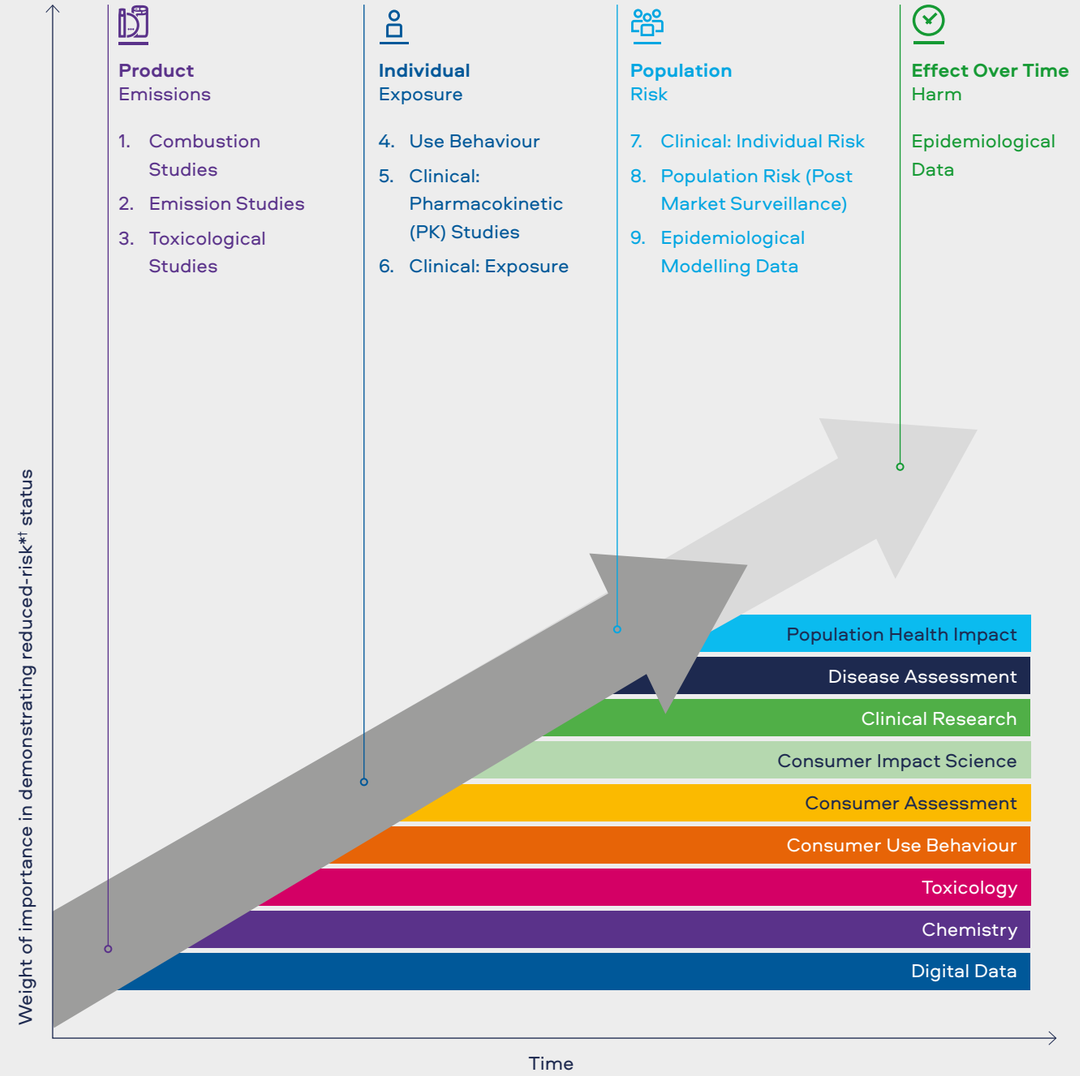
Today's multi-disciplinary R&D builds on the strong legacy of those origins, where we conduct research using multiple core scientific disciplines, aligned to our scientific assessment framework (Figure 1).

This approach to our transformation has married recruiting new talent from other industries with specific new skillsets, alongside a focused technical capability development programme of our longer-tenure scientists.

> **The measure of intelligence is the ability to change.**
>
> **Albert Einstein**



Figure 1. Our Science Capabilities and our 9-Step Risk Assessment Framework



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Figure 2. Science Capabilities Architecture

Chemistry	Toxicology	Consumer Use Behaviour
Thermodynamics	Quantitative Risk Analysis	Human Factors
Combustion Chemistry	Physiological Based	Topography
Untargeted Analysis	Pharmacokinetic [PBPK] Analysis	Session Consumption
Mainstream Aerosol Components	Toxicology	Daily Consumption
Harmful and Potentially Harmful Constituents	Mutagenicity	Product Preferences
Sidestream Aerosol Components	Cytotoxicity	Actual Use
Environmental Aerosol Analysis	Genotoxicity	Consumer Switching
Chemometrics	Systems Biology	Health Wearables
	21st Century Toxicology	
	Organ on a Chip	

Consumer Assessment	Consumer Impact Science	Clinical Research
Neuroscience	Chemosensory	Pharmacokinetics
Bioactive Pathway Analysis	Olfactory Science	Pharmacodynamics
Receptor Analysis	Gustatory Science	Abuse Liability
Calcium Imaging	Material Odour	Biomarkers of Exposure
Genomics	Human Odour Assessment	Safety Monitoring
Need State Methodologies	Teeth Staining	Disease Markers
	Skin Staining	Quality of Life
	Indoor Air Quality	Biomarkers of Compliance
		Clinical Research
		Ethics

Disease Assessment	Population Health Impact	Digital Data
Adverse Outcome Pathways	Real World Data	Data Standards
Inflammation	Real World Evidence	Statistical Analysis
Endothelial Function	Dynamic Population Modelling	Scientific Computing
Lipid Metabolism	Consumer Risk Perception Studies	Sparse Data
Oxidative Stress	Smoker Migration	Algorithms
Clotting	Longitudinal Consumer	Meta Analysis
Lung Function	Behavioural Analysis	Artificial intelligence
	Consumer Intentions and Perceptions	Actual Use
	Epidemiology	Machine Learning

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We utilised the following ethos as we built our technical capabilities (Figure 2):

- **Chemistry:** Advance from 2-D to 3-D chemical assessment incorporating the latest techniques that would enable characterisation of both whole aerosols in addition to the quantification of single molecules more accurately.
- **Toxicology:** Adoption of state-of-the-art Toxicological methods, building on expertise in classical toxicology, to enable more disease relevant assessment with a focus on reducing animal testing to a minimum via 21st Century Toxicology and novel Organ on a Chip methodologies.
- **Consumer Use Behaviour:** While smoker use behaviour has been measured for decades, augment techniques to enable measurement of Smokeless Products and how they impact adult consumers' lives.
- **Consumer Assessment:** As we continue to encourage adult smokers who would otherwise continue to smoke to switch to Smokeless Products, we are developing a range of techniques that enable better assessment of products that meet consumer preferences.
- **Consumer Impact Science:** Learn from other industries to develop novel scientific assessment methods that would measure the impact of Smokeless Products on adult smokers, in terms of personal hygiene and social consideration.
- **Clinical Research:** Create a suite of foundational clinical techniques that enables the assessment of the risk profile of our Smokeless Products relative to smoking.
- **Disease Assessment:** Augment classical clinical study methodologies to develop longer term clinical studies with Biomarkers of Potential Harm that are adaptable to novel Adverse Outcome Pathways methodologies.
- **Population Health Impact:** Entering into the second decade of transformation, changes in disease outcomes for adult smokers who have completely switched to Smokeless Products (as compared to continued smoking) are expected. Adapting cutting edge technologies and methodologies from the pharmaceutical industry and public health research would enable the measurement of morbidity related outcomes at a population level.

Lastly, **Digital Data** was one discipline that was required across all of the capabilities. A look at the evolution of the data landscape, at how technology is helping businesses solve for today, and how the data analysis that's possible today can provide us with a new understanding of how we can perform better in the future. Our ethos in augmenting our expertise on Digital Data is based on continuing to build expertise in the classical fields of statistical modelling and analytics, to bringing in novel techniques, which enable the analysis of sparse data and the creation of machine learning systems.

Our ethos in R&D is one of continual improvement where we strive for quantum leaps in our capabilities, but also continually seek the small percentage gains. We envision that advancing our technical capabilities will continue as one of the most important factors in developing and assessing the impact of Smokeless Products on global public health.

Overview of Scientific Frameworks



Why is there a need for a scientific assessment framework for Reduced-Risk*† Products?

Reduced-Risk*† Products (RRPs), whether they are Heated Products, Vapour Products or Oral Nicotine Pouches, are all relatively new. While we are still understanding their long-term effects, we know that in the short-term, our Smokeless Products are less risky than smoking. Absent conclusive epidemiology, there is no single test that would determine that a new product is, for certain, reduced risk compared to another. So scientists both from industry[1-5] and from public health[6,7,8] have set out a series of tests that, when taken as a whole, would help give confidence to comparative risk assessments.

Weight of evidence approaches

Most proposed scientific assessment frameworks include chemical, toxicological and clinical studies.

Chemical studies

Chemical studies fall into two broad categories: the first measuring the level of toxicants found in the emissions of the RRP and the quantification of what reductions are seen relative to that of a reference cigarette.[9,10,11] The second examines whether there are toxicants not found in cigarette smoke present in the emissions of the RRP.[12,13,14]

Toxicological studies

Toxicological studies can be:

- **In silico:** using computer models built on previous studies to assess the likely impact of any toxicants in RRP emissions[15]
- **In vitro:** using laboratory biological systems typically developed and validated for many different chemicals and mixtures to observe the impact of the emissions on cells cultured in the laboratory on biological changes to the cells[16,17,18]
- **In vivo:** which uses live animals and is not undertaken by BAT unless required to do so by regulators.[19] This looks at changes in organs or other biological material after exposure[20]

Clinical studies

Clinical studies ask people, typically regular adult smokers, to take part in studies where they attend clinics and provide samples of blood, urine or other biological samples. These are then used to measure biomarkers that either measure the amount of exposure to specific toxicants (biomarkers of exposure) or biological indicators of potential disease pathways (biomarkers of potential harm).[21,22] Other clinical studies look at nicotine uptake.[23,24]

The above focus is on the potential reduction of risk to a smoker as compared to continued smoking. To look at the reduction in harm to a population, other studies may be needed that look at what happens in terms of uptake, use and cessation when an RRP is commercially introduced.

Comparison to scientific frameworks for other product categories

The assessment of RRPs consists of some relatively unique challenges given the range of diseases associated with smoking. Assessment frameworks for other product categories provide some guidance. These are often focused on efficacy against a specific biological endpoint (such as blood pressure reduction) or disease (such as Alzheimer's) and their evaluations are weighted to several phases of clinical study to determine what effect the new drug may have, and what side-effects might occur.[25] For functional foods, where additives may be applied that might have a biological benefit, again typically the biological endpoint (such as reduction in cholesterol levels) is reasonably closely defined.[26]

In each of these cases there are often regulators who set common approaches to what data is expected and how it will be judged. However, with RRPs there are, to date, few regulators who have set out an assessment framework. The U.S. Food and Drug Administration is an example of one that does have guidelines but no prescriptive approach.

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

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Our Scientific Framework

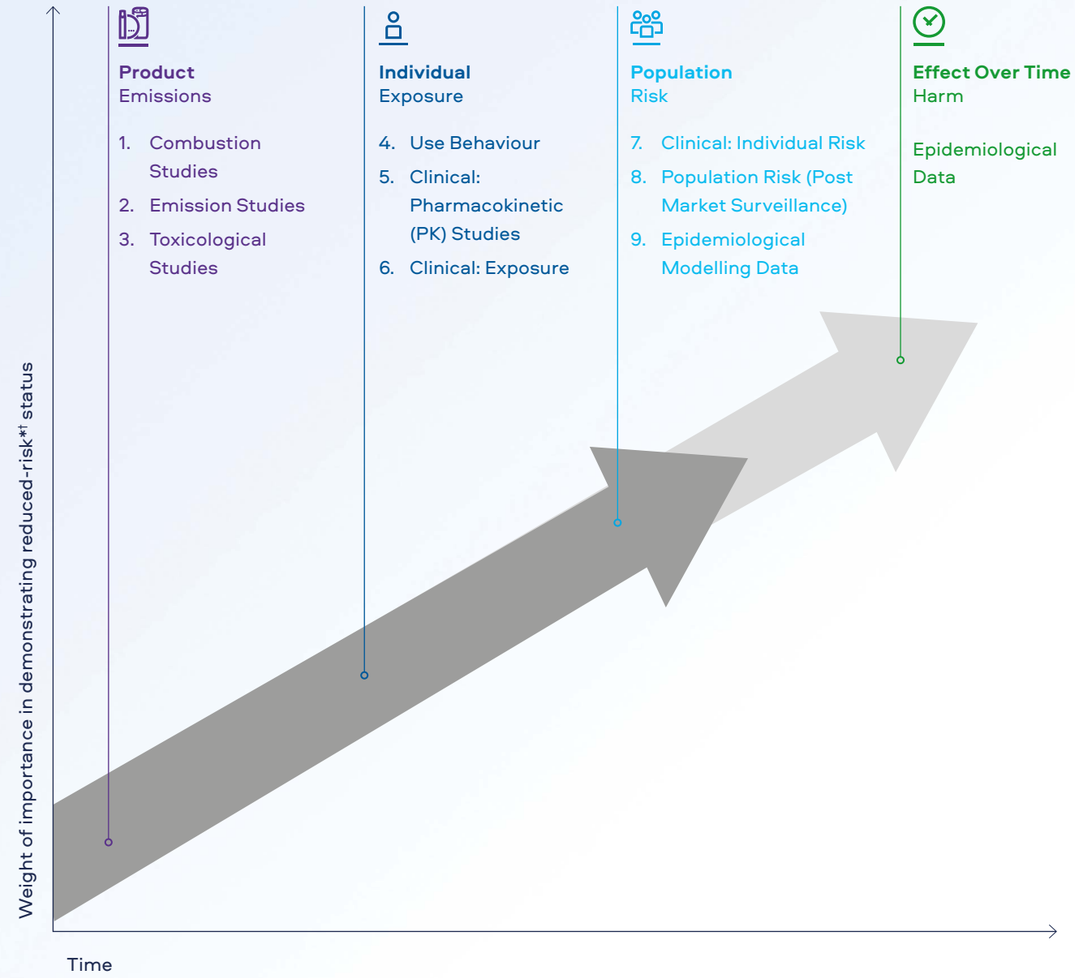
We first shared our framework approach 'for the assessment of Reduced-Risk Tobacco and Nicotine products' in 2015.[1] Over time, the presentation of our approach has evolved; however, the principles behind how our weight-of-evidence approach is used to assess our Smokeless Products have remained consistent.

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Our 9-Step Risk Assessment Framework



We look to understand:

How the product works;

How the product may impact an individual;

How the product may impact a population; and

What the effect of time may be.



Dr Mark Forster
Principal Scientist,
Global Life Sciences

The original presentation of our 9-Step Scientific Risk Assessment Framework used the headings of Emissions, Exposure, Risk, and Harm. The evolution of this Framework now refers to these events as Product, Individual, Population, and Effect Over Time. We believe these titles better explain how the scientific evidence explores the Smokeless Products' effects at each assessment stage.

Product

When we consider how the product works, our focus is on its emissions and how these compare to cigarettes.

01 Combustion Studies

It is the combustion of tobacco in cigarettes that produces the thousands of chemicals in smoke.[2] We have established a series of analytical techniques to determine that there is no combustion in our Smokeless Products.[3]

02 Emission Studies

In the absence of combustion, the aerosols of our Vapour and Heated Products are simpler, compared to cigarette smoke. We measure the levels of toxicants in these aerosols and compare them to those found in cigarette smoke, demonstrating significant reductions.[4,5]

Oral Nicotine Pouches do not form an aerosol. We measure the toxicant levels that can be extracted from these products and compare these levels to those found in cigarette smoke. With no combustion or tobacco, these products show the lowest levels of toxicants compared to cigarette smoke.[6]

03 Toxicological Studies

With our Smokeless Products having simpler aerosols and extractions, and lower levels of toxicants, we then determine their impact on biological cells and tissues compared to cigarette smoke. Our toxicological assessments use a variety of standardised historical and contemporary cell- or tissue-based test methods.[7,8] These studies help determine that the aerosols and extractions of our Smokeless Products have reduced toxicity compared to cigarette smoke.[9,10,11]

Individual

Once we have proven that a Smokeless Product can offer a smoker a reduction in toxicants and toxicity, we determine whether adult consumers may use the product in a way which negates these reductions.

04 Use Behaviour

We conduct clinical studies with current adult smokers to understand how adult consumers use the product and how often they use it. This information helps assess consumers' exposure to product emissions and informs the design of our laboratory and clinical studies, which aim to mimic actual usage patterns.

05 Clinical: Pharmacokinetic (PK) Studies

We conduct clinical studies to compare how nicotine from our Smokeless Products is absorbed and metabolised before, during, and after product use. We compare this data to historical cigarette data. This is important to demonstrate that our Smokeless Products can be satisfactory alternatives for adult smokers who would otherwise continue to smoke.

06 Clinical: Exposure

We conduct clinical studies to determine whether the reduction in toxicants in our Smokeless Products' aerosols and extractions result in reductions in exposure for adult smokers that switch completely. Biomarkers that indicate product exposure to certain toxicants are measured in the user's urine and bloodstream. We compare adult smokers who switch to Smokeless Products, with adult smokers who continue to smoke, and adult smokers who quit. Overall, all our Smokeless Products showed significant reductions in exposure to toxicants by adult smokers who switched completely.[12,13,14]

Population

Once we have proven that individuals will use our products in a manner that does not offset the described toxicant reductions, we look to determine what the long term and population effects could be.

07 Clinical: Individual Risk

We conduct longer-term clinical studies of at least three months duration. We evaluate changes in biomarkers of potential harm (BoPH). These BoPH are associated with the potential development of smoking-related diseases. Overall, all our Smokeless Products showed favourable changes in these biomarkers by adult smokers who switched completely.[12,13,14]

08 Population Risk (Post Market Surveillance)

We monitor the natural consumption behaviour of a population over time to understand potential effects relevant to Tobacco Harm Reduction (THR). We have evidence that demonstrates average daily consumption of our Smokeless Products is comparable and/or lower than smoking consumption rates.[15]

09 Epidemiological Modelling Data

We have developed and validated a modelling tool to assess a wide range of scenarios that consider potential benefits and harms from changes in tobacco and nicotine product use patterns.[16,17] We can model if there is a potential survival benefit in smoker groups who completely switch to Smokeless Products. We can model this data against the risk of never- and former-adult smokers adopting the new product. These types of studies evaluate population health risks and predict how these risks may change over time.

Effect Over Time

We know it is not possible to accelerate time; however, understanding the long-term effects of using Smokeless Products is important. We are constantly assessing how we can leverage available real-world evidence and data from adult smokers who have switched to Smokeless Products, long-term.

Long-term epidemiological data exists for traditional Oral Tobacco Products (snus) that demonstrate its THR potential.[18,19] Through our risk assessment framework, we have demonstrated that Oral Nicotine Pouches have reductions in toxicants, toxicity and exposure comparable and lower than snus, which would support the bridging of snus epidemiological data to the Oral Nicotine Pouch category.[6]

A weight of evidence for Tobacco Harm Reduction

Our risk assessment framework enables us to deliver a body of evidence that validates the reductions in toxicants, toxicity, and exposure for our Smokeless Products when compared to cigarettes. We believe this evidence should increase acceptance of THR principles by regulators which can help encourage adult smokers who would otherwise continue to smoke to switch to smokeless alternatives.

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> **Where possible we conduct our research in third party labs using accredited third-party methods to ensure impartiality and robustness of our science.**

Danni Tower
Group Head of Scientific & Regulatory Affairs

Strategic Approach to Scientific Assessment

Assessment of the reduced-risk*† profile of our Smokeless Products hinges not only on the weight of evidence across our 9-Step Risk Assessment Framework but also on the rigour underpinning each individual assessment.

These elements cut across many dimensions; from the quality of the laboratories performing the studies and the methods utilised to generate data, to the competency of the scientists conducting the research and the systems that capture and archive these data. These elements of scientific rigour are:

Quality Systems

As a fundamental principle, the quality of scientific data is only as good as the quality of the laboratory that performs the research. For chemistry analyses such as combustion and emissions studies, our laboratories adhere to the International Organization for Standardization (ISO) standards for (1) quality management systems (ISO 9001) and (2) competence, impartiality, and consistent operation of laboratories (ISO 17025).

For toxicological assessments, studies are conducted in accordance with Good Laboratory Practice (GLP).

In clinical or observational assessments involving human subjects, studies are conducted in accordance with the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) Guideline for Good Clinical Practice (GCP) E6(R2). If applicable, bioanalytical procedures are conducted under GLP.

For population-level assessments such as cross-sectional surveys or post market surveillance, studies are conducted in accordance with the guidelines for Good Epidemiological Practice (GEP).



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Scientific Methods

Incremental to a laboratory's quality system, scientific data is most reliable when generated using methods that have been validated, assessed through intra-laboratory studies, and standardised.

For chemistry analyses, our data is generated with ISO methods or CORESTA (Cooperation Centre for Scientific Research Relative to Tobacco) recommended methods (CRM). If neither option exists, internally developed methods are validated and added to the laboratory's scope of accreditation under ISO 17025.

Regulatory toxicology studies are conducted to the relevant, internationally agreed testing guidelines by the Organisation for Economic Co-operation and Development (OECD).

Methods for assessments with human subjects, at the individual or population level, are conducted in accordance with ICH E6(R2), GCP, GLP, and GEP where relevant, other applicable regulatory requirements, and/or relevant guidance for tobacco product regulatory applications (e.g. U.S. Food and Drug Administration).



Scientific Training

The rigour of our laboratories and methods means little without the strength of our most important asset, our people. That's why initial and ongoing training of our scientists is a critical component to the science we conduct on our Smokeless Products.

Our chemists are trained to perform their assigned tasks through their education, training and experience. Technical proficiency may include, but is not limited to, initial test method training on specific work instructions, web-based technical trainings with skill or competency demonstration, formal training by an external training facilitator, refresher training, and on-the-job training administered by a subject matter expert. A training matrix is maintained as a record of employees trained to perform specific methods.

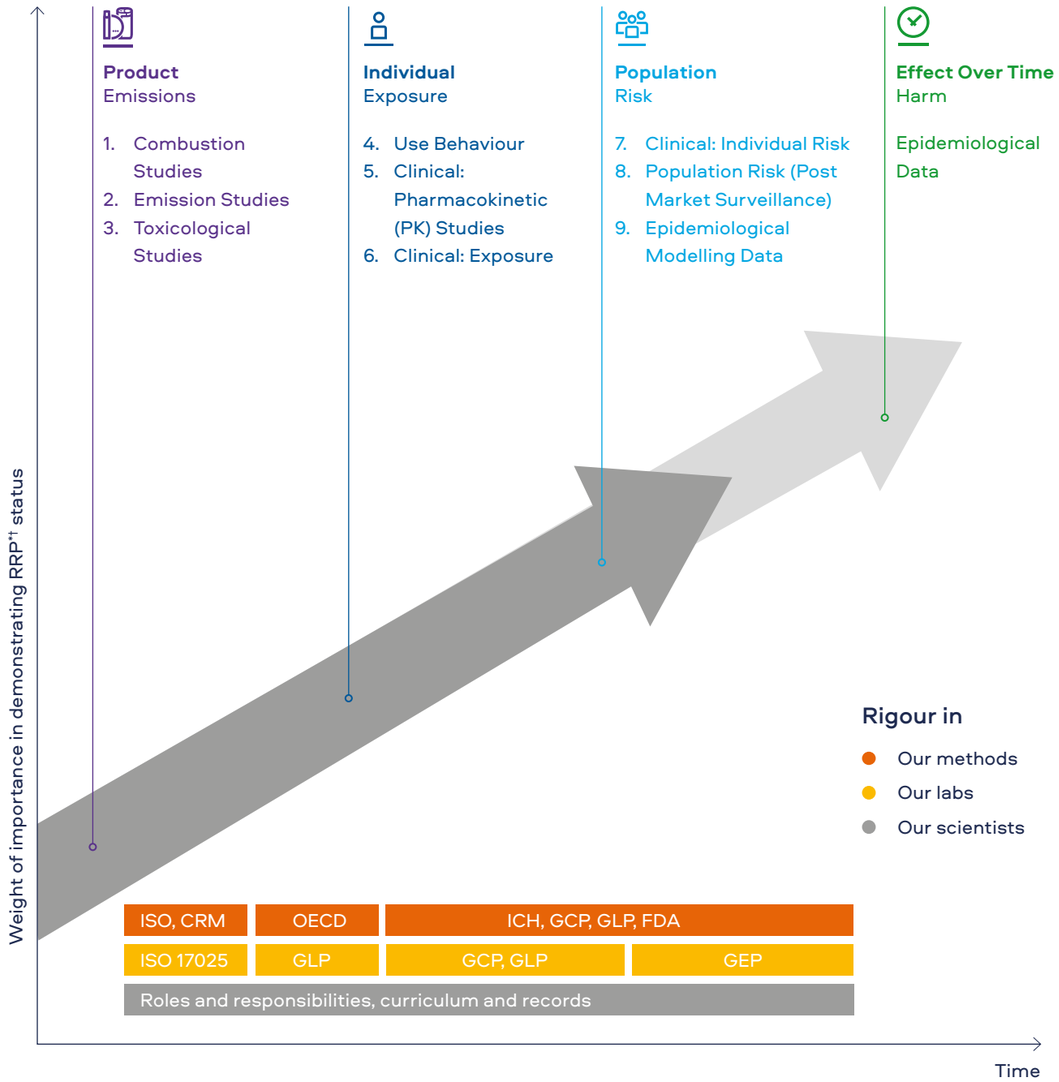
For our preclinical scientists, team members are trained in GLP, and training records are maintained for relevant standard operating procedures (SOPs).

Training for our clinical researchers and, as relevant, our epidemiological researchers, is focused on the fundamentals of ethical research, conduct of research in accordance with standards, clarity on roles and responsibilities, and ensuring the quality, accuracy, and credibility of study data. All team members are trained in GCP and, as relevant, GLP (21 CFR Part 58).

Specific roles and responsibilities for each team member are assigned and communicated via individual job descriptions and associated training curricula. This ensures that personnel possess the necessary training, skills, experience, and education to adequately perform their assigned responsibilities. All training is documented in our electronic quality management system (e-QMS).

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Rigour in our 9-Step Risk Assessment Framework



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> The rigour of our laboratories and methods means little without the strength of our most important asset, our people.
>
> **Danni Tower**
> Group Head of Scientific & Regulatory Affairs

ISO: International Organization for Standardization

CRM: Certified Reference Materials

OECD: Organisation for Economic Co-operation and Development

GLP: Good Laboratory Practice

ICH: International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use

GCP: Good Clinical Practice

FDA: U.S. Food and Drug Administration

GEP: Good Epidemiology Practice

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Seeking Validation of Our Science

> All science irrespective of who conducts it should be judged on its merit.



Dr Chris Junker
Vice President,
U.S. Scientific & Regulatory Affairs,
RAI Services Company

The scientific ecosystem works best when science is judged on its merits.

More journals are refusing to even consider industry-funded research for publication[1,2] and some scientific meetings refuse entry to industry scientists.[3] Academic researchers who do accept industry funding risk the loss of government funding and, in some cases, the designation of their institution.

We can draw on the experience of other industries to address these challenges. For example, the Institute for the Advancement of Food and Nutrition Sciences (IAFNS) Assembly on Scientific Integrity recently updated its Guiding Principles for Funding Food and Nutrition Research.[4] These provide a framework for minimising bias and promoting integrity in industry-funded research.

With these challenges in mind, our three tenets to drive validation amongst the scientific community are:

01 Transparency of industry science

Industry researchers are encouraged to publish in available peer-reviewed journals and present at scientific meetings. Sharing data with external researchers (e.g. online) increases research transparency.

02 Collaborative research

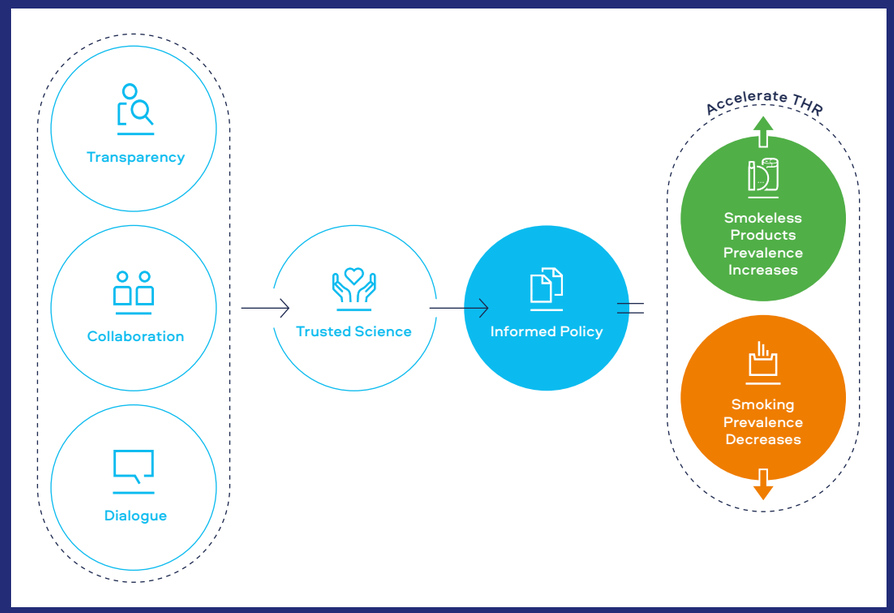
Researchers are encouraged to collaborate within and across industries to develop external acceptance of appropriate scientific methods. Where possible, academic collaborations or independent academic research on Smokeless Products can serve to validate research findings.

03 Cross-party dialogue

Parties across the scientific and regulatory ecosystem are encouraged to come together in constructive scientific discussion. While all differing opinions may not be resolved, there can be areas of common ground that can move the broader community forward.

Many of these same concepts have been articulated by thought leaders in the public health community; noting that these actions create an environment that incentivises sound science, rewards innovation in Smokeless Products and accelerates the decline in smoking.[5]

Figure 1. Validation of our science



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The Transition From Combustible to Smokeless Products Science

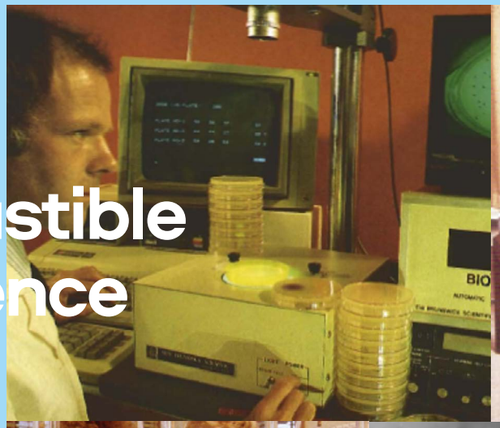
Traditionally and in addition to efforts to reduce the risk associated with tobacco products, companies' research focused on areas such as understanding the products or measuring tobacco and smoke,[1] while academic researchers focused on medical studies relating to the harm caused by cigarette smoking.[2] Tobacco and nicotine science was typically published in specialist tobacco- or combustion-related scientific journals and presented at scientific conferences.

The 21st century saw a new wave of Tobacco Harm Reduction (THR) interest that changed the landscape.[3] There became a need to publish data on new categories of products, including Heated Products, Vapour Products, and Oral Nicotine Pouches, to contribute to the scientific understanding of how they performed chemically and toxicologically. This coincided with cross-industry and government efforts to develop new ways of testing products that did not involve the use of animals.[4]

At BAT, we recruited scientists with a range of expertise and set out a new programme of research, seeking to publish in widely read and often medical-based peer-reviewed journals.

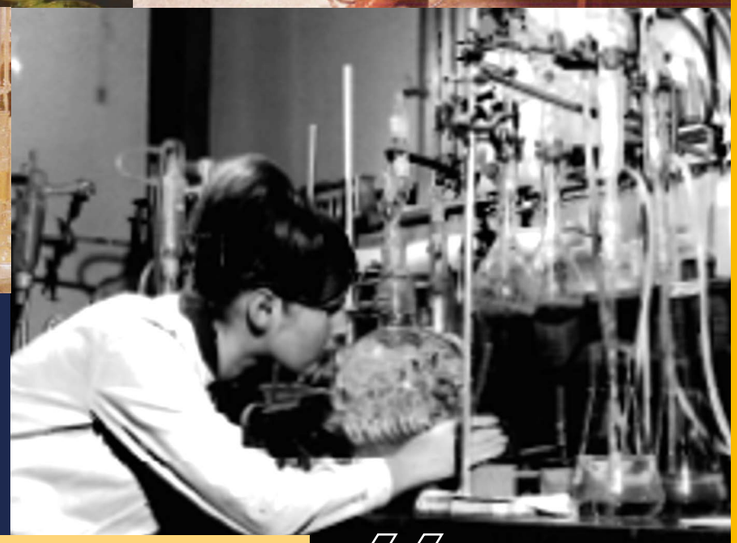
To substantially increase transparency, we opened our R&D facilities to host scientific conferences; developed a dedicated science website, www.bat-science.com, and began publishing Science and Technology reports on research intentions and findings.[5] We also set out risk assessment frameworks covering chemistry, toxicology, consumer use, and clinical studies, to assess whether new products could deliver on their harm reduction potential.[6] It became essential to develop partnerships with Contract Research Organisations (independent laboratories used by a range of industrial and academic researchers) and ensure the use of internationally-recognised research approaches on toxicology[7] and ethical ways to conduct clinical studies.[8,9] Details are also published on publicly accessible trials websites[10] so that anyone can follow the subsequent findings.

Tobacco and nicotine science continues to have its critics, and some journals have banned the publication of such research.[11] Others have accepted our research, subject to the rigorous scientific procedures of peer-review by independent scientists.[12] Publication rate, particularly on THR issues, has dramatically accelerated over the past decade and our researchers are now invited to speak at expert workshops such as those held by the U.S. FDA Center for Tobacco Products.[13,14]











We're in the eighth decade of our Research & Development within the BAT Group.

Tim Nestor
Executive Vice President, U.S. R&D, RAI Services Company

The Growth of the BAT Group's R&D

1953
Reynolds R&D, U.S.

1956
BAT R&D, UK

2007
Souza Cruz R&D, Brazil

2021
BAT Innovation Centre, Italy

2022
KBio Biotech, U.S.

2022
BAT Innovation Centre, China

2024
BAT Innovation Centre, UK

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Combustion, Emissions, and Toxicological Studies

How the products work

Cigarette smoke is an extremely complex and hazardous aerosol. It contains more than 7,500 individual chemicals, of which 150 are known to be harmful and more than 60 are known carcinogens.[1,2,3]



Combustion equals complexity. Our Smokeless Products are shown not to combust. Without combustion our Smokeless Products have fewer chemicals present in their aerosols/extractions. The chemicals that are present are often greatly reduced compared to those found in cigarette smoke.

Dr Sandra Costigan
Head of Analytical and Preclinical Research, Global Life Sciences

Smoke is formed when a cigarette is lit and its tobacco and paper combusts (burns). This process happens at temperatures of up to 950°C and combustion will continue if there is enough tobacco (fuel) and oxygen available. If there is insufficient fuel, oxygen or heat, combustion will not occur.[4]

Our Smokeless Products do not combust

For our Oral Tobacco Products and Oral Nicotine Pouches, the absence of combustion is self-evident with how they are consumed in the absence of heat. Our Vapour Products and Heated Products utilise controlled heating as part of their operation. Vapour Products have a metal coil/trace that heats the e-liquid to no more than 200°C to deliver an aerosol. Heated Products heat plant-based (tobacco leaf or non-tobacco leaf) material to no more than 300°C. These temperatures are low enough to avoid both ignition and burning and neither Vapour Products nor Heated Products produce smoke.

For our Heated Products we utilise a multi-step approach to confirm the absence of combustion. These steps include determining the temperature profile of the Heated Product's heater and consumable during use; measurement of combustion markers e.g. carbon monoxide; and mapping the thermal degradation of our Heated Product consumables.

Through mapping the thermal degradation of our Heated Product consumables via Thermogravimetric Analysis (TGA), we can determine at what temperature combustion will occur. TGA allows us to incrementally heat our Heated Product consumable from room temperature up to 1000°C whilst we monitor its mass. We complete this assessment in the presence and absence of oxygen, comparing the differences in mass loss to determine at what point combustion occurs. Thermal degradation mapping of our Heated Product consumables has demonstrated that combustion occurs at above 450°C, when significant mass loss is observed in the presence of oxygen but not in the absence of oxygen (Figure 1).[5] When there is no oxygen, combustion cannot occur. When there is oxygen, combustion occurs above 450°C.

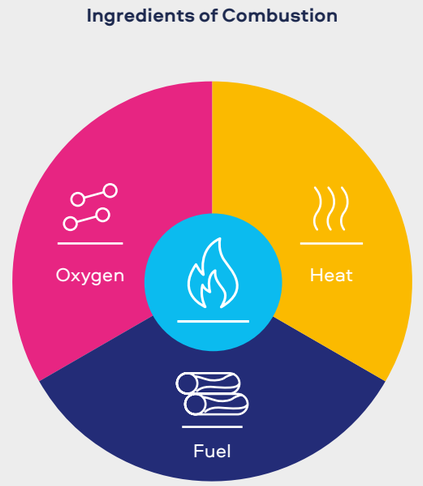
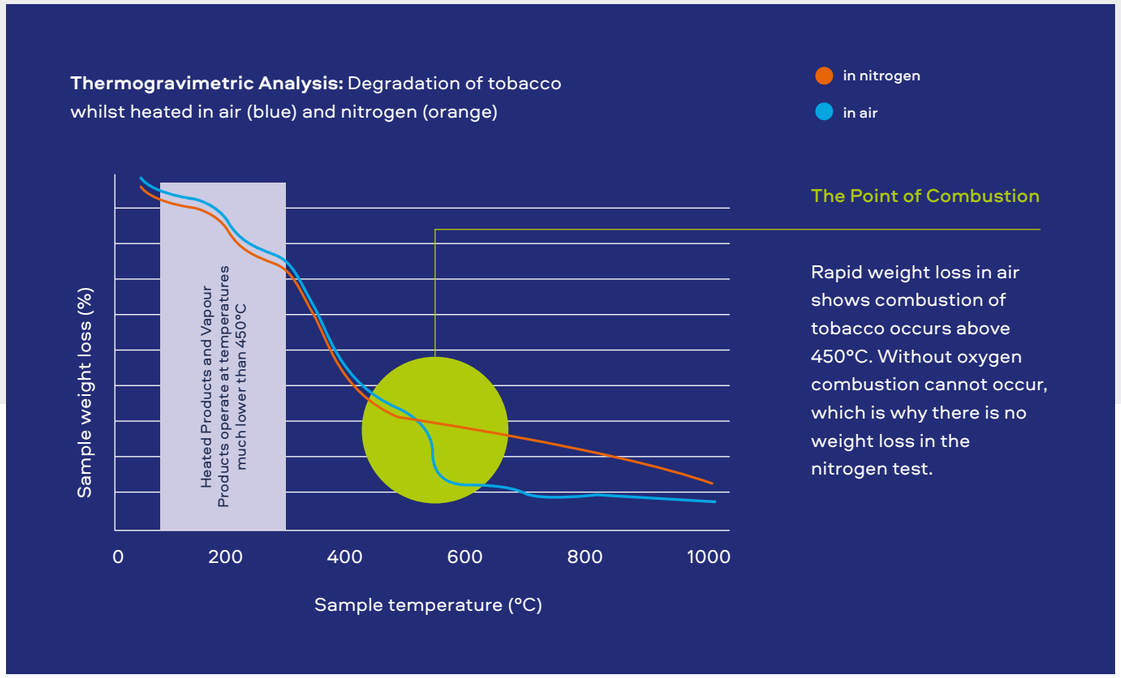




Figure 1. Thermogravimetric Analysis of our Heated Product consumable in the presence (in air) and absence (in nitrogen) of oxygen



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Fewer and lower levels of harmful chemicals

When tobacco is combusted the aerosol, smoke, produced is incredibly complex with >7,500 individual chemicals present, of which 150 chemicals are known to be harmful, and >60 are known carcinogens.[1,2,3] With no combustion, the aerosols of our Heated Products and Vapour Products are significantly simpler than cigarette smoke.

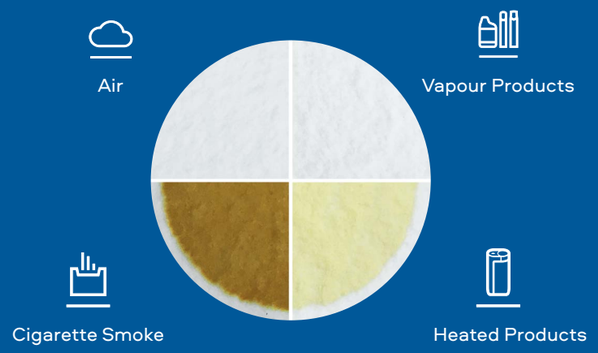
Our Heated Products heat a consumable of natural material (tobacco leaf or non-tobacco leaf), which is why its aerosol is the most complex of our Smokeless Products. However, the total number of chemicals in our Heated Product aerosols is approximately >10 times less than in cigarette smoke and their concentrations are significantly reduced.[6,7,8]

Our Vapour Products contain no tobacco. The e-liquid that comprises high-quality materials is heated to form an aerosol. As a result, our Vapour Product aerosols consist predominantly of the e-liquid ingredients and are >100 times less complex than cigarette smoke.[9,10]

Our Oral Tobacco Products and Oral Nicotine Pouches also have significantly lower levels of chemicals present in their extractions than cigarette smoke. As they contain tobacco, our Oral Tobacco Products have a more complex extraction compared to our Oral Nicotine Pouches. Our Oral Nicotine Pouches are like our Vapour Product e-liquids in that they comprise solely high-quality materials. Of all our Smokeless Products, Oral Nicotine Pouches have the lowest number of chemicals present in their extractions.[12]

This consolidated picture illustrates the visual difference in aerosol complexity for Heated Products (bottom right) and Vapour Products (top right) compared to cigarette smoke (bottom left) and air (top left).[11] Approximately 10 puffs of each product and the discolouration of the laboratory filter pad is greatest with the most complex aerosol, cigarette smoke.

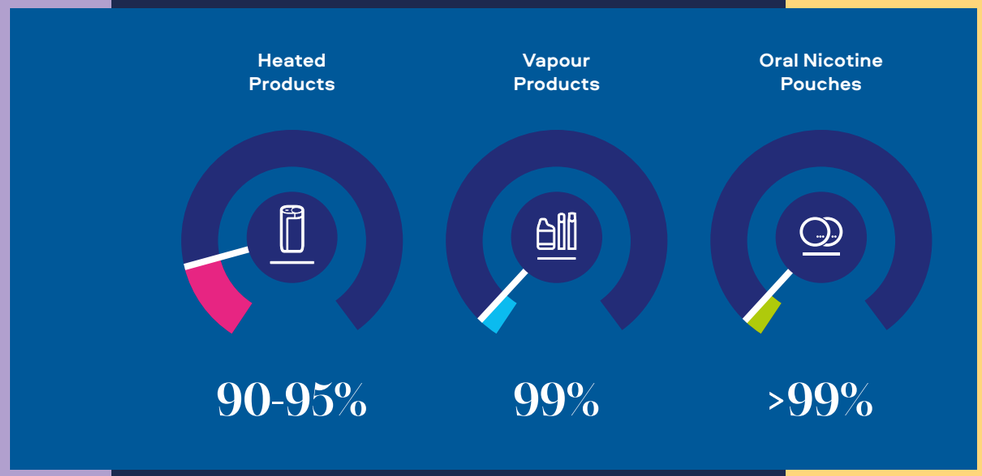
Figure 2. Laboratory Filter Pads



Our Smokeless Products have >90% fewer toxicants[#]

In 2008, the World Health Organization recommended the reduction of nine chemicals ('toxicants') in cigarette smoke.[13] In our Smokeless Products, on average, these nine toxicants are reduced by 90-95% for Heated Products,[6] 99% for Vapour Products,[10] and >99% for Oral Nicotine Pouches.[12] (Figure 3)

Figure 3. Average % reductions of nine toxicants in our Smokeless Products[#]



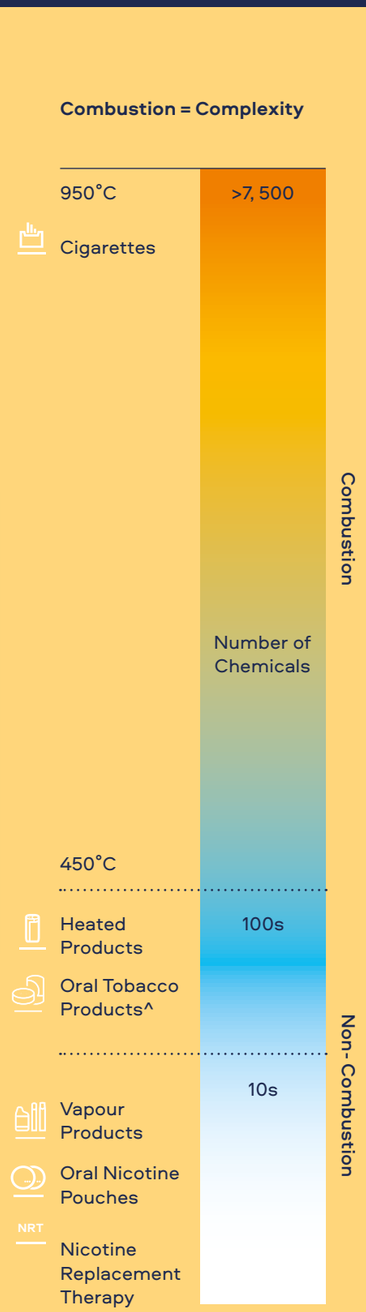


Figure 4. Our Smokeless Products have fewer chemicals in their aerosols/extractions. Combustion = Complexity

[#] Comparison with smoke from a scientific standard reference cigarette (approximately 9 mg tar) in terms of the average of the 9 harmful components the World Health Organization recommends to reduce in cigarette smoke.

^ Oral Tobacco Products operate at ambient temperature but placed here as number of chemicals in its extract are in the 100s.

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Less toxic than cigarette smoke

Cigarette smoke is toxic. With fewer chemicals generated in the aerosols and extractions of our Smokeless Products, we use regulatory toxicology in vitro tests to understand if this translates to a reduction in toxicity. The regulatory toxicology in vitro tests we employ allow us to assess four types of toxicological endpoints:

01 **Mutagenicity:**
The ability to cause permanent, typically negative, changes to a cell or organism by altering the structure of its DNA.

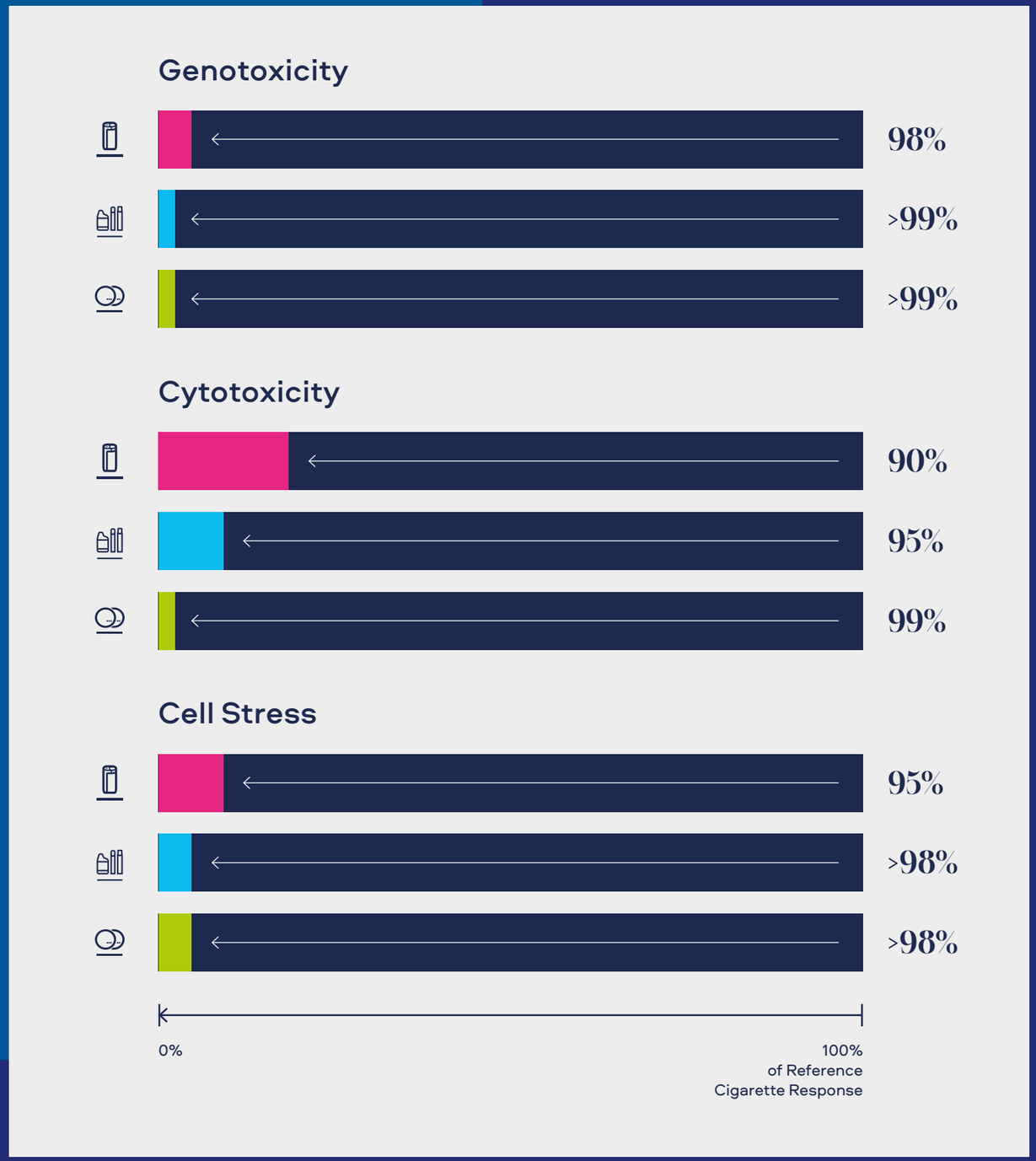
02 **Genotoxicity:**
The ability to damage the genetic information within a cell causing mutations, which may lead to cancer.

03 **Cytotoxicity:**
The level at which something is toxic to a cell.

04 **Cell Stress:**
The level at which cells are stressed and/or die through exposure to a chemical/chemicals.

We have compared the toxicity of our Smokeless Products to the toxicity of cigarette smoke. For each Smokeless Product we have observed substantial reductions across all four regulatory toxicology in vitro tests (Figure 5).[14-26]

Figure 5. Smokeless Product reductions in genotoxicity, cytotoxicity and cell stress#



Comparison with smoke from a scientific standard reference cigarette (approximately 9 mg tar) in terms of the average of the 9 harmful components the World Health Organization recommends to reduce in cigarette smoke.

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Use Behaviour and Pharmacokinetic Studies

How individuals use the product

Through laboratory tests we understand that the emissions of our Smokeless Products are simpler than cigarette smoke and proven to be less toxic. However, it is important that we understand how adult consumers may use our products to confirm they do not use them in a manner that offsets these reductions. To understand consumer use behaviour we carry out studies that assess:



> Our 'use behaviour' studies show that adult consumers use our Smokeless Products in a manner that will not offset the lab-measured reductions in emissions. This use behaviour gives us confidence that we should see reductions in clinical measures when we assess biomarkers of exposure and biomarkers of potential harm.



Dr Sarah Baxter-Wright
Head of Behavioural & Clinical Research, Global Life Sciences

Product type

01 Puffing Topography

How big (volume), long (duration), frequent (time between) and number of times (total) a consumer may puff on our Heated Products and Vapour Products compared to a cigarette.

02 Mouth Hold Time

How long (duration) a consumer may use our Oral Tobacco Products or Oral Nicotine Pouches.

Understanding consumer use

03 Mouth Level Exposure (MLE)/Transfer

Level of exposure to defined emissions at mouth level of consumers.

04 Nicotine Pharmacokinetic (PK) Studies

How nicotine is absorbed by the body when using our Smokeless Products.

05 Average Daily Consumption (ADC)

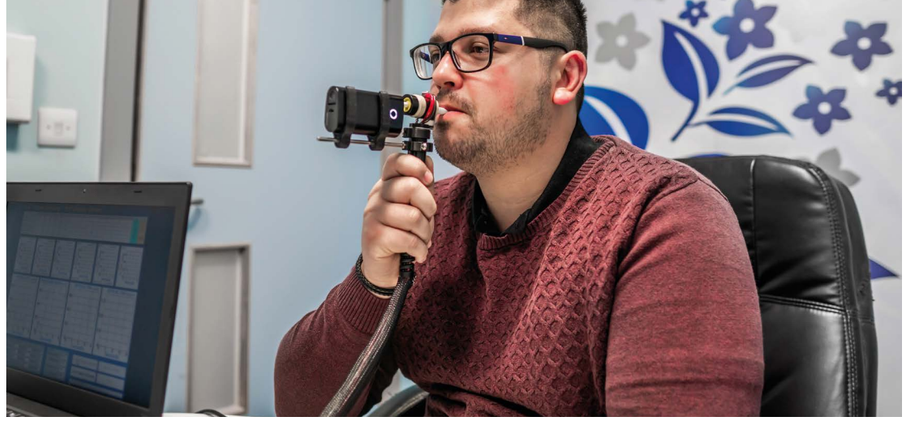
How much a consumer may use throughout a day compared to their daily cigarette consumption.

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01

Puffing Topography

The puffing behaviours of our Heated Products and Vapour Product adult consumers have identified differences and similarities to how adult consumers use cigarettes.[1-4] Our Heated Product adult consumers are reported to take bigger and more frequent puffs. Our data shows that our Vapour Product adult consumers use the product in a similar manner to cigarettes when considering volume and duration. Overall, puffing topography data for Heated Products and Vapour Products clarify how adult consumers use our products; however, we need MLE, PK and ADC data to obtain a more complete picture.



	Puff Volume	Puff Duration (seconds, s)	Puff Frequency (seconds, s)	Puff Number
Cigarettes[1]	41.3 ± 12.7mL	1.5 ± 0.5s	18.8 ± 10.6s	17.3 ± 5.9
Heated Products[2]	80.8 ± 67.5mL	1.80 ± 1.03s	8.9 ± 4.4s	20.6 ± 9.6
Vapour Products[3]	49.4 ± 20.6mL	2.29 ± 0.99s	10.3 ± 6.2s	10.1^ ± 0.3

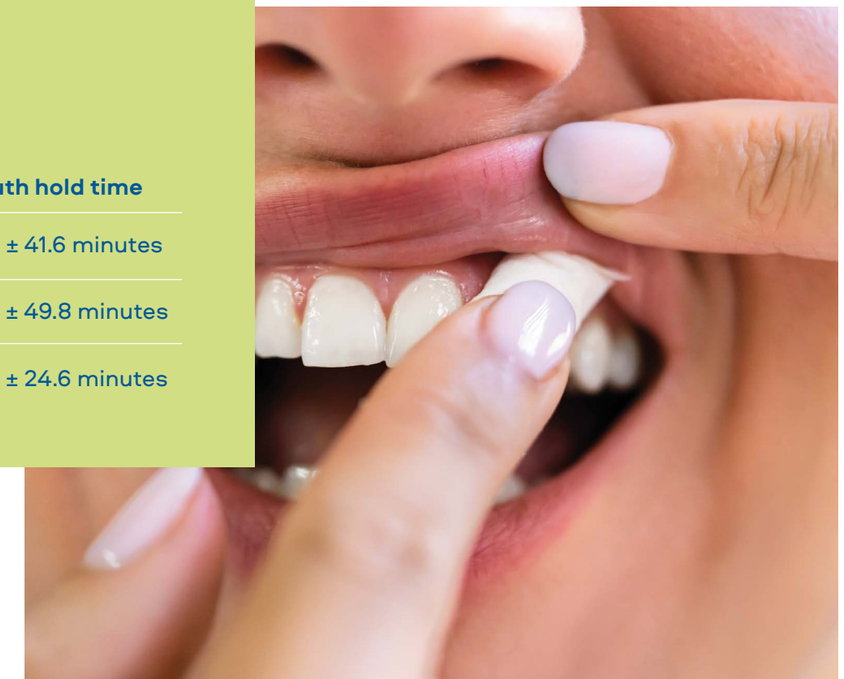
^The Vapour Product's study had a fixed number of 10 puffs.

02

Mouth Hold Time

For mouth hold time, our benchmark is Oral Tobacco Products, e.g. snus, because of their history of significant use and epidemiological data showing reduced risk*† of smoking-related disease compared to smoking. Average data for our Oral Nicotine Pouches show that adult consumers hold these in mouth for around half the time of an Oral Tobacco Product consumer.[5]

	Mouth hold time
Oral Tobacco Product - Loose[6]	69.2 ± 41.6 minutes
Oral Tobacco Product - Pouch[6]	65.2 ± 49.8 minutes
Oral Nicotine Pouch[7]	33.3 ± 24.6 minutes



03

Mouth Level Exposure/Transfer

Our puffing topography and mouth hold time studies also afford us the opportunity to gather data on potential consumer exposure to certain chemicals. Optical and gravimetric measurements of the aerosol and products, respectively, allows for the estimation of how much nicotine has been consumed during use.[1,8,9] Measuring estimated nicotine consumption of our Smokeless Products is important as it provides the opportunity to compare these values to cigarette data. For our Smokeless Products to be effective alternatives to smoking they need to deliver satisfactory levels of nicotine.

Overall, while there is large individual variability, our data for mouth level exposure/transfer gives us confidence that adult smokers can receive levels of nicotine comparable to smoking.



	Estimated Nicotine Exposure
Cigarette[1]	1.55 ± 0.63mg
Heated Product[2]	1.68 ± 1.12mg
Vapour Product^^[3]	1.38 ± 0.52mg
Oral Tobacco Product - Loose[5]	3.38 ± 1.92mg
Oral Tobacco Product - Pouch[5]	3.45 ± 1.42mg
Oral Nicotine - Pouch[7]	2.30 ± 1.43mg

^^Per puff data multiplied by average cigarette puff number for direct Vapour Product versus cigarette comparison

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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04

Pharmacokinetic Studies

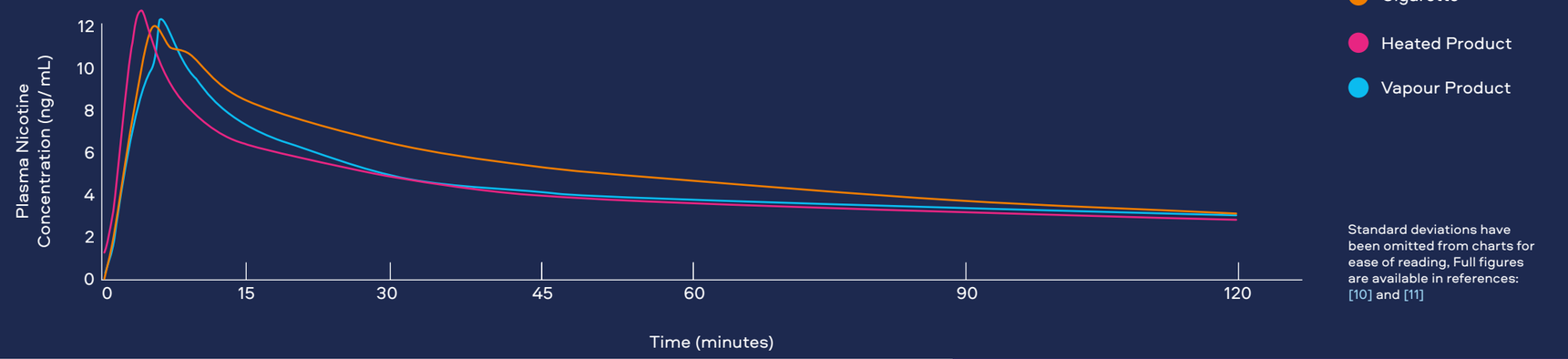
Inclusive of lab-based studies, we conduct controlled clinical pharmacokinetic (PK) studies to understand the speed and amount of nicotine uptake into the consumer's bloodstream. Our studies have shown that for our Heated Products and Vapour Products the timing of the peak nicotine concentration in the blood is comparable to cigarette smoking (Figure 1).[10,11] This peak timing is important as it shows through using either a Heated Product or Vapour Product the nicotine experience for a smoker should be familiar.

Our Oral Tobacco Products and Oral Nicotine Pouches have different nicotine PK profiles compared to cigarettes (Figure 2). Driven by the different mode of absorption (buccal mucosa vs. lung), the time taken to reach maximum nicotine blood concentration for our Oral Products is slower than a cigarette.[12] This slower nicotine peak delivery for Oral Products provides adult smokers with an unfamiliar initial experience compared to cigarettes. Overall, the unfamiliar nicotine experience of Oral Products can still offer adult smokers an acceptable alternative to cigarettes, as shown by countries such as Sweden.

	Average Daily Consumption
Cigarette[10]	13.2 ± 4.4 sticks
Heated Product[10]	10.2 ± 4.9 sticks
Vapour Product^^^[11]	0.75 ± 0.49 cartridges^
Oral Tobacco Product - Loose[6]	12.3 ± 6.6 portions
Oral Tobacco Product - Pouch[6]	11.7 ± 6.5 pouches
Oral Nicotine - Pouch[12]	10.4 ± 4.7 pouches

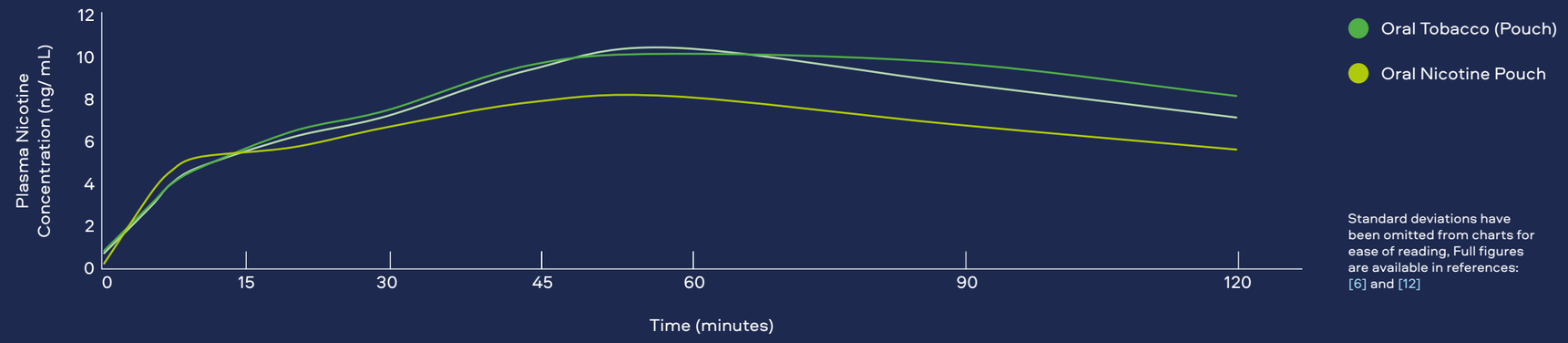
^The Vapour Product study had a fixed number of 10 puffs.
^^^Equivalent to 4.8±3.7mg of estimated nicotine consumption. Cigarette daily estimated nicotine consumption is 20.9±12.3mg.

Figure 1.
Pharmacokinetic Profiles - Inhalable (Cigarette, Heated Product and Vapour Product)



Standard deviations have been omitted from charts for ease of reading, Full figures are available in references: [10] and [11]

Figure 2.
Pharmacokinetic Profiles - Oral (Nicotine Pouch, Tobacco - Loose and Tobacco - Pouch)



Standard deviations have been omitted from charts for ease of reading, Full figures are available in references: [6] and [12]

05

Actual Use and Average Daily Consumption

Our final method in understanding consumer use is to conduct an "actual use" home study.[13] Typically, a six-week study that lets adult smokers use our Smokeless Products in their real-life/home environment. During these studies participants record daily data, which includes how much of the product they use. This data allows us to understand a consumer's average daily consumption of our Smokeless Product, which we compare to their previously reported smoking use. Overall, we find adult consumers use our Smokeless Products at comparable-to-lower levels than their usual cigarettes.

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Clinical: Exposure

What individuals are exposed to when using the products



"Adult smokers who completely switch to our Smokeless Products can greatly reduce their exposure† to a number of harmful chemicals as compared to continued smoking."

Dr Kristen Jordan
Head of Clinical Research,
Global Life Sciences,
RAI Services Company

Our lab-based emission and toxicological studies have proven that our Smokeless Products deliver significantly lower levels of harmful chemicals than cigarette smoke. To understand the potential impact of these reductions on adult smokers who completely switch to our Smokeless Products, we conduct clinical studies for both exposure and potential risk.

In our clinical exposure studies, we measure up to 15 biomarkers in adult smokers that indicate exposure to certain harmful chemicals. These 'Biomarkers of Exposure' (BoE) can be measured in urine, blood and/or exhaled breath, at levels that can demonstrate exposure differences between adult smokers, former adult smokers, and non-adult smokers.[1]

Associated with tobacco product use, our 15 BoE are linked to the harmful and potentially harmful constituents (HPHC) the World Health Organization has recommended lowering in smoke (Table 1).[2]

Table 1: Our 15 BoEs and their associated HPHCs

BoE	Associated HPHC	Carcinogen	Respiratory Toxicant	Cardiovascular Toxicant
4-Aminobiphenyl (4-ABP)	4-Aminobiphenyl	+		
2-Aminonaphthalene (2-AN)	2-Aminonaphthalene	+		
3-Hydroxybenzo(a)pyrene (3-OH B[a]P)	Benzo[a]pyrene (B[a]P)	+		
2-Cyanoethylmercapturic acid (CEMA)	Acrylonitrile	+		
Carbon monoxide (CO)	Carbon Monoxide			+
2-Hydroxyethylmercapturic acid (HEMA)	Ethylene Oxide	+	+	
3-Hydroxy-1-methylpropylmercapturic acid (HMPMA)	Crotonaldehyde	+		
3-Hydroxypropylmercapturic acid (HPMA)	Acrolein		+	+
Monohydroxybutenylmercapturic acid (MHBMA)TNeq	1,3-Butadiene	+	+	
Total nicotine equivalents (TNeq)	Nicotine			
Total 4-(methylnitrosamino)-1-(3-pyridyl) -1-butanol (NNAL)	4-(methylnitrosamino) -1-(3-pyridyl)-1-butanone (NNK)	+		
Total N-nitrosonornicotine (NNN)	NNN	+		
1-Hydroxypyrene (1-OHP^)	Pyrene	+		
o-Toluidine (o-Tol)	o-Toluidine	+		
s-Phenylmercapturic acid (S-PMA)	Benzene	+		

^ Marker of carcinogenic polyaromatic hydrocarbon exposure

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Our core principles for conducting clinical research:

- **Ethics committee or independent review board assessment of our study objectives, as per the 1964 Declaration of Helsinki**
- **Good Clinical Practice (GCP) and Good Laboratory Practice (GLP) for clinical conduct and bioanalysis**
- **All studies conducted in independent clinics under supervision of a principal investigator**

As part of our clinical exposure studies, we look to measure the BoE of up to four different participant groups to represent different 'smoker' status.



In our clinical exposure studies, our primary objective is to statistically compare the BoE levels of those who smoke to those who have completely switched to our Smokeless Products. This comparison allows us to determine if our significant reductions in lab-measured emissions is also achieved when adult consumers switch to our Smokeless Products.

We also compare the BoE levels of those who have completely switched to our Smokeless Products to Former and Never Smokers. We make this comparison as "the closer the risks and exposures [...] are to cessation products, the more confident a regulator can be in the chances for net public health benefit." (U.S. Institute of Medicine).[3]

Compliance - CEVal

Cyanoethylvaline (or CEVal) is a blood biomarker that can determine if someone has been smoking cigarettes.

It is formed through exposure to a chemical found in cigarette smoke, acrylonitrile, and can last in the body for up to 120 days. We use CEVal as a biomarker of compliance in our clinical studies.

It allows us to confirm whether participants in our studies have stopped using cigarettes as requested. It provides us with evidence that our non-smoking groups' biomarker data is truly reflective of a complete switch to Smokeless Products or cessation.

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We have two different clinical study designs to evaluate exposure: Longitudinal and Cross-Sectional. Both study types have their benefits when evaluating exposure.

Cross-Sectional (Snapshot)

Ambulatory (Real world)

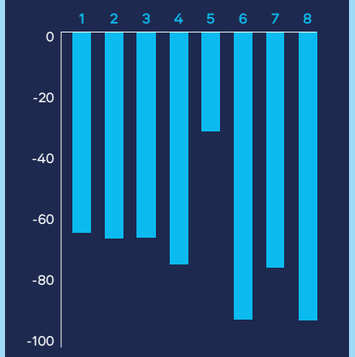
Point in time

One-off clinic visit

Participants are asked to declare what products they use (Smokeless Product or cigarettes).

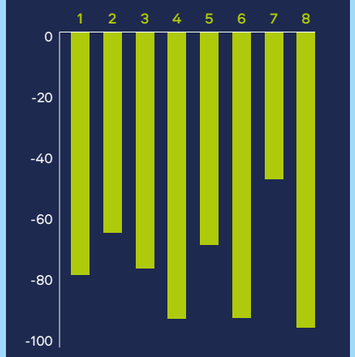
Cross-sectional studies enable a comparison of realistic use between those who smoke and those who use our Smokeless Products at a specific point in time. The resulting data can be presented as a '%difference' in BoE levels between study groups.

Vuse Users: BoE %Difference vs. Smokers



1. 3-OH B[a]P
2. HMPMA
3. HPMA
4. MHBMA
5. TNeq
6. Total NNAL
7. Total NNN
8. S-PMA

Velo Users: BoE %Difference vs. Smokers



1. 3-OH B[a]P
2. HMPMA
3. HPMA
4. MHBMA
5. TNeq
6. Total NNAL
7. Total NNN
8. S-PMA

Our cross-sectional clinical exposure studies have proven that adult consumers of our Vuse[4] and Velo[5] products have lower levels of exposure to a number of harmful chemicals compared to adult smokers.

Standard deviations have been omitted from charts for ease of reading, Full figures are available in references: [4], [5] and [6]

Longitudinal (Journey)

Confined (In clinic)

Short-term (<7 days)

Single-stay clinic visit

Ambulatory (Real world)

Mid-/Long-term (>30 days)

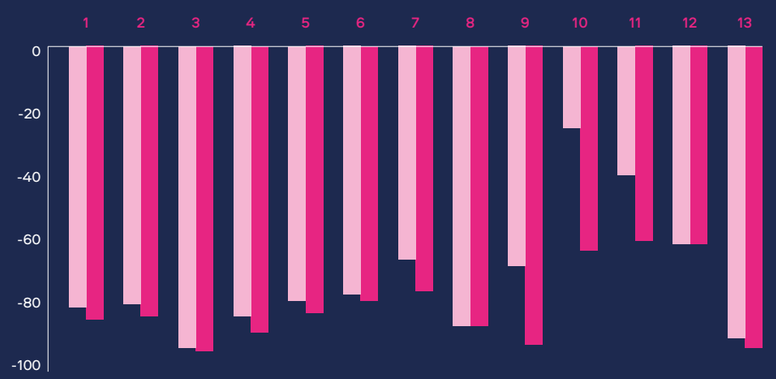
Multiple clinic visits

Participants are asked to either switch completely to our Smokeless Product or continue to smoke cigarettes.

Longitudinal studies allow for a baseline measurement of all participants at Day 0. Subsequent clinic measurements then show changes in effects over time. The resulting data can be presented as a '%change from baseline' (Day 0), which can be compared between study groups.

glo Switching: % Change vs. Cessation (Day 0 to Day 360)

Switch to glo | Quit Smoking



1. 4-ABP
2. 2-AN
3. CEMA
4. CO
5. HEMA
6. HMPMA
7. HPMA
8. MHBMA
9. Total NNAL
10. Total NNN
11. 1-OHP
12. o-Tol
13. S-PMA

Our longitudinal exposure study tracked and measured a range of BoEs when smokers switched to glo for one year. The results showed that smokers who completely switched to glo had significant reductions in BoEs compared to participants who continued to smoke. These reductions were comparable to those who quit smoking.*†[6]

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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Clinical: Individual Risk*†

How the product may impact consumers



In our clinical risk studies, we monitor seven BoPH and one physiological measure associated with disease endpoints:

BoPH	Physiological Process	Disease Endpoint	Favourable Change vs. Smoking
8-epi-prostaglandin F2α Type III	Oxidative Stress/ DNA Damage	COPD, CVD, and Lung Cancer	↓
White Blood Cell Count (WBC)	Inflammation	COPD and CVD	↓
Carbon Monoxide	Oxygen Delivery	CVD	↓
Soluble Intercellular Adhesion Molecule (sICAM)	Endothelial Function	CVD	↓
High-density lipoprotein (HDL) Cholesterol	Lipid Metabolism	CVD	↑
Thromboxane (11-dTx-B2)	Clotting	CVD	↓
Total 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL)	Carcinogenicity	Lung Cancer	↓
Forced expiratory volume^ (FEV1)	Lung Function	COPD, CVD, and Lung Cancer	↑

^Not a BoPH but physiological measure

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Our clinical exposure studies have shown that adult smokers who switch completely to our Smokeless Products reduce their exposure to a number of harmful chemicals as compared to continued smoking.*† Using the same methods, our clinical risk studies focus on biomarkers that reflect unfavourable changes within the body known to occur with smoking.

Referred to as 'Biomarkers of Potential Harm' (BoPH) or 'Biomarkers of Biological Effect' (BoBE), we monitor those that are known to occur with smoking. These BoPH are markers of physiological processes in the body such as inflammation, oxidative stress, and DNA damage. These processes can be indicators of potential disease pathways: chronic obstructive pulmonary disease (COPD), cardiovascular disease (CVD), and lung cancer.

As these physiological changes take time to occur, our clinical risk studies focus on product use for at least six months. This gives a reasonable time for changes to occur. However, it should be noted that by their very nature these effects can be caused by other lifestyle choices and not just smoking (e.g. obesity also affects cardiovascular disease risk).

Unfavourable Changes and Disease

Oxidative Stress

Oxidative stress is a significant factor in the development of CVD, COPD and cancer.[1,2,3] Oxidants produced as a result of cigarette smoking can cause damage to DNA and affect arteries and lung tissue. We measure 8-epi-prostaglandin F2α Type III (8-epi-PGF2α Type III) as a biomarker for oxidative stress. Levels have been shown to be higher in smokers compared to never-smokers.

Inflammation

We monitor white blood cell count (WBC) as a biomarker for inflammation. White blood cells are part of the immune system and increased levels occur with bacterial and viral infections. Levels also increase with various cancers, inflammatory disorders (e.g. arthritis) and COPD, as well playing a prominent role in CVD.[4,5,6] Levels have also been shown to be higher in smokers compared to never-smokers.

CVD

We measure several biomarkers for CVD:

- **Carbon monoxide**

  Carbon monoxide attaches to red blood cells and therefore prevents the attachment of oxygen which places stress on the heart to deliver oxygen to the body. Smoking leads to higher carbon monoxide levels in the blood compared to never-smokers. It is measured in exhaled breath (COex) or Carboxyhemoglobin the blood (COHb).[7,8]

- **Soluble intercellular adhesion molecule (sICAM)**

  sICAM is part of the blood vessel inflammatory system. It contributes to CVD with levels in blood greater for smokers compared to never-smokers.[6]

- **High-density lipoprotein (HDL) cholesterol**

  HDL cholesterol or 'good cholesterol' plays a protective role in CVD, levels tend to be lower in smokers compared to never-smokers.[6]

- **Thromboxane (11-dTx-B2)**

  Thromboxane is a molecule produced in the blood to help it clot, generally after an injury. Levels measured in urine are greater for smokers compared to never-smokers.[6]

Lung Cancer

Tobacco-specific nitrosamine 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) has been shown to be associated with lung cancer development in smokers. Measured as total NNAL in the urine, levels in smokers are greater compared to never-smokers.[9]

Potential Detrimental Health Outcomes

Inclusive of measuring BoPH/BoBE, we assess potential detrimental health outcomes through physiological measures for all our participants such as blood pressure monitoring. We have also used spirometry, a simple test to help diagnose and monitor certain lung conditions.[10,11]

> BOPH could serve as more intermediate endpoints for assessing potential health risk of new and novel tobacco products in the absence of long-term epidemiological evidence.
>
> **Scientists from the Office of Science**
> Center for Tobacco Products, Food and Drug Administration[14]

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

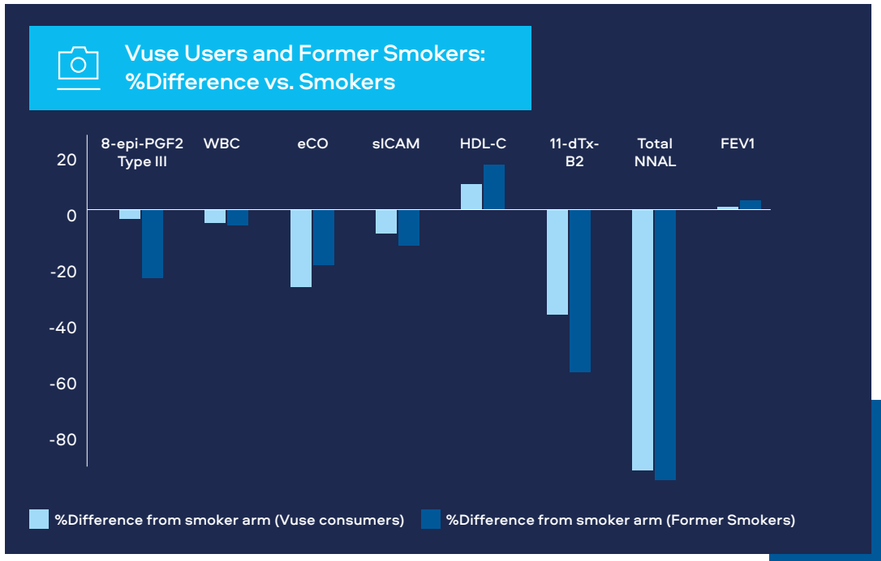
† Our products as sold in the U.S., including Vuse, Velo, Grizzly, Kodiak, and Camel Snus, are subject to FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

Smokers who completely switch to our Smokeless Products can achieve favourable changes in biomarkers of potential harm.

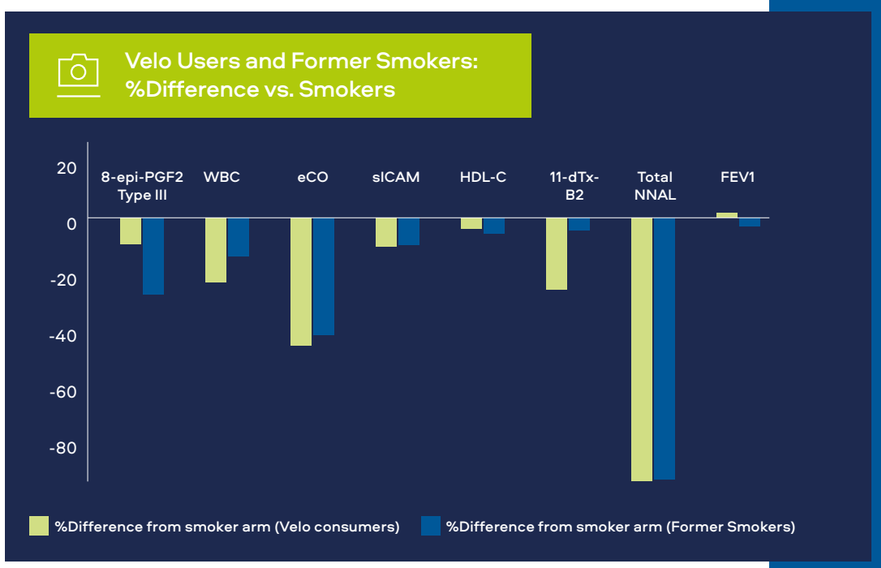
Like our clinical exposure studies, our clinical risk studies can be either Longitudinal or Cross-Sectional in design.

Longitudinal (Journey)

Cross-Sectional (Snapshot)

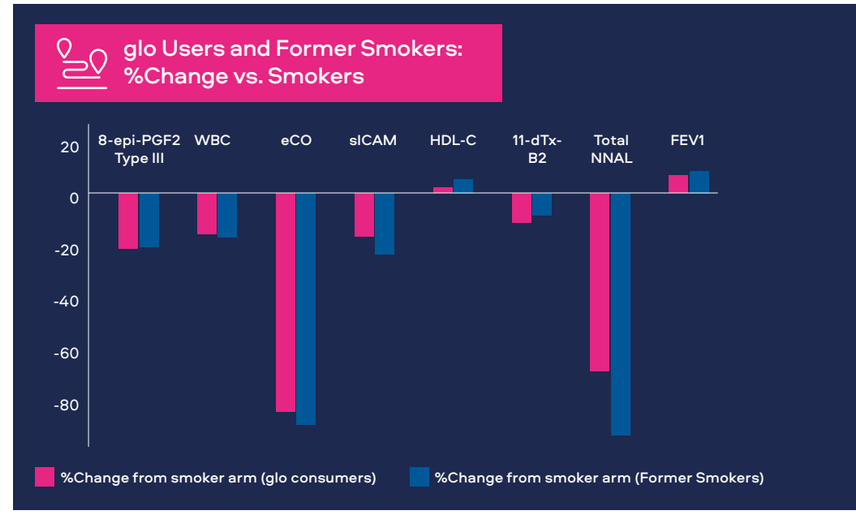


Our cross-sectional clinical studies have proven that adult consumers of Vuse and Velo have favourable differences in BoPH compared to adult smokers with some comparable to former smokers.*†[12,13]



Standard deviations have been omitted from charts for ease of reading, Full figures are available in references: [10], [11] and [12]

Our longitudinal clinical study has proven that switching completely to glo can have favourable changes in BoPH compared to smokers with some comparable to former smokers.*†[11]





In all of our clinical studies when switching completely to our Smokeless Products we observed statistically significant reductions in exposure to a number of harmful chemicals and favourable changes in biomarkers of potential harm when compared to continued smoking. The results of our studies demonstrate that reduction in the studied biomarkers of those switching to our Smokeless Product approach that of those quitting smoking.*†

Dr Michael McEwan
Head of Biomarkers,
Global Life Sciences

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Population Risk and Modelling

How the product may impact a population

Lab- and clinic-based science allows us to better understand the lower risk profile of our Smokeless Products as compared to cigarettes. With population models, we can generate insights into the potential health impact our products may have on the population when they are introduced to a market.



The introduction of a new product to a market can be associated with varying product usage behaviours among adult consumers, leading to both positive and negative health effects. These behaviours need to be evaluated in totality to understand the population level health impact.

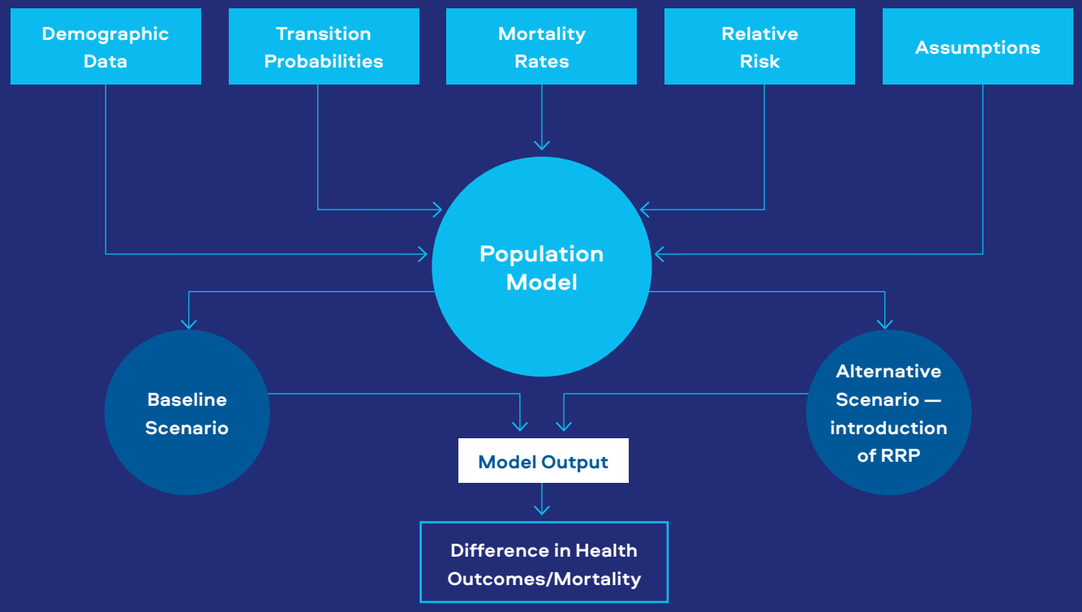
When a new Smokeless Product is introduced to the market, long-term observational data on use behaviour and health impact are not yet necessarily available. In the absence of these data, a need still exists to understand the potential population health impact. Computational models, which are commonly used in the fields of statistics, economics, and demography, can be developed and used to investigate the potential effect of new Smokeless Product introductions on consumer behaviour and population health.

Population health impact models

Computational models enable the projection of population-level effects by assessing the potential for specific outcomes. These models use mathematical methodologies to simulate the potential effects of different exposure and risk scenarios within a specified population, allowing the input of data such as product use behaviour transition probabilities (e.g. initiation, quitting, switching) and a risk estimate dependent on product use status. Customarily, such models use publicly available demographic data and published studies to inform model input parameters. Where data are not available, informed assumptions and consensus estimates can be used. The outputs of population models are often evaluated comparatively, calculating the potential health outcome of the base case scenario (e.g. cigarettes only) and comparing it to a scenario where a Smokeless Product has been introduced to a market. This comparison enables the calculation of the difference in health outcomes/ mortality (Figure 1).

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Figure 1. Example schematic of model input and output data and assumptions



Population modelling can be prospective (look forward) or retrospective (look backward)

Prospective modelling: predicting the population-level effect of Smokeless Products

Over the past decade, various mathematical models have been used to evaluate the potential public health impact of switching smokers to Smokeless Products. The results of these evaluations support the proposition that such products have the potential to reduce the prevalence of smoking and the related death toll across the globe.

A recent study using a vaping model by Levy et al. evaluated the potential impact on public health of relaxing restrictions on vaping products in Australia, predicting that as many as 100,000 deaths could be averted during the period 2017–2080 if Australia were to embrace Tobacco Harm Reduction by increasing access to these products.[1] This finding aligns with similar studies on Smokeless Products' potential to reduce smoking prevalence in Germany[2] and Russia.[3]

Retrospective modelling: applying the Swedish Experience across the EU

An example of retrospective modelling is the analysis performed by group of physicians and academics regarding the population health impact of the Oral Tobacco Product, snus.[4] At the time of the analysis in 2017, the total tobacco consumption level in Sweden was similar to that of other European Union (EU) countries, but Sweden consistently had much lower smoking prevalence, the reduction of which occurred alongside a rise in the use of snus. However, snus products have been banned in the European Union, aside from Sweden, since 1992.[5]

Utilising data from the World Health Organization,[6] which calculated the tobacco-related mortality rate of each of the relevant countries as well as the prevalence of smoking, the researchers extrapolated the impact of introducing snus in the other European countries. The resulting report predicted that had other EU Member States adopted Sweden's tobacco consumption patterns, more than 2.8 million potential deaths could have been averted over a 20-year period (Table 1).[4]



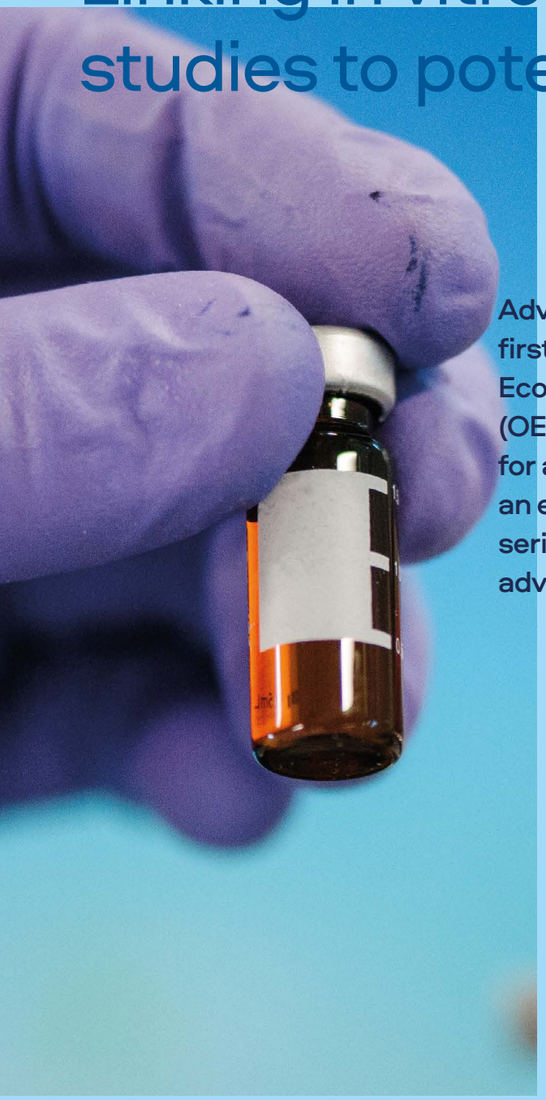
Table 1. Retrospective Population Modelling: Apply Sweden's Tobacco-Attributed Mortality and Morbidity, 2000-2019[4]

Country	Lives Saved
Denmark	116,000
Netherlands	125,000
Italy	125,000
France	91,000
Germany	454,000
UK	680,000
Spain	31,000
Poland	442,000
Romania	251,000
Greece	170,000
Bulgaria	249,000
Hungary	251,000
EU	**2.89 million**

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Adverse Outcome Pathways

Linking in vitro and clinical studies to potential disease



Adverse outcome pathways (AOPs) were first proposed by the Organisation of Economic Co-operation and Development (OECD), with the goal of reducing the need for animal testing.[1] AOPs describe how an exposure to a stimulus can produce a series of changes resulting in a disease or adverse outcome (AO).

In an AOP, a stimulus, such as a chemical exposure, can result in an initial change or molecular initiating event (MIE). The pathway consists of a series of key events (KE) that are adverse changes to cells, tissues and organs. For the purposes of an AOP, any change must be both critical and measurable to become a KE. Any change that leads to a measurable increase in a KE, is likely to lead to progress to the next KE and in turn potentially disease.

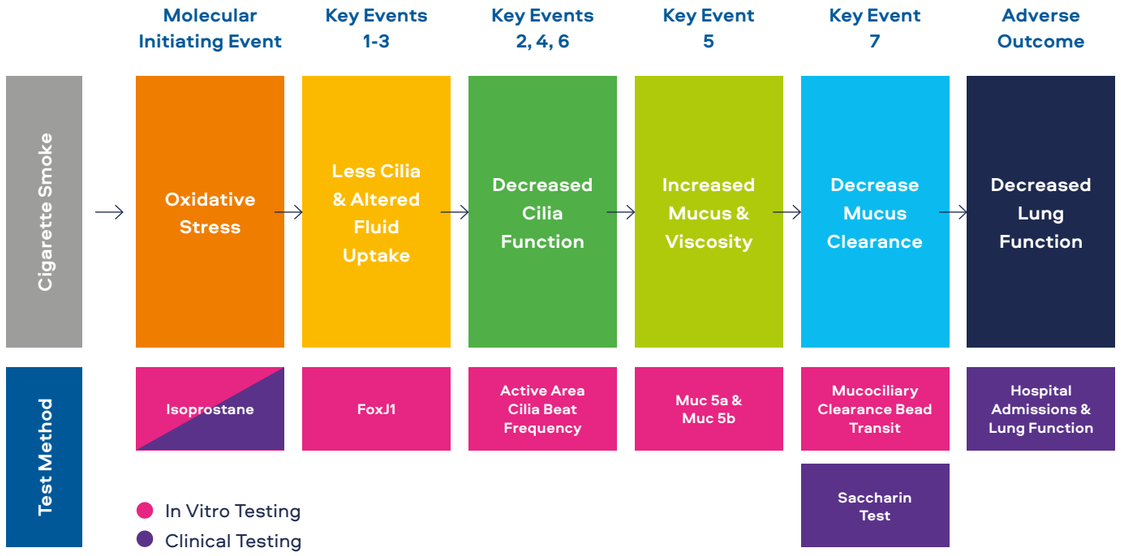
The use of an AOP pathway allows the use of non-animal data, such as clinical and lab-based studies to assess the likelihood of disease to develop. To gain scientific acceptance, all AOPs are open to peer review via the OECD AOP wiki online portal.[2]

AOPs are currently being used as part of the Tobacco Harm Reduction (THR) programme to look at two of the main smoking-related diseases, COPD and CVD. These investigations will hopefully support clinical studies and product testing in the lab. We have developed a potential CVD AOP and COPD AOP in collaboration with other industry participants.[3,4]

Using the AOP below for COPD (Figure 1), we have mapped evidence from in vitro studies to show how earlier events can lead to disease progression. Some of these changes can be tested in both the lab and in the clinic allowing us to align our testing. These tests can then be used to show how switching to our new Smokeless Products could reduce these changes compared to cigarette smoking.

> The adverse outcome pathway (AOP) has been proposed as a simplified organisational construct to contribute to this transition by linking molecular initiating events and earlier (more predictive) key events at lower levels of biological organisation to disease outcomes.
>
> **Anna Bal-Price**
> Developmental Biologist
> European Commission Joint Research Centre[5]

Figure 1. Combined AOP (AOP 411, 424 & 425) for COPD



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COPD combined AOP (AOP 411, 424 & 425) - Evidence

Clinical Testing

Oxidative Stress

Molecular Initiating Event

glo 360-Day Clinical Trial:[6]
8-epi-prostaglandin F2I Type III (ng/24h) (biomarker for isoprostane)

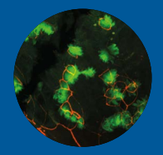
glo and air exposure (quitting) = comparable isoprostane reductions

Continue to smoke	Switch to glo	Stop Smoking
329.5	258.1 (-22%)	259.2 (-21%)

In Vitro Testing

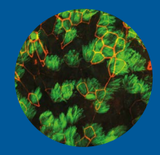
Less Cilia & Altered Fluid Uptake

Key Events 1-3



Cigarette smoke

Significant reduction in cilia when exposed to smoke compared to air. (Air is a proxy for Never Smokers)



Air

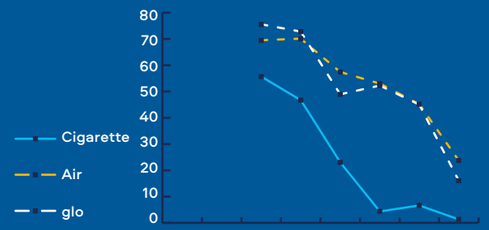
In Vitro Testing

Decreased Cilia Function

Key Events 2,4,6

Active function for cilia exposed to glo aerosol comparable to air exposure over a six-week period.

Smoke exposure resulted in zero function after four weeks.

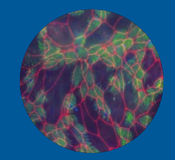


In Vitro Testing

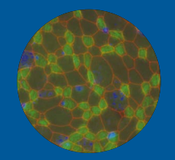
Increased Mucus & Viscosity

Key Events 5

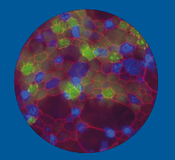
Increased goblets (blue dots) on cilia observed with smoking. Cilia / goblet number for glo aerosol and air exposure = comparable.



Air



glo



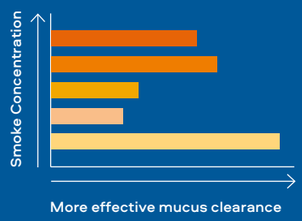
Cig

In Vitro Testing

Decreased Mucus Clearance

Key Events 7

Effective mucus clearance is reduced with smoke exposure. Air exposure results in the most effective mucus clearance.



Decreased Lung Function

Adverse Outcome

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A Summary of Our 9-Step Scientific Risk Assessment Science

Our 9-step scientific Risk Assessment Framework allows us to understand:

How the product works;

How the product may impact an individual;

How the product may impact a population; and

What the effect of time may be.

Through our published science, we can summarise the following key conclusions for each of our Smokeless Products: glo, Vuse and Velo.

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Table 1. A summary of conclusions for our Smokeless Products from key scientific studies within our risk assessment framework.

	Heated Products -glo-	Vapour Products -Vuse-	Oral Nicotine Pouches -Velo-
Combustion studies (see Pages 172-177)	**No Combustion** Our glo products heat their consumables below 300°C, and our science has shown combustion does not occur below 300°C.	**No Combustion** Our Vuse products heat its e-liquid below 200°C delivering an aerosol without combustion	**No Combustion** Our Velo products are oral products that are consumed without heat.
Emissions studies (see Pages 172-177)	90-95% **less toxicants***†^\	99% **less toxicants***†^	>99% **less toxicants***†^
Toxicology studies (see Pages 172-177)	98% **lower genotoxic response**# 90% **lower cytotoxic response**# 95% **less cell stress**#	>99% **lower genotoxic response**# 95% **lower cytotoxic response**# >98% **less cell stress**#	>99% **lower genotoxic response**# 99% **lower cytotoxic response**# >98% **less cell stress**#
Clinical: Exposure (see Pages 184-189)	**Statistically Significant Reductions in Exposure** Complete switching to glo can reduce a smoker's exposure to several harmful chemicals as compared to continued smoking.	**Statistically Significant Reductions in Exposure** Adult solus consumers of our Vuse products have lower levels of exposure to several harmful chemicals compared to adult smokers.	**Statistically Significant Reductions in Exposure** Adult solus consumers of our Velo products have lower levels of exposure to several harmful chemicals compared to adult smokers.
Clinical: Individual Risk (see Pages 190-193)	**Favourable Changes in Biomarkers of Potential Harm** Complete switching to glo from combustible cigarettes can result in favourable changes in biomarkers of potential harm.	**Favourable Differences in Biomarkers of Potential Harm** Adult solus consumers of our Vuse products have shown favourable differences in biomarkers of potential harm as compared to smokers.	**Favourable Differences in Biomarkers of Potential Harm** Adult solus consumers of our Velo products have shown favourable differences in biomarkers of potential harm as compared to smokers.

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

† Our Vapour product Vuse (including Alto, Solo, Ciro and Vibe), and certain products, including Velo, Grizzly, Kodiak, and Camel Snus, which are sold in the U.S., are subject to FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

^ On average, in comparison with smoke from a scientific standard reference cigarette (approximately 9 mg tar).

On average, in comparison with smoke from a scientific standard reference cigarette (approximately 9 mg tar)

Beyond our own science, there is evidence across both scientific organisations/institutes and industry that supports a scientific risk assessment framework approach with published data available (Table 2). Scientific organisations including the National Academy of Sciences, Engineering and Medicine (NASEM),[1] Institute of Medicine (IOM),[2] U.S. Food and Drug Administration (FDA),[3,4] and Tobacco Product Assessment Consortium (TobPRAC)[5], all layout frameworks as how to evaluate the risk profile of Smokeless Products.



> Evidence-based tobacco regulation requires a comprehensive scientific framework to guide the evaluation of new tobacco products and health-related claims made by product manufacturers.
>
> **TobPRAC**[5]

Table 2. Selection of Third parties' scientific publications in areas described by the 9-step scientific Risk Assessment Framework**

	Heated Products	Vapour Products	Oral Nicotine Pouches
Combustion Studies	Academia, China[6] Philip Morris International[7]		
Emission Studies	Regulator, Japan[8] Philip Morris International[9, 10]	Philip Morris International[11] Altria[12, 13] Imperial Brands[14]	Regulator, Germany[15] Altria[16]
Toxicological Studies	Academia, Italy[17] Philip Morris International[18, 19] Japan Tobacco International[20, 21] Imperial Brands[22, 23, 24]	Academia, Italy[17] Philip Morris International[25] Altria[26, 27] Altria/ Philip Morris International[28] Imperial Brands[17, 29]	Japan Tobacco International[30] Imperial Brands[31]
Use Behaviour	Philip Morris International[32] Altria[33]	Altria[34, 35] Imperial Brands[36]	Altria[37, 38]
Clinical: Pharmacokinetic Studies	Philip Morris International[39, 40] Imperial Brands[41]	Imperial Brands[42]	Academia, U.S.[43] Altria[44, 45] Imperial Brands[46] Swedish Match[47]
Clinical: Exposure	Philip Morris International[48, 49, 50] Japan Tobacco International[51, 52]	Academia & Regulator, U.K. and U.S.[53] Academia & Regulator, U.S[54] Altria[55, 56] Imperial Brands[57, 58]	Altria[59]
Clinical: Individual Risk	Philip Morris International[34, 36]	Altria[39, 40, 59]	
Population Risk Post-Market Surveillance	Philip Morris International[60] Japan Tobacco International[61]	Altria[43]	Academia, U.S.[62]
Epidemiological Modelling Data	Philip Morris International[63, 64] Japan Tobacco International[65]	Altria[66]	

** The allocation for illustrative purposes of the individual third parties' scientific publications does not necessarily mean that the third parties listed follow a similar 9 step framework approach in their science.

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05 Our Smokeless Products



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A Better Tomorrow™ for Consumers

Combustible cigarettes pose serious health risks. The only way to avoid these risks is to not start smoking, or to quit.



As this report highlights, it is widely accepted that most of the harm associated with tobacco is caused by inhaling the smoke produced by its combustion.

It's clear to us then, that for those adult smokers who would otherwise continue to use cigarettes, they should be encouraged by all stakeholders to switch to Smokeless Products.

Adult consumers deserve choices. Our portfolio of Smokeless Products has been designed to provide a range of enjoyable, scientifically substantiated, reduced-risk*† alternatives to smoking.

We know that adult smokers are more likely to switch to new products if they can find acceptable alternatives that offer sensorial enjoyment and recapture some of the consumer moments associated with smoking.

Our range of high-quality products covers all segments, from value-for-money to premium, while also offering consumer choice among different product types and experiences.

However, if Smokeless Products are to meet their potential to deliver Tobacco Harm Reduction (THR), they must be widely available, with the right regulatory and market conditions in place, alongside high standards.

To support the success of our Smokeless Products, we will continue to advocate for regulation that enables market availability, applies the highest product quality and safety standards, and allows communication of the potential benefits and risks, while preventing underage appeal and access.

Our global community of adult consumers is diverse. We don't believe that a 'one size fits all' approach is right, and continuously work to satisfy evolving consumer preferences with a broad portfolio that takes into account geographic and market differences.

We have our Responsible Marketing Principles[1] and Code[2] in place to govern how we market our products, with particular focus on how to ensure our products are designed for adult smokers and nicotine consumers.

We have a proven track record of building and managing some of the most iconic brands in history. We will continue to build on this expertise to grow our Smokeless Products business, and through Building a Smokeless World, meaningfully contribute to Tobacco Harm Reduction.

> **Adult consumers deserve choice. Our portfolio of Smokeless Products has been designed to provide a range of enjoyable, scientifically substantiated, reduced-risk*† alternatives to smoking.**



Luciano Comin
Director, Combustibles & New Categories

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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Our Product Innovation Process



Our enhanced innovation pipeline is enabled by our approach to product lifecycle management, driven by our 5D model.

This process involves five 'D' stages. We DEFINE and prioritise consumer opportunities, DISCOVER at a technology and product level, DEVELOP the commercial offering through our internal or external capability network, then leverage our global scale and capabilities to fully DEPLOY our winning portfolio, and finally DELIST products when the time calls for it.

All stages are underpinned by strong portfolio management, ensuring our innovation pipeline and in-market portfolio are actively managed for maximum impact. This means better, faster innovations with efficient development, rollouts and removals, generating higher returns on investment.



"Our innovation ecosystem is designed to deliver products that meet consumer demands and bring value to our business. In designing our products, we seek to assess their environmental impact and ensure they are compliant, ready for global market rollout. Most importantly, they must align with our A Better Tomorrow™ vision through Building a Smokeless World and reducing the health impact of our business."

Luigi Giucca
Group Head of New Categories R&D

Innovation Formula

$$\mathcal{E}i = CxAxRxE$$

$\mathcal{E}i$ = Innovation Sufficiency

C = Consumer insights

A = Safety Assessment

R = Regulatory Compliance

E = Environmental, Social & Governance

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Enhanced Product Lifecycle Management



Active portfolio management

Define

- C = Consumer insights
- A = Safety assessment strategy
- R = Regulatory strategy
- E = Environmental strategy

Discover

- C = Qualitative and quantitative testing
- A = In silico evaluation
- R = Regulatory approach confirmed
- E = Lifecycle analysis and design choices

Develop

- C = Validated product experience
- A = In vitro, in vivo and human testing
- R = Regulatory submission compilation
- E = Environmental target delivery

Deploy

- C = Adult consumer launch deployment
- A = Post market product vigilance
- R = Market by market compliance
- E = Responsible use and disposal guidance

Delist

- C = Product removed from market
- A = Vigilance until 100% removed from market
- R = Regulatory notifications as appropriate
- E = Footprint reduction of the next generation

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Tobacco Harm Reduction: Risk Perceptions



Our purpose of A Better Tomorrow™ through Building a Smokeless World is underpinned by Tobacco Harm Reduction (THR), which is based on adult smokers switching to lower risk*† profile tobacco and nicotine products. While much progress has been made, one of the most significant barriers to adult smokers switching is their perception of the risk of Smokeless Products.

Quite simply, the more adult smokers who perceive the risk of Smokeless Products to be lower than that of smoking, the more likely they will be to switch.

*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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

Vapour Products do not contain tobacco and operate at temperatures much lower than that in a burning cigarette, emitting fewer and lower amounts of harmful chemicals relative to cigarette smoke. Despite significant support for the reduced-risk nature of Vapour Products, many adult smokers perceive them to be equally or more risky than cigarettes, in part due to the following reasons:

- E-cigarette or vaping use-associated lung injury (EVALI) crisis when adulterated illicit e-cigarettes were sold and used in parts of the U.S. in 2019;
- Certain manufacturers using ingredients that have links to harm (e.g. Diacetyl and Bronchiolitis obliterans ‘popcorn lung’);
- They contain nicotine, which is misperceived as being the principal cause of smoking-related disease; and
- Historical association of nicotine and cigarette smoke, conflating the risks of nicotine.

What is risk perception?

Risk perception refers to people’s subjective judgements about the likelihood of negative occurrences such as injury, illness, disease, and death. Risk perception is important in health and risk communication because it determines which hazards people care about and how they deal with them. Risk perception has two main dimensions: the cognitive dimension, which relates to how much people know about and understand risks; and the emotional dimension, which relates to how they feel about them.[1]

How is risk perception measured?

Risk perception is typically measured using questionnaires, which can be administered either longitudinally (e.g. asking the same group about their risk perception over a period of time) or cross-sectionally (e.g. taking a random sample of the population at a single time point). The questionnaire can be administered either with or without stimulus (e.g. giving the subjects information about Smokeless Products relative to cigarettes).

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Figure 1. UK adults' perception of harm from e-cigarettes, Great Britain (2013-2023)[2]



> Despite NASEM's [National Academies of Science, Engineering and Medicine] conclusions that complete substitution of cigarettes with e-cigarettes reduces exposure to numerous toxicants and carcinogens... [only] 11.4% of Americans perceiv[e] e-cigarettes to be less harmful. Similarly, many physicians also believe that all tobacco products [including e-cigarettes] are equally harmful.
>
> **Dr Brian King**
> Director, Center for Tobacco Products, U.S. FDA[3]

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Table 1. Risk perceptions of U.S. adult smokers (%)[4]

Product comparison	Don't know	Less harmful	About the same	More harmful	Total misperception
LNC vs CC	0.56	13.13	82.08	4.23	17.92^
Snus vs CC	2.58	6.09	64.12	27.21	93.91^^
EC vs CC	2.17	18.69	70.18	8.96	81.31^^
EC vs NRT	2.26	11.04	64.61	22.09	77.91^^^

LNC = Low Nicotine Cigarette;
CC = Combustible Cigarette;
EC = Electronic Cigarette;
NRT = Nicotine Replacement Therapy

^ Total = Don't know + Less harmful + More harmful
^^ Total = Don't know + About the same + More harmful
^^^ Total = Don't know + Less harmful + About the same

Risk perception of THR products by different stakeholder groups

(i) Adult perceptions of THR products

The UK is entering its second decade of transformation with Vapour Products being available for sale since the early 2010s. The trend of risk perception of Vapour Products is profound,[2] with the number of adult consumers who perceive Vapour Products as being less risky than smoking dropping from 42% to 34% over the last decade. Contrary to this, the number of adult consumers who perceive Vapour Products as being more risky than smoking has increased from 8.1% to 43% over the last decade (Figure 1). Those who state they don't know has also dropped from 38% to 21%, meaning that while adult consumers are making more decisions on the risk profile of Vapour Products compared to smoking, these decisions appear to be running contrary to the messaging of the mainstream UK public health authorities.

In a similar manner, researchers in the U.S. surveyed 33,822 adults (Wave 4 of PATH survey),[4] to assess their perceptions of risk between different types of products (Table 1). The findings were profound with respondents stating that all three product types assessed, snus, e-cigarettes and Nicotine Replacement Therapy, were about the same level of risk or more harmful than cigarettes. This outcome is despite all the epidemiological evidence from Sweden on snus, the public health support for the reduced risk profile of e-cigarettes and the fact that Nicotine Replacement Therapy is medically regulated, and therefore must demonstrate its safety profile.

Noteworthy was the fact that more adults (13.13%) perceived low nicotine cigarettes as being less harmful than conventional cigarettes, whereas only 4.23% perceived them as being more harmful, signalling the impact that misperceptions of nicotine have on the total risk perception of products.

In South Korea, where Heated Products and Vapour Products have been available, 3,713 tobacco and/or nicotine-using adults were surveyed, to gather insights on harm perceptions.[5] Overall, around a quarter of respondents believed that Heated and Vapour Products (<28% and <24%, respectively) are less harmful than cigarettes. However, this belief is notably different between respondents who exclusively smoke and those who smoke cigarettes and use Heated Products and/or Vapour Products (Figure 2 and Figure 3, respectively).

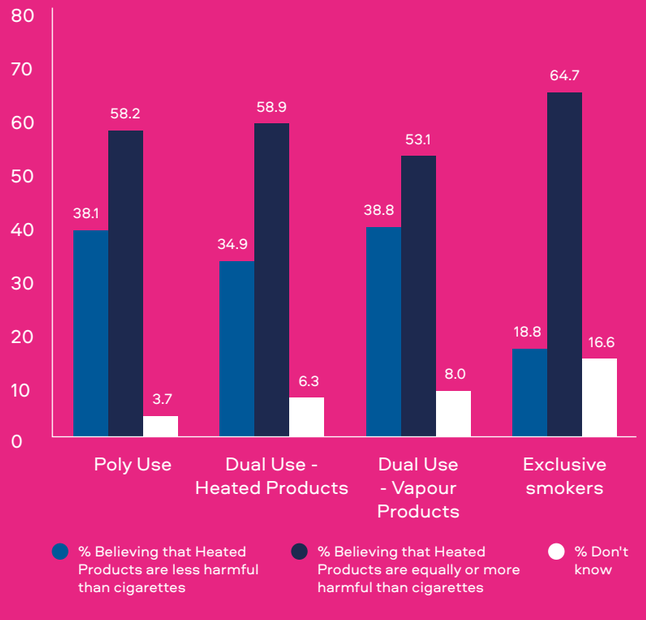
(ii) Medical practitioner risk perception of THR products

Multiple leading public health and regulatory stakeholders have concluded that Smokeless Products, while not safe, are reduced-risk relative to smoking. Despite this, knowledge and subsequent risk perception of Smokeless Products is struggling to filter down to the 'front line' medical practitioners, who adult smokers rank as the most trustworthy source for information relating to risk (59.6% of 519 current adult smokers surveyed).[6]

U.S. physicians have been provided with guidance relating to tobacco use through the U.S. Public Health Service-sponsored Clinical Practice Guideline 'Treating Tobacco Use and Dependence' publication.[7] Updated in 2008, this guideline does not include any reference to e-cigarettes and/or other Smokeless Products.

A 2018/9 U.S. cross-sectional survey of 2,058 physicians reported that more than three in four physicians had not used this Public Health Service-sponsored guideline (32.5% unaware of these guidelines, 40.6% aware but had not read the guidelines, and 7.3% had read the guidelines but did not use them).[8] Of these 2,058 physicians, 70% reported being asked about e-cigarettes by their patients, with one in three physicians being asked within the past 30 days. When considering risk, most physicians (60.1%) endorsed the belief that "all forms of tobacco were equally harmful and that cessation from all tobacco use was the best approach."

Figure 2. Perceived harmfulness of Heated Products compared to cigarettes among adults who smoke cigarettes, Republic of Korea, June 2020 (%)



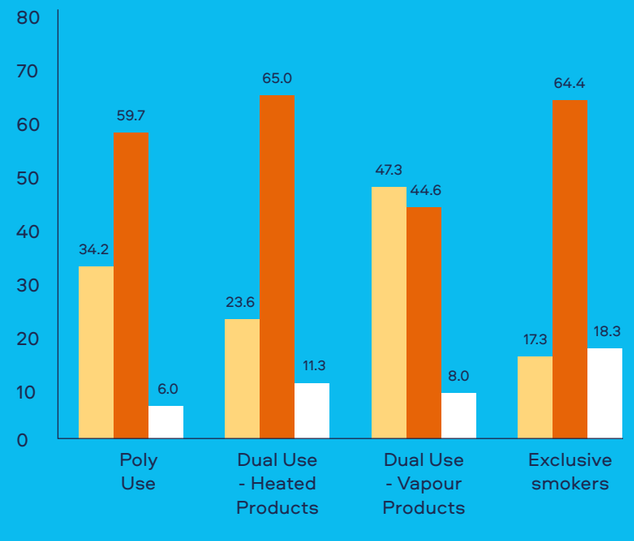
The remaining physicians (39.9%) endorsed the belief that cigarettes were the most dangerous form of tobacco and getting adult smokers to quit was the goal. However, only 22% of the surveyed physicians ever recommended e-cigarettes to adult smokers.

In Japan, where Heated Products is the most prevalent Smokeless Products, physician awareness of Smokeless Products was high (Heated Products, 76.7% and Vapour Products, 71.3%).[9,10] Of the physicians who were aware of Heated Products (n=3,730), two in three were never smokers and a small number had ever used Heated Products (n=140). For physicians who had never smoked or used Heated Products, most (>50%) agreed with the statements "misguided assumption that [Heated Products] are less harmful than cigarettes" and "misguided assumption that [Heated Products] does not causing [sic] passive smoking."

Agreement with these statements was lower for physicians who used Heated Products (<27%). All physicians had strong agreement with the statement "Lack of evidence regarding the long-term safety of [Heated Products]". Overall, although most Japanese physicians were aware of Smokeless Products, disparity in knowledge regarding their relative risk compared to cigarettes may result in adult smokers receiving contrasting guidance and support with regards to quitting.

In contrast to U.S. and Japanese physician knowledge of Smokeless Products and their relative risk, the UK's National Health Service (NHS) provides advice and support to adult smokers wanting to use e-cigarettes to quit smoking. In 2023, the UK Government pioneered a 'Swap to Stop' scheme with the ambition to encourage one million adult smokers to switch to e-cigarettes.[11] The Government's intention is to improve the health of the nation and cut smoking rates. This campaign highlights the progressive methodologies that countries such as the UK are adopting to persuade adult smokers to switch to lower risk profile tobacco and nicotine products.

Figure 3. Perceived harmfulness of Vapour Products compared to cigarettes among adults who smoke cigarettes, Republic of Korea, June 2020 (%)



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Risk perception of nicotine by different stakeholder groups

(i) Adult risk perceptions of nicotine

In the survey of U.S. adults described above,[4] the respondents were asked to rank their perception of nicotine alone as well as nicotine in different product formats. Despite the public health guidance on nicotine, nearly two-thirds of adults perceive the nicotine in cigarettes to be what causes most of the cancer caused by smoking.

In different product formats adults ranked the risk of nicotine to be somewhat, very or extremely harmful, in cigarettes (89%) e-cigarettes (83%) and Nicotine Replacement Therapy (73%) (Table 2). This illustrates the need for the education of adults around nicotine risk, as otherwise we believe this will remain a barrier for adult smokers to switch to lower risk profile tobacco and nicotine products.

In the UK, a 2021 ASH Adult Survey of 1,679 adult smokers and Vapour Product consumers, reported that only 13.9% "had accurate perceptions believing that none or a very small amount of the risk of smoking were due to nicotine".[12]

Of the 1,679 respondents, >68% reported nicotine as being the source of risk in cigarette smoke to some degree (23.9% "under half the risk", 17.3% "half the risk", and 26.9% "much more than half the risk"). The remaining 18.1% of those surveyed did not know. This data further highlights the confusion that is faced by adults when considering the risks of nicotine.

(ii) Medical practitioner risk perception of nicotine

In a recent survey of 926 physicians in the U.S., the participants were asked to what extent they agree or disagree that nicotine on its own directly contributed to health effects (Table 3).[13]

Similarly, a second published study surveyed 1,020 physicians and overall, most physicians "strongly agreed" that nicotine directly contributes to the development of cardiovascular disease (83.2%), COPD (80.9%), and cancer (80.5%).[14]

Table 2. Risk Perception of nicotine amongst U.S. adults (%)[4]

Product Formats	Don't Know	Not at all Harmful	Slightly Harmful	Somewhat Harmful	Very Harmful	Extremely Harmful
Nicotine	0.20	2.59	6.66	25.03	35.87	29.63
Nicotine in Cigarettes	0.29	2.40	7.88	28.20	33.81	27.41
Nicotine in EC	2.18	3.02	11.81	40.86	25.67	16.47
Nicotine in NRT	2.03	4.37	20.27	41.84	17.59	13.88

Table 3. Distribution of results to nicotine questions (%)[13]

Condition	Agree	Strongly Agree	Agree or Strongly Agree
COPD	10.2	67.3	77.5
CVD	11.9	78.2	90.1
Cancer	12.7	69.6	82.3



Linking THR risk perceptions to THR outcomes: the Swedish experience

Utilising Sweden as the vanguard market for THR (lowest smoking incidence, equivalent per capita usage of tobacco and nicotine to EU, and lowest lung cancer fatalities), risk perceptions of THR products were assessed with Swedish adult smokers and Oral Nicotine Pouch consumers. This was then compared with THR perceptions from other markets that used similar products (Table 4).[15]

In terms of target setting for national risk perception targets, one approach could be to achieve the favourable risk perception observed in Sweden of 74%, meaning that a national risk perception score of 100% would not necessarily be required to have a successful implementation of THR. Therefore, in Europe for example, new education programmes could be implemented in Denmark to improve risk perceptions from 31% to 74%; UK from 36% to 74% and Switzerland from 23% to 74%.

Table 4. THR Risk Perceptions: Oral Nicotine Pouches[15]

	THR Risk Perception#			
Country	Adult Smokers	Adult Oral Nicotine Pouch users	Adult Tobacco and Nicotine users	Oral Nicotine Pouches Incidence ##
Sweden	67%	71%	74%	55%
Denmark	23%	45%	31%	21%
UK	36%	36%	34%	8%
Switzerland	17%	42%	23%	8%

Percentage of the cohort that believe Smokeless Products are safer than cigarettes
Among Total Tobacco and Nicotine Market

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Overview of THR perceptions in key Smokeless Product Markets

A summary of Smokeless Product penetration and THR risk perception for all three categories in selected markets for each category is summarised in Table 5.[15] Heated Products have a market penetration of 21-45% and with an average favourable THR score of 55%. Vapour Products have a market penetration of 19-57% and with an average favourable THR score of 52%. Oral Nicotine Pouches have a market penetration of 2-55% and with an average favourable THR score of 50%. Improving favourable THR risk perceptions would go a long way to improving the adoption of Smokeless Products, facilitating the migration of adult smokers to lower risk products.

Advancing forward

The key to making progress in correcting misperceptions on the risk profile of THR products and nicotine in general comes down to improving education. There is an urgent need for clear, informed, science backed communications from key stakeholder groups. While important publications supporting THR (see Big Question 6, Page 64) are becoming more prominent across the globe, more must be done to amplify these messages and ensure accurate information gets into the hands of the front-line medical community.

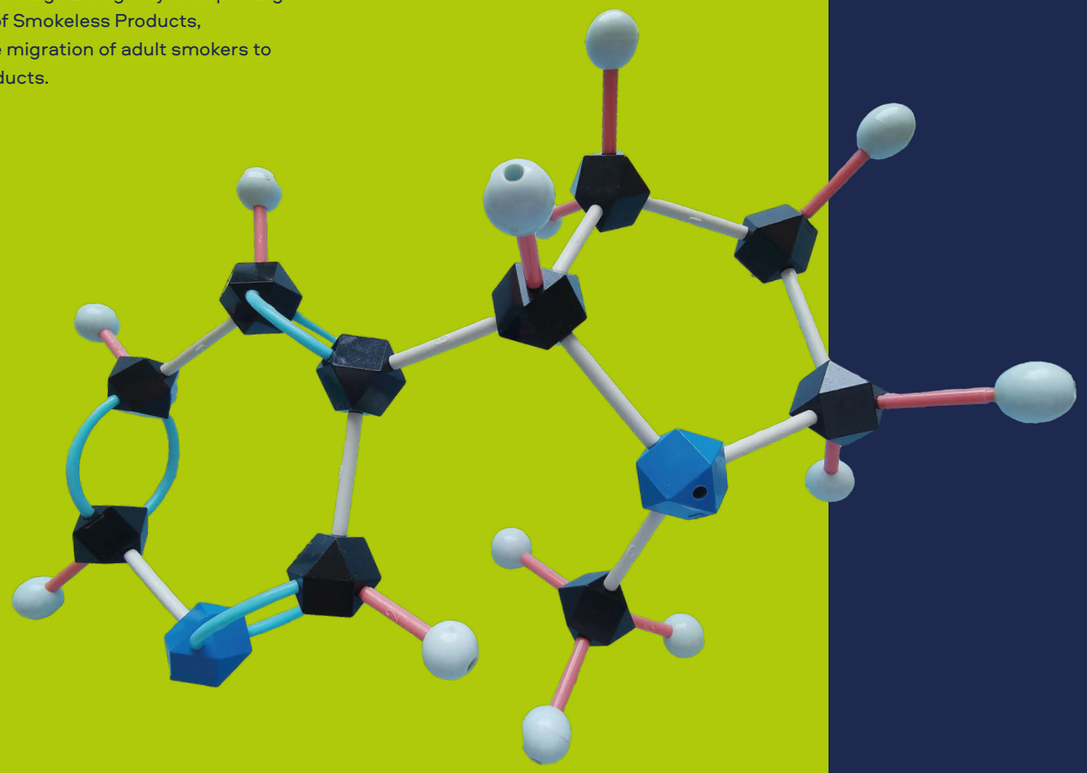


Table 5. THR perceptions and market penetration: a category view[15]

Heated Products

Market	Heated Products Incidence^ (%)	Favourable THR Perceptions^^(%)
Japan	45	70
Italy	31	50
Poland	21	50
Korea	32	50
Average	**32**	**55**

Vapour

Market	Vapour Products Incidence (%)	Favourable THR Perceptions^^(%)
Canada	38	53
UK	57	64
France	31	51
Germany	19	39
Average	**36**	**52**

Oral Nicotine Pouches

Market	Oral Nicotine Pouches Incidence^ (%)	Favourable THR Perceptions^^(%)
Sweden	55	74
Denmark	21	31
Switzerland	8	23
Pakistan	2	71
Average	**22**	**50**

^ Among Total Tobacco and Nicotine Market

^^With adult smokers and Smokeless Products consumers



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Consumer Product Research

BAT is a global company with innovation at its core. New technologies and rapid market shifts require increasing agility from us to respond to consumer demand. Simultaneously, our Research and Development (R&D) teams, continue to ensure we maintain our ethical standards and procedures.

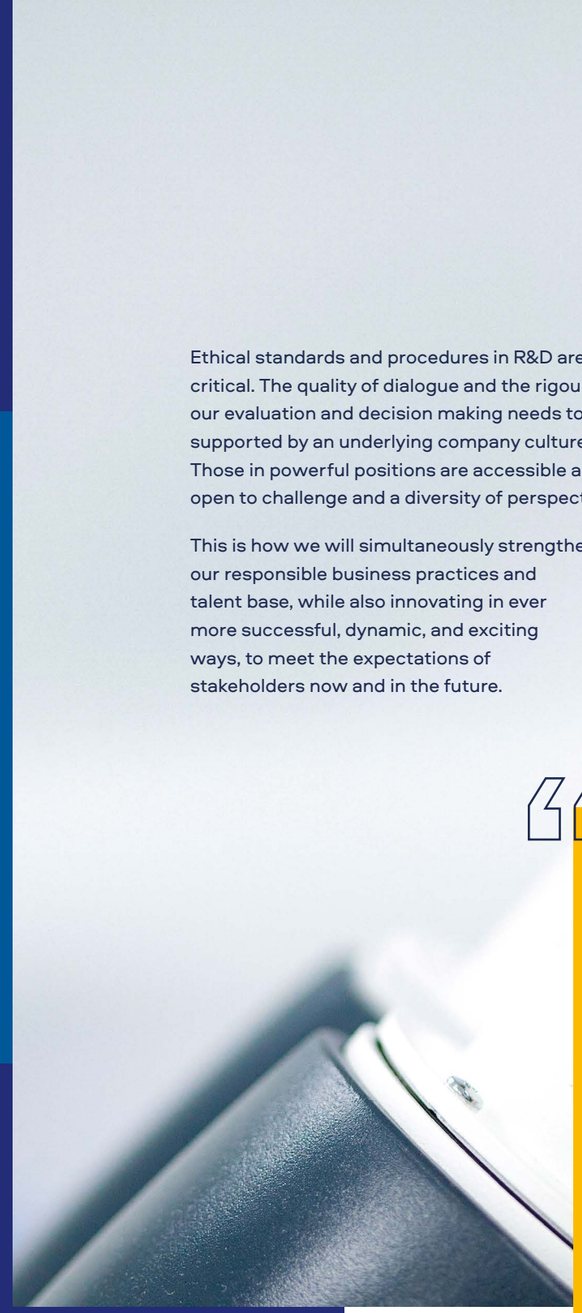
Our overriding objective is to ensure that our scientific studies provide meaningful outcomes, while minimising any risks and burdens placed on study participants.

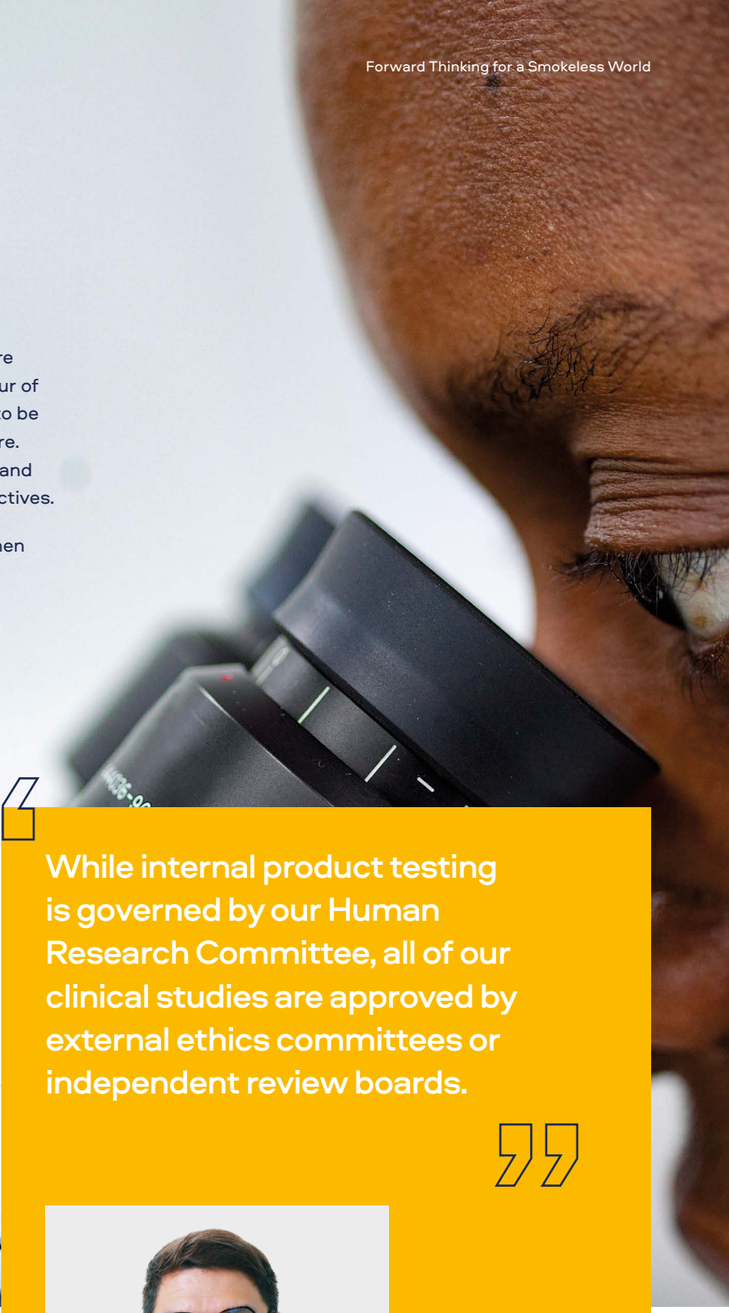
Our Human Research Committee (HRC) operates by drawing on the individual inputs and collective expertise of different disciplines in science, including medical and scientific as well as other disciplines from which input is required. Through open engagement with project teams – structured by a clear preparatory and submissions process – it provides our scientists and product developers with an inclusive environment in which to ask questions, draw on diversity of experience, and benefit from the knowledge and lateral thinking provided by the Committee's members.

In parallel to the work that the HRC does, we ensure that all our products meet all legal standards required through rigorous stewardship and testing. We also prioritise fair and safe working conditions for employees and suppliers. We embed sustainable practices throughout our supply chain, from the sourcing of raw materials, and the reduction of waste and pollution, to the development and adoption of practices that promote environmental conservation.

Ethical standards and procedures in R&D are critical. The quality of dialogue and the rigour of our evaluation and decision making needs to be supported by an underlying company culture. Those in powerful positions are accessible and open to challenge and a diversity of perspectives.

This is how we will simultaneously strengthen our responsible business practices and talent base, while also innovating in ever more successful, dynamic, and exciting ways, to meet the expectations of stakeholders now and in the future.





> While internal product testing is governed by our Human Research Committee, all of our clinical studies are approved by external ethics committees or independent review boards.



Dr Hugo Tan
Group Medical Safety Officer

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Six key steps in our approach to consumer product testing

01
Participants are current adult smokers and/or nicotine consumers

02
Participants' suitability for study

03
Robust study objectives

04
Test products are safe for study use

05
Participants provide informed consent in choosing to join a study

06
Adverse events triaged by Global Medical Safety Officer

How do we approach this?

The 1964 Declaration of Helsinki developed by the World Medical Association is regarded as a cornerstone for guiding human research ethics.[1]

Our internal Human Research Committee (HRC) governs our overall standard of conduct for scientific research and development across the business. It provides ethical review, recommendations and guidance to all project teams across the organisation conducting any form of human research. With these principles at its core:

Study objectives are clear and well-articulated;

Study participants are engaged, and test products are used appropriately, with a disciplined focus on meeting those objectives;

Study design is robust, ensuring that it doesn't need to be repeated due to inconclusive results;

Participant suitability criteria are appropriate for the study; and

Volunteers are able to make informed decisions about participating, based on information about the study and its objectives, what they are required to do, and any potential risks involved.



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Product Safety Assessment

Each employee has a responsibility to implement attention, caution and prudence when developing and maintaining products.



It is the collective responsibility of our teams to:

01 **Understand our products** from idea to retail and consumer consumption, spanning all stages of product development and all elements of our products, including ingredients, materials, electrical safety, and consumer exposure to emissions.

02 **Respond and act** on any new information that may impact the safety of our products.

03 **Confirm** that our products meet the appropriate standards required to deliver consumer products that align with our Tobacco Harm Reduction (THR) strategy.

Toxicological Assessment

For our Smokeless Products, we apply toxicological assessment principles to identify hazards and contextualise the risk to adult consumers.



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Electrical Safety of Devices

We employ robust checks to ensure the safety of our electrical devices. We conduct appropriate safety testing and meet the applicable regulations for our electrical devices, such as Electromagnetic compatibility (EMC), electrical safety, battery safety, etc.

Product Compliance

Each product manufactured by BAT meets the regulatory requirements for its market. We assess the technical requirements, identify and check packaging/devices requirements, and notify regulatory bodies of new launches as required.

Post Market Surveillance

Robust internal processes and procedures monitor any consumer complaints, and we act accordingly, in line with the TPD, FDA, or other similar requirements. We intake, triage, process and analyse cases systematically. Our database ensures seamless reporting to regulators, when necessary, along with signal detection, efficient support for adult consumers, the carrying out of investigations and the generation of aggregated safety reports.

Duty of care statement

In line with the business principle of responsible product stewardship, we will continue to ensure that our products are developed and manufactured in a responsible manner. This means products will meet legal and regulatory requirements in the country of sale and will meet the Group's duty to use adequate attention, caution, and prudence in bringing a product to market.

In addition, we maintain scientific expertise relevant to our products by undertaking our own programme of research, participating in scientific engagement and keeping abreast of external scientific and regulatory developments.



Smokeless Product Stewardship: Our Approach

	Heated Products (Inhalation)	Oral Tobacco Products (Buccal Absorption)	Vapour Products (Inhalation)	Oral Nicotine Pouches (Buccal Absorption)
System (Emissions Toxicology)	✓		✓	
Device (Electrical, Mechanical Materials, E&L)	✓		✓	
Consumable (Content, Toxicology)	✓	✓	✓	✓

Scientific challenge increases

Each category poses unique questions for safety evaluation with inhalation products most complex

> For our Smokeless Products, we apply toxicological assessment principles to identify hazards and contextualise the risk to adult consumers.



Dr Karina McQuillan
Group Head of Toxicology

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Product Regulatory Compliance

We ensure that all of our Smokeless Products comply with global and national safety standards, where applicable.

BAT-developed Smokeless Products include electronic products and accessories supplied to us, and to our subsidiary companies, by third-party manufacturers. Our supply chain uses material declarations to track and declare specific information about the material composition of its products.

To harmonise requirements across the supply chain and to improve economic efficiency, we follow international standards and practices covering the determination of regulated substances. This allows for a global, harmonised approach to the exchange of material composition data, and provides the requirements for material declarations and test methodologies.



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REACH

We ensure that our products and materials supplied to us comply with the EU Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), which addresses the production and use of chemical substances and their potential impacts on human health and the environment. Materials used in all product and product packaging-related applications are assessed against the REACH Candidate List published and updated regularly by the European Chemicals Agency.

Electromagnetic compatibility

Electromagnetic interference (EMI), or radio-frequency interference (RFI), may degrade the performance of a circuit or even stop it from functioning.

We comply with the International Electrotechnical Commission's (IEC) standards to provide a presumption of conformity with the protection requirements of Electromagnetic Compatibility (EMC) regulations, covering emission and immunity.

International harmonised standards are designed to satisfy the protection requirements of various global EMC approaches, for example, the European Union's EMC Directive.

Our simplest route to compliance is to use standards that cover the whole of the EMC protection requirements of the appropriate product standards, i.e. product-family or dedicated product standards that cover our Heated Products and Vapour Products. For our electronic Heated Products and Vapour Products, the appropriate product standards family is: 'household appliances and portable tools.'



RoHS restrictions

We abide by IEC 63000 regarding the technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances. Substances restricted under the EU's Restriction of Hazardous Substances (RoHS) Directive (2011/65/EU) in electrical and electronic equipment (not batteries) include cadmium, chromium VI, lead, mercury, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE).

All BAT-branded non-electrical and non-electronic Smokeless Products and parts must satisfy the minimum requirements of the legislation, and suppliers should comply with local laws and regulations where the products are sold.

Certain RoHS Directive exemptions can be used on our Smokeless Product parts. However, it is expected that alternative, compliant materials will be used where possible.



Low voltage safety

The standards that apply to electrical appliances that fall within low voltage regulations - including the EU's Low Voltage Directive (LVD) voltage limits - also encompass battery-operated appliances at much lower ratings. These include our Heated Product and Vapour Product devices. This ensures safety protection for consumers throughout their likely use.

Conformity with the IEC harmonised standards provides a presumption of conformity with the protection requirements of Low Voltage (LV) regulations.

Our simplest route to compliance is to use standards that cover the whole of the LV protection requirements of the appropriate product standards. IEC 60335-1 is the core safety standard for our appliances, since it deals with the safety of electrical appliances for household and similar purposes.

> We submit our products for independent third-party certification, which provides clear evidence that they comply with the required safety standards.



Dr Marianna Gaca
Group Head of Product Regulatory Compliance

Wireless (connected appliances)

Wireless regulations are often governed by end market product specific regulations that establish the requirements for all wireless transmitters and receivers, apart from devices used exclusively for military, state security, radio amateurs, and civil aviation. We follow the appropriate regulations, articles and approaches for wireless standards when producing connected products in the Heated Products and Vapour Products categories.

Product packaging

The BAT Group's Product Stewardship Council (PSC) guidelines for packaging help to ensure that product packaging materials do not pose a toxicological risk to the consumer, either directly, or via contamination of the product by the packaging.

Substances not to be used as ingredients in packaging materials include but are not restricted to: substances classified as carcinogenic, mutagenic or toxic for reproduction, according to the Provisions of Regulation (EC) No 1272/2008 on classification, labelling and packaging substances and mixtures.



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Our Heated Products

Our Devices

The latest glo devices, Hyper Pro and Hyper, utilise induction heating to externally heat our tobacco and non-tobacco consumables that contain nicotine. Energy is transferred from the induction coils via a magnetic field to a heating element that surrounds and heats the consumable to a specific temperature range.

Heating Technologies

Resistive Heating

Heat is generated through an electrical current flowing through a resistive material (Figure 1). Our resistive heating devices utilise this technology with a flexible thin-film heater. The resistive heater is wrapped around a metal tube, in which the consumable is inserted.

Induction Heating

Heat is generated through a magnetic field that heats up a specific electrically conductive material. The magnetic field is generated by an alternating current passing through a wire coil (Figure 2). Our induction heating devices utilise this technology with an electrically conductive metal tube (1) surrounded by a specific wire coil (2). The wire coil generates the magnetic field (3) that heats the electrically conductive metal tube, in which the consumable is inserted.

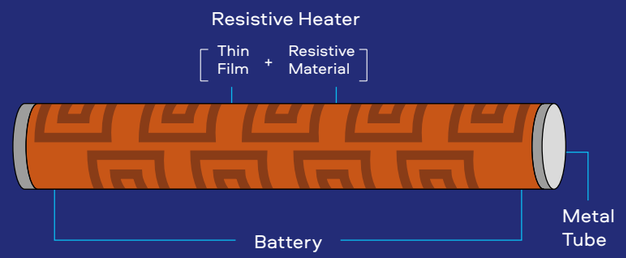


Figure 1. A simplified representation of a resistant heater

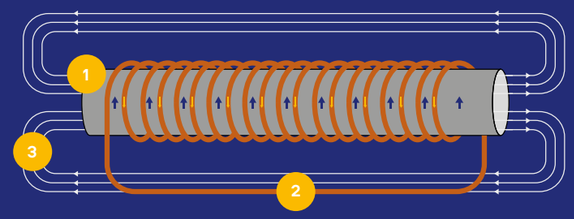


Figure 2. A simplified representation of an induction heater

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Our Consumer Drivers of Choice are:

01 Reduced-Risk*† Potential
Non-combustion for Heated Products results in aerosol that has ~90-95% reduction in key toxicant levels relative to cigarette smoke.*†#

02 Taste Satisfaction
Familiarity in taste satisfaction compared to their current nicotine product.

03 Ritual & Intuitiveness
Ease and familiarity when consuming the product.

04 Product Availability
Can the product be found everywhere?

05 Value
Is the product at the right price?

06 Identity
A brand that delivers through innovation and progression.

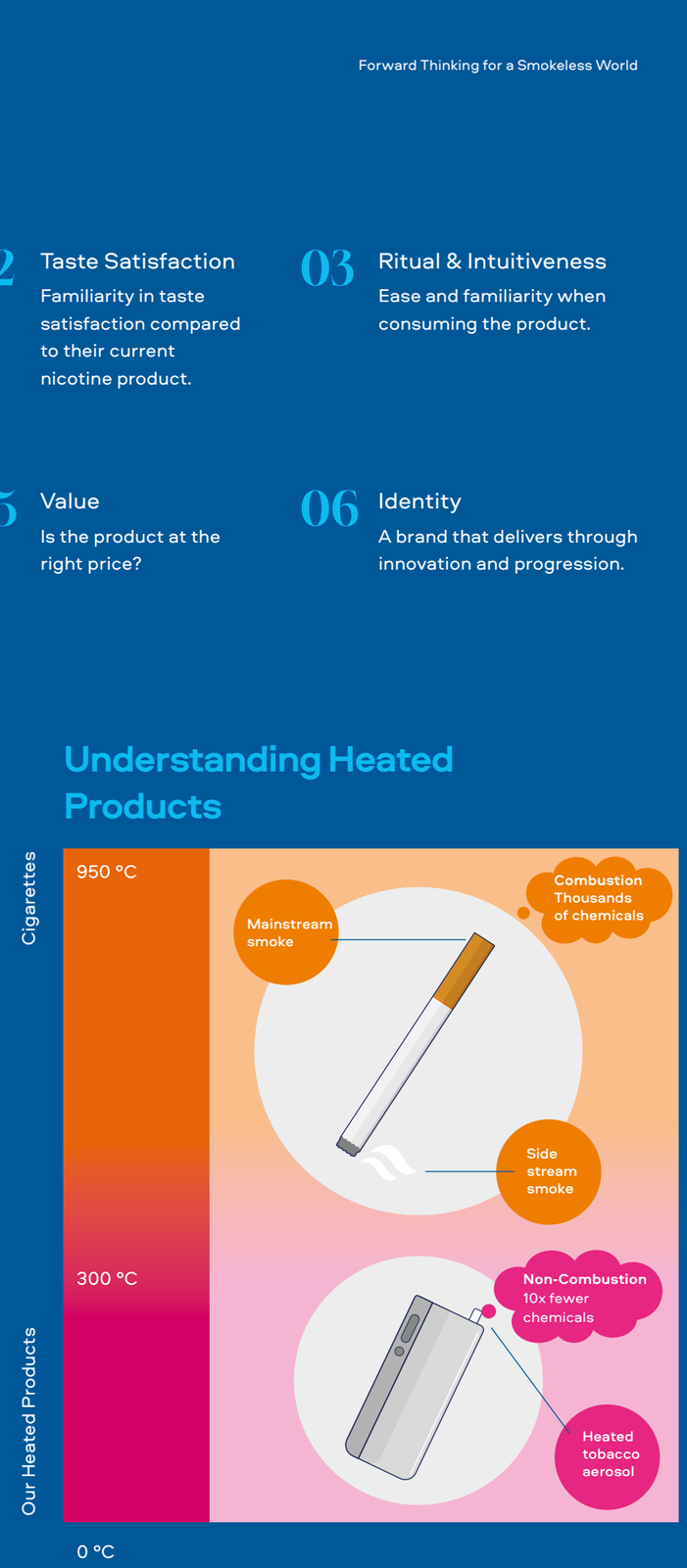
Our Consumables

Specifically designed for use with our glo devices, our consumables deliver an aerosol that comprises mainly of water, glycerol, nicotine and flavours when heated. Our consumables are not combusted but heated to temperatures closer to a baking experience. Controlled heating has a direct impact on the complexity of the heated product aerosol compared to cigarette smoke.

Why do adult consumers demand Heated Products?

With the objective of meeting our consumer demands, it is important that we can understand the drivers of choice and bring meaningful innovation through bespoke science to deliver and build on the future of the category.

Understanding Heated Products



* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

\# Comparison with smoke from a scientific standard reference cigarette (approximately 9 mg tar) in terms of the average of the nine harmful components the World Health Organization recommends reducing in cigarette smoke. These products are not risk free and are addictive.

The Evolution of Our Heated Products

Charcoal Tip Heated Products

Premier
The first heated tobacco product was introduced by RJ Reynolds in 1988. Premier was the same shape and size as a traditional cigarette, but used a carbon-based heat source attached to a tobacco roll and aluminium capsule containing tobacco extract and glycerol that would heat up to 225°C. Premier's distinct taste and odour led to low consumer acceptance.

Eclipse
Eclipse was the second-generation heated tobacco product introduced by RJ Reynolds in 1996, after undertaking substantial efforts to address the consumer acceptance issues that arose with Premier. Like Premier, Eclipse was the same shape and size as a traditional cigarette, but used an advanced carbon heating element, along with a two-segment roll of tobacco and glycerol. Eclipse continues to be sold in the United States but has had low consumer acceptance.



Resistive Heating, Kingsize Superslim (KSSS)

Launched: 2016 (1 Series 1), 2018 (2 Series 2) and 2019 (3 Mini, 4 Nano)

The first glo devices used resistive heating to heat a KSSS consumable to 240°C. The glo resistive heating series offered a single 3 minute 30 seconds heating mode with a ramp-up time of 40 seconds. Series 1 and 2 provided up to 30 sessions per charge; however, miniaturisation to Mini and Nano, saw this decrease to 15 and 10 sessions, respectively. Overall, a well-received series; however, the biggest negative was the ramp-up time, which adult consumers wanted shortened.

Induction Heating, Kingsize Superslim (KSSS)

Launched: 2019 (5 Pro) and 2021 (8 Pro Slim)

Induction heating is a more effective and energy efficient technology. This technology in glo resulted in three key improvements: 1. Two heating modes, 2. Shorter ramp-up times (20 seconds Standard, 10 seconds Boost), 3. 30 seconds longer standard experience. The Pro device was a similar shape and size to Series 1, whereas Pro Slim offered a slimmer and lighter design. Total sessions per charge for Pro and Pro Slim were up to 20 and 16, respectively.

Induction Heating, Demislim (DS)

Launched: 2020 (6 Hyper), 2021 (7 Hyper+), 2022 (9 Hyper X2), 2023 (10 Hyper X2 Air and 11 Hyper Pro)

Our glo KSSS systems were often described as offering a different sensory experience, which did not resonate with many adult smokers. The power of induction heating technology allowed us to move to a larger consumable size, which delivered adult smokers an improved sensory performance.

Our Hyper devices are our best performing Heated Products systems. Each device delivers two heating modes, standard and boost, with ramp-up times of 20 seconds and 10 seconds, respectively, and up to 20 sessions per charge.

The evolution in design for our Hyper devices is clear. Hyper X2 and Hyper Pro offer adult consumers a more differentiated device with the latter our first device to feature an Active Matrix Organic Light Emitting Diode (AMOLED) display screen. Hyper Pro also provides a TasteSelect™ rotation dial to enable adult consumers to open the consumable chamber and select their preferred heating profile.

Overall, our induction heating Demislim range has resulted in a real step-change in our Heated Products' performance.

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Our Vapour Products



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Our Devices

Vuse offers a range of Vapour Product 'systems' (device + e-liquid source + heating atomiser) to accommodate the breadth of consumer preferences across the category.

Aerosol is generated when the e-liquid is heated, without combustion, by the atomiser within the Vuse system. The heating atomisers in Vuse are either a ceramic microporous substrate with printed metallic heating track or a metallic wire/mesh that is in contact with a cotton wick. The ceramic microporous substrate and cotton wick draw the e-liquid to the heating atomiser.

Our e-Liquids

Vuse e-liquids only use high-quality ingredients; typically, water, propylene glycol and glycerol, flavourings, and nicotine. Vuse e-liquid ingredients are assessed by our team of EU-registered toxicologists.

Heating Technologies



Coil and Wick | Metallic Wire/Mesh | Ceramic



Closed, Rechargeable Systems

The device is rechargeable and used in conjunction with a separate e-liquid cartridge that contains the heating atomiser. The e-liquid cartridge is closed, which means the consumer cannot refill the e-liquid or change the heating atomiser. The cartridge is disposed of once empty.



Closed, Disposable Systems

Typically, the device is not rechargeable, and the e-liquid and heating atomiser are not separable from the system. As the system is closed, the consumer cannot refill the e-liquid or change the heating atomiser. The full system is disposed of once empty.



Open, Rechargeable Systems

The device is rechargeable, and the consumer can change the heating atomiser and refill the e-liquid tank when required. Heating atomisers are recommended to be changed every two to four weeks or when a deterioration in vapour performance is observed.

The Evolution of Our Vapour Products

Closed, Disposable Systems

Launched: 2013 (Solo 1 and Vype*), 2022 (GO 500 11 and GO Max*), 2023 (GO 700*, GO 800* and GO Edition 12), and 2024 (GO 1000* and GO 1000 Box*)

Our first e-cigarettes were closed, disposable 'cigalike' systems with coil and wick heating technologies. With a cigarette form, these devices offered adult smokers a degree of familiarity when switching. However, due to their size, sensorial performance could be sub-optimal. Almost 10 years later, technological improvements and form changes have seen the advent of 'Modern Disposables' that now offer adult consumers both performance and convenience.

Open, Rechargeable Systems

Launched: 2015 (eTank 3), 2016 (eBox 5 and eTank Pro*), 2018 (eTank Pro 2*), and 2021 (eTank Mini*)

Our open, rechargeable systems offer adult consumers greater control of the vaping experience. Often larger, these systems have bigger batteries that can offer increased power outputs (delivering a fuller vaping experience) and longer times between recharging. With more control, adult consumers can change the heating coils and wicks, e-liquid tank and liquids. However, this maintenance could be an inconvenience for some adult consumers.

Closed, Rechargeable Systems

Launched: 2014 (ePen 2 and eStick*), 2016 (Vibe 4, Pebble 6, Ciro 7 and Alto 8), 2017 (ePen 2* and eStick Maxx*), 2018 (ePod 8, iSwitch* and ePen 3 9), 2020 (ePod 2 10), 2023 (Pro 13 and Pro Smart*), 2024 (Vuse GO Reload 14)

Our closed, rechargeable systems offer adult consumers convenience and choice. Each system comes with a rechargeable device and separate flavour cartridges/pods that contain the heating element and e-liquid. Our earlier systems took a 'cigalike' form, which, like our closed, disposable systems, could underperform sensorially.

Our ePen system was the first of our 'pod mod' systems, where the e-liquid cartridge/pod did not look like a filter from a cigarette.

This change in form factor offered adult consumers increased battery life and heating power that provided an overall improved performance compared to our 'cigalike' systems.

Our 'pod mod' systems have evolved in both form and heating technologies. Earlier iterations of our 'pod mod' systems utilised metal coils with cotton wicks, whereas later systems now adopt a ceramic wick with metal heating element. This change in heating technology has enabled a change in the design of our pods, while offering increased performance and consumer satisfaction.

*Not shown



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Our Oral Products



Oral Tobacco Products and Oral Nicotine Pouches offer adult smokers a very different experience from that of cigarettes

We offer adult consumers three main types of Oral Products: tobacco-containing moist snuff and snus, and tobacco leaf-free Oral Nicotine Pouches. In contrast to cigarettes, where nicotine is delivered to the lungs through the inhalation of smoke, nicotine from Oral Products is delivered via the mucous membrane lining of the mouth. Adult consumers place Oral Products between the cheek and gum and flavour and nicotine are released.

These Oral Products offer a distinct sensation in the oral cavity that is not experienced when smoking cigarettes. Oral comfort in terms of fit, site sensation, feel, and flavour also contribute to the differentiated consumer experience. In contrast to cigarettes, Heated Products and Vapour Products, Oral Products do not emit an aerosol. This affords adult consumers the opportunity to use Oral Products without impacting those around them. Social consideration is one driver for adult smokers to switch to Oral Products.



Oral Tobacco Products: Moist snuff and snus

Oral Tobacco products like moist snuff and snus include cut or ground tobacco that is provided loose or pouched for placement between the cheek and gum. Early products were often a loose leaf/powder, minimally processed, that produced a brown extract in the mouth that almost always required spitting. Over time, many of these products have advanced greatly in terms of usability, manufacturing, and composition, particularly with respect to modern snus, which typically has reduced toxicant levels relative to other tobacco-containing Oral Products and requires no spitting. Moist snuff products similarly have progressed over time; while loose tobacco leaf/powder formats remain available, there has been a trend in recent years toward moist snuff pouched in a cellulose-based fleece material for ease of use and convenience.

Oral Nicotine Pouches

Oral Nicotine Pouches do not contain tobacco leaf. They contain a cellulose-based filler with high purity nicotine and flavours, wrapped in a fleece. They utilise nicotine extracted from tobacco that is refined and purified to minimise tobacco-related toxicants. As such, Oral Nicotine Pouches have <1% of the toxicants found in cigarette smoke.[#]

[#] Comparison with smoke from a scientific standard reference cigarette (approximately 9 mg tar) in terms of the average of the 9 harmful components the World Health Organization recommends reducing in cigarette smoke. These products are not risk free and are addictive.

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The Evolution of Our Oral Products

18th century

Dry Snuff: fermented and powdered tobacco product that comes in both regular and sweetened flavours

1952

Loose Leaf: fermented and powdered tobacco product that comes in both regular and sweetened flavours

Plug: a length of solid chewing tobacco pressed into a 'plug'

1967

Twist: a form of chewing tobacco in which the tobacco leaves have been rolled and twisted together. Products come in both sweet and unsweet

Moist: a fermented blend of dark fired and air cured tobaccos, cut and sold in both loose and pouched versions

1970s

Brown Portion Snus: pouched ground and processed tobacco. The pouches offer convenience, cleaner and more hygienic insertion, usage and extraction



1990s

White Portion Snus: the white pouches offer an additional step in convenience and hygiene due to their dry and clean surface



2006

Camel Snus: the white pouch product offers an additional step in convenience and hygiene due to its dry and clean surface



2010s

Oral Nicotine Pouch: the Oral Nicotine Pouch took a revolutionary step from the traditional Oral Tobacco Pouch with its clean and white cellulose blend, naturally-derived liquid nicotine, and additional flavours. The white pouch offers an additional step in convenience and hygiene due to its dry and clean surface



Figure 1. Our Oral Products

	Moist snuff	Snus	Oral Nicotine Pouches
Formats	Loose, Pouch	Loose, Slim Pouch, Large Pouch	Mini Pouch, Slim Pouch, Regular Pouch, Large Pouch
Nicotine Levels	Loose: 10mg/g Pouch: 13mg/pouch	Loose: 8mg/g Slim: 7mg/pouch Large: 8-15mg/pouch	Mini: 2-8mg/pouch Slim: 2-17mg/pouch Regular: 15mg/pouch Large: 20mg/pouch
Manufacturing	1. Tobacco Selection 2. Tobacco Ageing 3. Tobacco Blending 4. Blend Fermentation 5. Blend Storage/Ageing 6. Pouching 7. Packing	1. Tobacco Blending 2. Grinding & Storage 3. Mixing of Ingredients 4. Maturing 5. Pouching 6. Packing	1. Ingredient Blending 2. Pouching 3. Packing
Available	U.S.	Sweden Denmark U.S.	35+ Countries

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Social Consideration and Personal Hygiene: A Benefit of Smokeless Products

An important aspect that drives adult smokers to switch to Smokeless Products is related to personal hygiene and social consideration.

Our Smokeless Products have little to no adverse effect on indoor air quality

Cigarette smoke is known to impact the environment in two ways: 1) exhaled smoke from the consumer, and 2) smoke from the tip of the cigarette when smouldering.[1] Our Smokeless Products operate at temperatures where there is no combustion, the aerosols for Vapour Products and Heated Products are simpler, and Oral Nicotine Pouches produce no aerosol at all.

We devised an environmental assessment approach to assess the impact of our Vapour and Heated Products aerosols in three different environment settings: home, office, and hospitality.[2]

We measured 23 compounds, including tobacco-specific nitrosamines, carbonyls, and volatile organic compounds alongside particulate matter measurements. When using our Vapour and Heated Products, the levels for 20 of the compounds were lower than background levels for all environment settings. Only nicotine, formaldehyde and acetaldehyde were raised above baseline values. However, these levels were significantly lower than those for cigarette smoke. Particulate matter measurements were also at measurable levels; however, these were well below cigarette smoke levels.[3]

Home

1.2

Air Changes per Hour ($45.4 m^3 h^{-1}$)



	Background (No Products)	Combusted Cigarettes	Heated Product	Vapour Product	Oral Nicotine Pouch
Total Particle Number (cm^3)	>7,400	>190,000	>10,000	>17,000	Per Background*
Total Volatile Organic Compounds ($\mu g/m^3$)	39	386	32	55	Per Background*
Total Carbonyls ($\mu g/m^3$)	24	136	28	26	Per Background*

* Oral Nicotine Pouches do not produce an aerosol during use, hence their output is deemed to be "per background".

Home air change rates are the lowest across the three locations, thus offer the highest measurements as shown.

Office

2.16

Air Changes per Hour ($81.6 m^3 h^{-1}$)



Hospitality

7.68

Air Changes per Hour ($290.3 m^3 h^{-1}$)



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Our Smokeless Products offer reduced odour on clothes, hair, and hands

Our range of consumer tests help assess the positive impact switching to our Smokeless Products can have on the odour of clothes, hair, and hands. Trained odour assessors have compared cloth, hair, and hands exposed to our Smokeless Product aerosols versus cigarette smoke. Overall, the mean odour intensity score was significantly greater for cloth and hair exposed to cigarette smoke, with Smokeless Product results close to zero.[2] Hands exposed to Smokeless Product aerosol had mean perceived intensity scores that were close to those of clean hands.[2]

Our Smokeless Products cause minimal teeth staining

Our Smokeless Products offer reduced staining on teeth as compared to cigarettes.[4] Enamel staining was measured in bovine enamel samples over 86 days with significant staining seen for cigarette smoke. Minimal staining was seen for Heated Products, Vapour Products and Oral Nicotine Pouches. Staining levels were also found to be reduced by brushing.





ODOUR INTENSITY SCORE	COMBUSTED CIGARETTES	HEATED PRODUCT	VAPOUR PRODUCT	ORAL NICOTINE POUCH
Hair	>4	<10	<5	<1
Fabric	>40	<10	<5	<1
Fingers	>5	<1	<1	0



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06 THR: A Global Transformation

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Smokeless Products: Market Access

Aligned to the Tobacco Harm Reduction (THR) equation (THR = Scientifically Substantiated Reduced-Risk*† Products x The Number of Adult Consumers Using Reduced-Risk*† Products Who Would Otherwise Smoke Cigarettes),[1] the greater the access to Smokeless Products the greater the opportunity for THR to be a success.

With one billion people still smoking cigarettes, we believe the opportunity for THR success is clear. However, some countries' regulatory approach to Smokeless Products is prohibiting access to these products, which will inhibit THR success.

The global regulatory footprint is different for Heated Products, Vapour Products, and Oral Nicotine Pouches, with access to each product category different across the world. This disparity in global regulatory approaches limits access to Smokeless Products for adult smokers.

Our view is that a world where Smokeless Products are regulated and accessible to adult smokers is key in achieving THR. We believe that a science-based regulatory framework which is enforced by authorities will be the most effective approach.

Regulatory position may differ after publication (17 September 2024)

Figures calculated using estimated smoker numbers from banned countries as reported on Global Tobacco Control Information & Statistics | Tobacco Atlas (Accessed 13 August 2024)

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.



>240m#

Adult smokers who are not able to readily access Heated Products due to regulatory restrictions.

>290m#

Adult smokers who are not able to readily access Vapour Products due to regulatory restrictions.

>175m#

Adult smokers who are not able to readily access Oral Nicotine Pouches due to regulatory restrictions.

● Banned or otherwise not available in general retail or specialist tobacco/vapour shops*[2-5]

* Some markets shown as "Banned" may allow minimal product to be sold such as vapour products which don't contain nicotine

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Smokeless Products: Our Markets

Our decade of transformation has seen us grow from two Smokeless Product markets in 2013, to having our products sold in 82 different countries by the end of 2023.



Our ambition is to continue to expand the availability of our Smokeless Products globally to create A Better Tomorrow™ by Building a Smokeless World.

Our market growth has been driven through a strategy of:

01 Regulatory permissibility

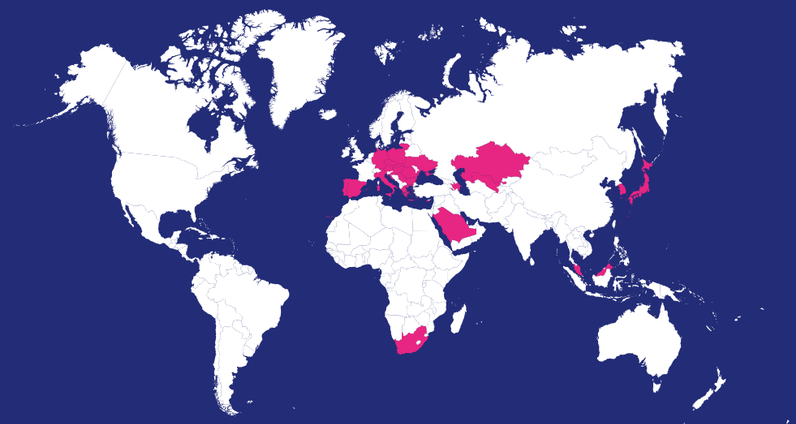
02 Tobacco Harm Reduction (THR) impact

03 Consumer relevance

04 Low- and Middle-Income Country (LMIC) considerations

05 Revenue / Value

Heated Products





30
Markets where our Heated Products are currently available

Vapour Products





63
Markets where our Vapour Products are currently available

Oral Nicotine Pouches





33
Markets where our Oral Nicotine Pouches are currently available

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A Case Study: Japan

JAPAN

A Heated Products Story



0.3%

of junior and senior high-school students reported current use of Heated Products in a 2021 online survey funded by the Ministry of Health, Labour and Welfare, Health Science Research Fund in Japan[4]

AT A GLANCE

Japan is the leading market for Heated Products

>44%

Heated Products hold >44% share of the total tobacco product market[1,2]

-33%

Between 2018 and 2023, domestic cigarette sales dropped approximately 33%, from 133.6 billion sticks to 89.2 billion sticks[1]

>60%

Between 2018 and 2023, Heated Product sales grew by more than 60%, from 35.1 billion sticks to 56.6 billion sticks[2]

> **Heated Products account for 44% of the tobacco product market in Japan and in Tokyo it is up to 50%.**



Emma Dean
Area Director,
APMEA North & General Manager,
British American Tobacco Japan, Ltd

Japan is a leading market for Heated Products, also known as heat-not-burn (HNB) products. By heating tobacco rather than burning it, Heated Products produce fewer harmful chemicals compared to traditional cigarettes.

In the mid-1970s, Japan had a cigarette smoking prevalence of ~75% amongst men.[3] Since the three most prominent tobacco product manufacturers in Japan launched Heated Products between 2014 and 2016, domestic cigarette sales have dropped whilst Heated Product sales have grown. Between 2018 and 2023, domestic cigarette sales decreased by approximately 33%, from 133.6 billion sticks to 89.2 billion sticks, whilst Heated Product sales increased by more than 60%, from 35.1 billion sticks to 56.6 billion sticks. Today, the share of the total tobacco product market for Heated Products has grown to more than 44%.

Development and introduction of Heated Products in Japan

2014

PMI launches Japan's first Heated Product, IQOS in Nagoya

2016

BAT launches its first Heated Product, glo, in Sendai, and Japan Tobacco Inc. launches its Heated Product, PloomTECH, in Fukuoka.

2017

As adult smokers switched to Heated Products, PMI, BAT and JTI began to roll their Heated Products out nationally.

2018

Introduction of separate regulation to that for traditional cigarettes. The Japanese regulations allowed for separate taxation and marketing practices for Heated Products, creating a more favourable retail environment and making them an attractive alternative for adult smokers who would otherwise continue to smoke.

2019

Continued market expansion across Japan sees Heated Products use prevalence rise to 11.3% from 0.2% in 2015

2020

Device evolution and flavour expansions create improved consumer experiences, further driving Heated Products adoption.

2024

Heated Products hold a >44% share of the total tobacco product market.

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The growth of Heated Products in Japan can be attributed to several factors

Reduced harm perceptions

Academics from Canada, U.S. and Japan conducted a national International Tobacco Control web-based survey that included more than 500 Heated Product consumers. The results from this survey identified the most common reasons for regularly using Heated Products were "beliefs that HTP [Heated Tobacco Products] are less harmful than cigarettes to themselves (90.6%) or to others (86.7%), enjoyment (76.5%), and social acceptability (74.4%)".[5]

Tobacco consumption culture

Japan has a strong tobacco consumption culture, and Heated Products provided a novel and technologically advanced option for adult smokers looking for a change from conventional cigarettes.

Innovation

Japan is a country that has long been seen as being at the forefront of innovation, for example, this is the nation that invented bullet trains and android robots.[6] The Government of Japan has stated that "Japan leads developed markets in the infrastructural pull factors of research and development capabilities and early technological adoption" and "continues to forge ahead, advancing innovation on a global level".[7] We believe Japan's tradition of early adoption of technology is a contributing factor in the growth of Heated Products.

Social consideration and personal hygiene

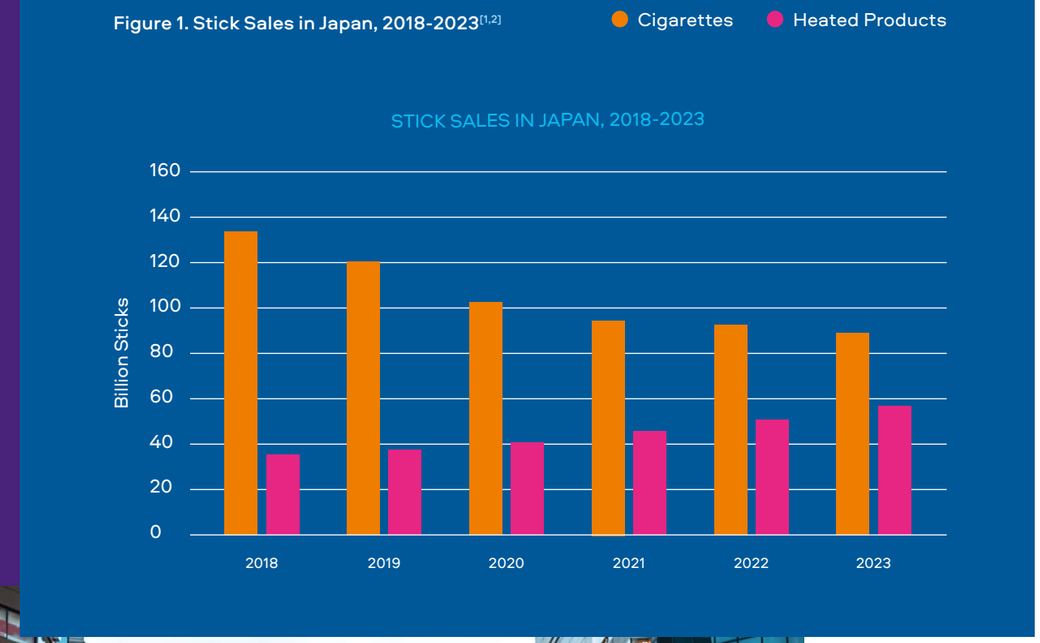
Heated Products were perceived as more socially acceptable due to their reduced smell and absence of smoke production compared to conventional cigarettes.

Overall, the Heated Product experience offers adult smokers, who would otherwise continue to smoke, an alternative that combines authentic tobacco-flavour with modern technology. However, the long-term health effects of using Heated Products are still being studied, and these products are not risk free and are addictive.

Opportunity for Japan

There remains an opportunity for the Japanese Government to integrate further Tobacco Harm Reduction as good public policy. This might include encouraging smokers who would otherwise not quit to switch to Smokeless Products and also further establish excise for Heated Products relative to their risk profile.

Figure 1. Stick Sales in Japan, 2018-2023[1,2]





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A Case Study: U.S.

U.S. Our Vapour Products Story

Vapour Products first entered the U.S. market in 2007. Since their introduction they have evolved extensively and grown in popularity with adult prevalence rates at a high of 6.4% in 2023.[1]

The growth of the vapour category in the U.S. parallels an accelerated decline of combustible cigarette smoking. Data from the Centers for Disease Control and Prevention's (CDC) National Health Interview Survey, a U.S. nationally representative cross-sectional household interview survey, show that "current use" of combustible cigarettes by U.S. smokers (ages 18+) has declined from 18.1% in 2012 to 11% in 2023.[1] Conversely, "current use" of e-cigarettes by U.S. consumers (ages 18+) has grown from 1.9% in 2012 to 6.4% in 2023 (Figure 1).[1,2,3] In the 2019-2023 timeframe, the prevalence reduction of smoking and increase in Vapour Product use, respectively, appear linked. Applying a line of best fit would suggest that Vapour Products may be a key driver of the decline in adult smokers.

AT A GLANCE

6.4%

Vapour Product prevalence has grown in the U.S. to 6.4% from 2007-2023

-7.1%

Smoking prevalence in the U.S. has decreased by 7.1% between 2012-2023



16

Vuse has one of the broadest portfolios of legal adult Vapour Products on the U.S. market with 16 Market Granted Orders

Vuse Solo

FDA NEWS RELEASE

FDA Permits Marketing of E-Cigarette Products, Marking First Authorization of Its Kind by the Agency

Vuse Ciro and Vuse Vibe

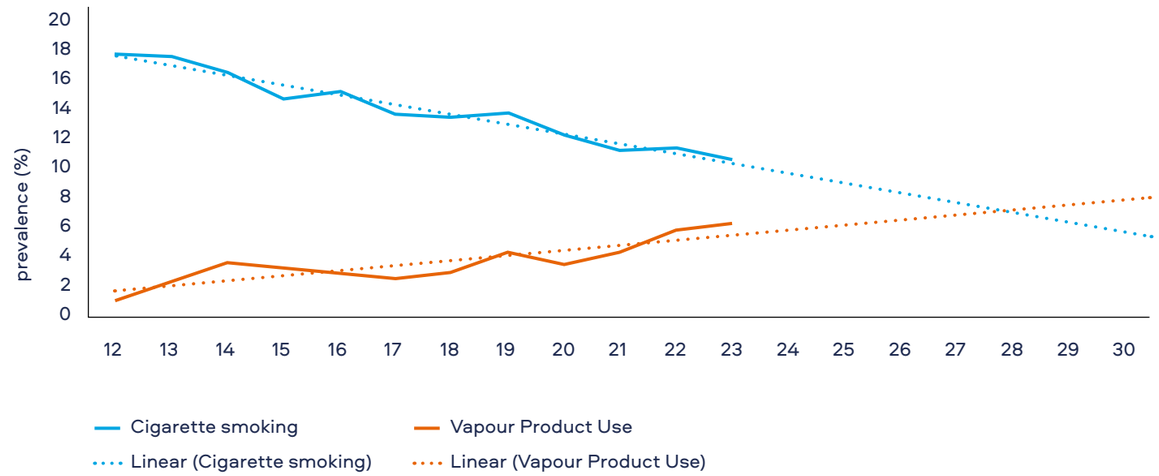
FDA Issues Marketing Decisions on Vuse Vibe and Vuse Ciro E-Cigarette Products

Vuse Alto

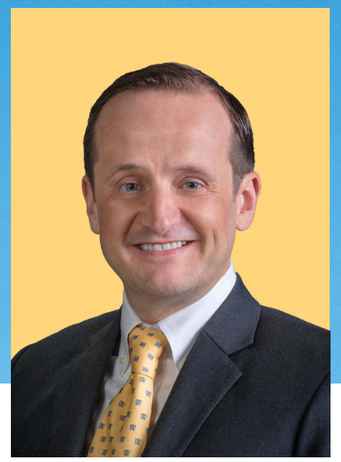
FDA Authorizes Marketing of Vuse Alto Tobacco-Flavored E-Cigarette Pods and Accompanying Power Unit

U.S. FOOD & DRUG ADMINISTRATION

Figure 1: Trends in Current Cigarette and E-Cigarette Use Among U.S. Consumers (18+)[1,2,3]



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Dr Ryan Potts
Senior Vice President, U.S. Scientific & Regulatory Affairs
RAI Services Company

> With more than 15 Marketing Granted Orders, Vuse has one of the broadest portfolios of authorized Vapour Products in the U.S. market.

Public Health Impact of Vapour vs. Smoking

The Food and Drug Administration (FDA) has acknowledged that "No tobacco product is safe. However, the health risks for different tobacco products exist on a spectrum, which is sometimes referred to as a 'continuum of risk.' Combusted, or smoked, tobacco products - such as cigarettes - are the most harmful type of tobacco product. Non-combusted products - such as e-cigarettes and other smokeless tobacco products - generally have lower health risks than cigarettes and other combustible tobacco products."[4] The National Academies of Sciences, Engineering, and Medicine also found that there "is substantial evidence that except for nicotine, under typical conditions of use, exposure to potentially toxic substances from e-cigarettes is significantly lower compared with conventional cigarettes" and "conclusive evidence that completely substituting e-cigarettes for combustible tobacco cigarettes reduces users' exposure to numerous toxicants and carcinogens present in combustible tobacco cigarettes."[5]

In 2016, the FDA began to regulate Vapour Products as tobacco products, requiring regulatory approval for new products to be legally marketed in the U.S. and banning sales to anyone under 18 years old (later increased to 21 years old in 2019). Manufacturers are required to submit a Premarket Tobacco Product Application (PMTA). Each PMTA will need to demonstrate that the product meets all the regulatory requirements and has sufficient scientific evidence to conclude it is "appropriate for the protection of the public health" (APPH). The FDA's thorough scientific review of all scientific evidence determines if a product is APPH. Successful applications are granted a marketing granted order (MGO) by the FDA, allowing it to be sold in the U.S.

Vuse and the PMTA Process

Under the brand Vuse, BAT's affiliate RJ Reynolds Vapor Company launched its first Vapour Products in June 2013. Through the release of Vuse Solo, Vuse Ciro, Vuse Vibe, and Vuse Alto, we have contributed to the decline in smoking prevalence through offering adult smokers these Vapour Products.

FDA's "deeming regulation," which deemed Smokeless Products—including Heated Products, Vapour Products and Oral Nicotine Pouches—to be under the agency's authority and subject to the same regulatory and statutory requirements of cigarettes and other traditional tobacco products, took effect 8 August 2016. The newly applied provisions included a requirement that all "deemed" products must receive premarket authorization from the FDA to be legally marketed. Manufacturers of products on the market as of the effective date were required to submit PMTAs by 9 September 2020.

We successfully processed several PMTAs for the broad portfolio of Vuse Solo, Ciro, Vibe, and Alto Vapour Products. Through the PMTA process, we have submitted comprehensive scientific data packages, including hundreds of thousands of pages of data and thousands of scientific documents. These PMTAs were designed to help the FDA determine that the marketing of Vuse Vapour Products is appropriate for the protection of the public health.

The FDA issued the first-ever Vapour Product Marketing Granted Orders (MGOs) for Vuse Solo in October 2021. Additional MGOs followed for Vuse Ciro and Vuse Vibe in May 2022. In July 2024, the FDA issued MGOs for the Vuse Alto device and its Golden Tobacco and Rich Tobacco flavoured pods. The current FDA-authorized Vuse Vapour Products represent one of the broadest portfolios of legal Vapour Products on the U.S. market with 16 MGOs.

U.S. Vapour Journey

2010
Internal research and development on an e-cigarette product begins

June 2013
Vuse Solo launches in Colorado; expands to Utah shortly thereafter

June 2014
National launch of Vuse Solo

2016
Launch of Vuse Ciro, Vibe, and Alto

2020
Vuse Solo, Ciro, Vibe, and Alto PMTAs are filed with the FDA

October 2021
Vuse Solo device and Original flavour cartridges receive FDA Marketing Granted Orders (MGO) - the first authorizations for Vapour Products[6]

April 2022
Vuse becomes #1 vapour brand in the U.S.[7]

May 2022
Vuse Vibe & Vuse Ciro devices and Original flavour cartridges receive FDA MGOs[8]

July 2024
Vuse Alto device and Golden and Rich Tobacco flavour pods receive FDA MGOs - Vuse Vapour Products become one of the broadest portfolios of legal Vapour Products on the U.S. market[9]

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A Case Study: New Zealand

A tale of two countries
NEW ZEALAND VS AUSTRALIA



> The comparison of New Zealand and Australia illustrates how regulation can drive THR

Peter Simmons
Area Director,
BAT Australia



AT A GLANCE

New Zealand has emerged as a global leader in Tobacco Harm Reduction

6.8%

New Zealand's smoking prevalence has more than halved since 2011/12

2025

ASH New Zealand says the country is on track to become 'smoke-free' (<5% smoking prevalence) by 2025

New Zealand has emerged as a global leader in Tobacco Harm Reduction (THR), achieving a remarkable decline in smoking rates in recent years. Following in the footsteps of Sweden, New Zealand is also on the verge of becoming smoke-free by 2025. This success story is largely a result of the government endorsing a pragmatic approach that embraces Vapour Products as a better alternative for adult smokers who wish to continue nicotine use, while enforcing the regulation of the category in the right way, to mitigate underage access.

The New Zealand government's approach focused on harm reduction, acknowledging the reality that some adult smokers may not quit. Its government has stated that its intent is to "support smokers to switch to regulated products that are significantly less harmful than smoking."[1] By providing a choice and making lower risk profile alternatives available and accessible for adult smokers, it aimed to encourage them away from cigarettes. This strategy proved remarkably effective.

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Recognising the role of Vapour Products

In 2019, New Zealand's Ministry of Health, Manatū Hauora, and Health New Zealand, Te Whatu Ora (the primary publicly funded healthcare system of New Zealand), co-launched the 'Vaping Facts' website. This website provides New Zealanders with helpful information related to Vapour Products and their risk relative to cigarettes. The Ministry of Health and Health New Zealand said that "Vaping has the potential to help people quit smoking and contribute to New Zealand's Smokefree 2025 goal."[2]

The introduction of Vapour Products was associated with a dramatic decrease in the daily smoking rate, which dropped to 6.8% in 2022/23, down from 8.6% the previous year and 16.4% in 2011/12.[3] With smoking rates so low, ASH New Zealand says the country remains on track to reach its 2025 smoke-free goal of <5%.[4]

Regulation: key to a measured approach

New Zealand's success hinges not just on embracing Vapour Products but also on implementing a robust regulatory framework. Unlike some countries with complete bans on Vapour Products, such as Australia, where the black market has thrived as a result of prohibition, New Zealand opted for a regulated market.

Under New Zealand's Smokefree Environments and Regulated Products Regulations 2021,[5] Vapour Products are legal for adults, with flavours and packaging regulated to reduce underage appeal. Additionally, the government requires quality control measures to ensure product safety.

Although Vapour Products' prevalence has increased overall, there hasn't been a significant increase in underage use, which suggests the regulations are effective. According to ASH NZ, regular underage Vapour Product use, defined as at least once a month, has decreased since the introduction of a regulated market, which "suggests that the regulations are starting to have the desired impact."[6]

Furthermore, the availability of regulated Vapour Products discourages the use of black market products that may contain unknown and unregulated ingredients.

Challenges and the road ahead

New Zealand's journey hasn't been without its challenges and there may be more ahead. Any future regulations will need to continue to strike the right balance between preventing underage access and the needs of adult consumers to have access to reduced-risk*† products.

Despite the uncertainties, New Zealand's experience presents valuable lessons for other countries grappling with the public health burden of smoking. It demonstrates the potential of harm reduction strategies, particularly when coupled with robust regulations.

A beacon of hope for a smoke-free future

A smoke-free future is finally within reach for New Zealand. It is a success story that offers a glimmer of hope for other countries wanting to transition to a smoke-free future. By adopting a pragmatic approach that embraces THR and lower risk profile products such as Vapour Products, other countries can potentially replicate its success.

> **Vaping has the potential to help people quit smoking and contribute to New Zealand's Smokefree 2025 goal.**
>
> **Vaping Facts**
> New Zealand's Ministry of Health, Manatū Hauora, and Health New Zealand, Te Whatu Ora, co-launched website

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

New Zealand's Journey

2017

Electronic Cigarette Technical Expert Advisory Group formed.

2018

Cabinet agrees to improve the regulation of vaping and smokeless tobacco products.

BAT NZ launches the ePen 3 in November.

2019

The Ministry of Health and Health New Zealand co-launched a smoking cessation website, 'Vaping Facts', which informed adult smokers that, although not licensed for this purpose, "Vaping is a way to quit cigarettes by getting nicotine with fewer of the toxins that come from burning tobacco."[2]

BAT NZ launches the ePod in September.

2020

A regulatory regime designed to balance the need to encourage adult smokers to switch to products with reduced-risk potential while protecting young people is approved by New Zealand's four major political parties.

2021

The Smokefree Environment Regulated Products Regulations 2021 start to come into effect. The Vaping Regulatory Authority is established to regulate vaping products.

BAT NZ launches the ePod 2 in March.

2022

BAT NZ launches Vuse GO in October.

2023

The Smokefree Environments and Regulated Products Regulations introduced new Underage Protection measures including flavour labelling restrictions that preserved suitability for adults.[7]

BAT NZ launches Vuse GO XL in May.

2024

BAT NZ launches the world first Vuse GO Reload device to meet new regulations.

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Australia: Restricted Access

Meanwhile, Australia has taken a very different path in regulating Vapour Products. While nicotine Vapour Products have never been legal for adult retail sale in Australia, since October 2021, Australia introduced a severely restricted prescription-only access model. This model requires adult consumers to obtain a doctor's prescription and only legally purchase Vapour Products from a pharmacy. According to the Royal Australian College of General Practitioners, Australia is the only country in the world to restrict access to nicotine Vapour Products on a prescription-only basis. In 2023, the Australian government further announced the extended restrictions on importation and retail sales including non-nicotine Vapour Products and shut down a personal importation scheme.

The government also implemented heavy penalties of up to A$32,000 and imprisonment for those in possession of unauthorised nicotine, which is much more severe than the penalties for possession of small quantities of drugs such as cannabis. Alongside punitive regulation, the public health campaigns launched by the government highlighted the dangers of vaping with graphic imagery and testimonials with the slogan "Every Vape is a Hit to Your Health"; in contrast to the pro-switching messaging of their New Zealand counterparts.

Did these extreme measures work? In our opinion, this is a clear no. The current estimate indicates there are now 1.4 million adult vapers in Australia. Of these, more than 90% are using vapes from illegal sources. The smoking rate has also flatlined – by 2021, New Zealand overtook Australia in terms of smoking incidence reduction rate, despite starting at a higher level of prevalence.

A 2022 study using a vaping model by Levy et al. evaluated the potential impact on public health of relaxing restrictions on Vapour Products in Australia, predicting that as many as 104,200 deaths could be averted during the period 2017–2080 if Australia embraced Tobacco Harm Reduction by increasing smokers' access to these products.[8]

Australia's regulated approach is changing. From 1 October 2024, therapeutic Vapour Products containing nicotine, or a zero-nicotine substance, will be available for supply in pharmacy settings to patients 18 years or over without a prescription.[9] However, this approach has already been rejected by pharmacists, with the Pharmacy Guild of Australia publicly stating "it is unclear how this change will address concerns around availability of black-market vapes and organised crime."[10]



> "The current prescription-only model has been disastrous proof of this problem. Implementing more severe restrictions on vaping products will only spur the black market and reduce smoking quit rates."
>
> **Australian National Advisory Council on Alcohol and Other Drugs (ANCAD)**

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A Case Study: Sweden

SWEDEN

Soon Europe's First 'Smoke-Free' Country



> Sweden has shown that THR can be accelerated through providing smokers access to Smokeless Products.

Asli Ertonguc
Area Director, British American Tobacco UK Limited

Based on current trends, Sweden will soon become a smoke-free society. Smoking in Sweden has fallen to just 5.6% of people over the age of 16, compared to 15% in 2008. The World Health Organization (WHO) considers countries to be smoke-free when smoking prevalence is less than 5% of the population.[2] As a result, Sweden is reaping the benefits.[3]

A key to Sweden's success has been its openness to allow the sale of smokeless alternatives to cigarettes that satisfy adult smokers' desire for nicotine, and to avoid excessively restricting these products.

Since the 1970s, snus, a moist, pasteurised Oral Tobacco Product, has been contributing to Sweden's lower smoking rate and the reduced incidence of smoking-related disease and death, when compared to the rest of Europe. The introduction of newer, smokeless alternative products has continued to propel it towards a smoke-free society. Vaping was first introduced in 2015 and Oral Nicotine Pouches became available in 2018.

AT A GLANCE

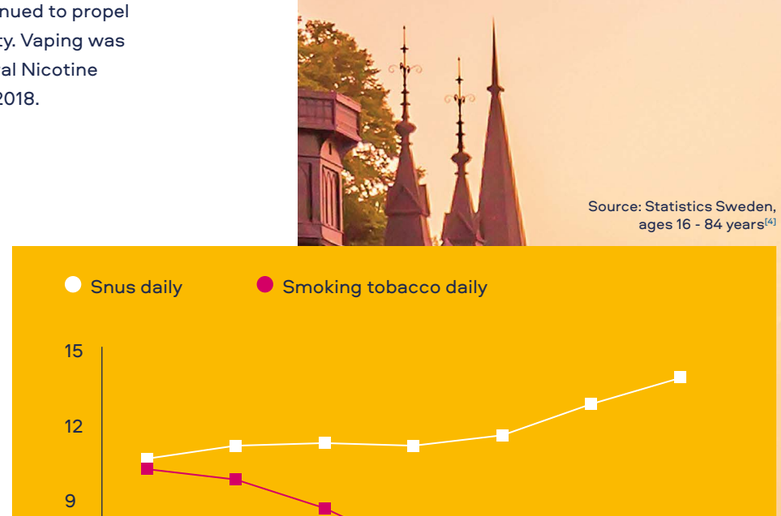
Sweden is reaping the benefits of Tobacco Harm Reduction

39.6%

lower rate of death from tobacco-related diseases compared to the EU average[1]

41%

lower incidence of cancer than EU average[1]



Source: Statistics Sweden, ages 16 - 84 years[4]

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3.5m



In Europe, 3.5 million early deaths could be prevented across the EU if other countries adopted the 'Swedish model'.[1]

Swedish adult smokers have access to a wide range of Smokeless Products – snus, Oral Nicotine Pouches, Vapour Products, and Heated Products – which are legal and available both online and in stores.

There are a wide range of flavours and nicotine concentrations.

Smokeless Products are more affordable than cigarettes because products are taxed based upon estimated risk profile. Products that are judged to be higher risk, are taxed higher.[5]

Learning from Sweden's success story and replicating its approach on a global scale are considered both critical to driving down smoking rates, and reducing tobacco-related health risks, diseases and premature deaths.

In Europe, 3.5 million early deaths could be prevented if other countries adopted the 'Swedish model.'[1] Smoking is a significant public health challenge, and it is essential that governments use proven approaches to reduce smoking.

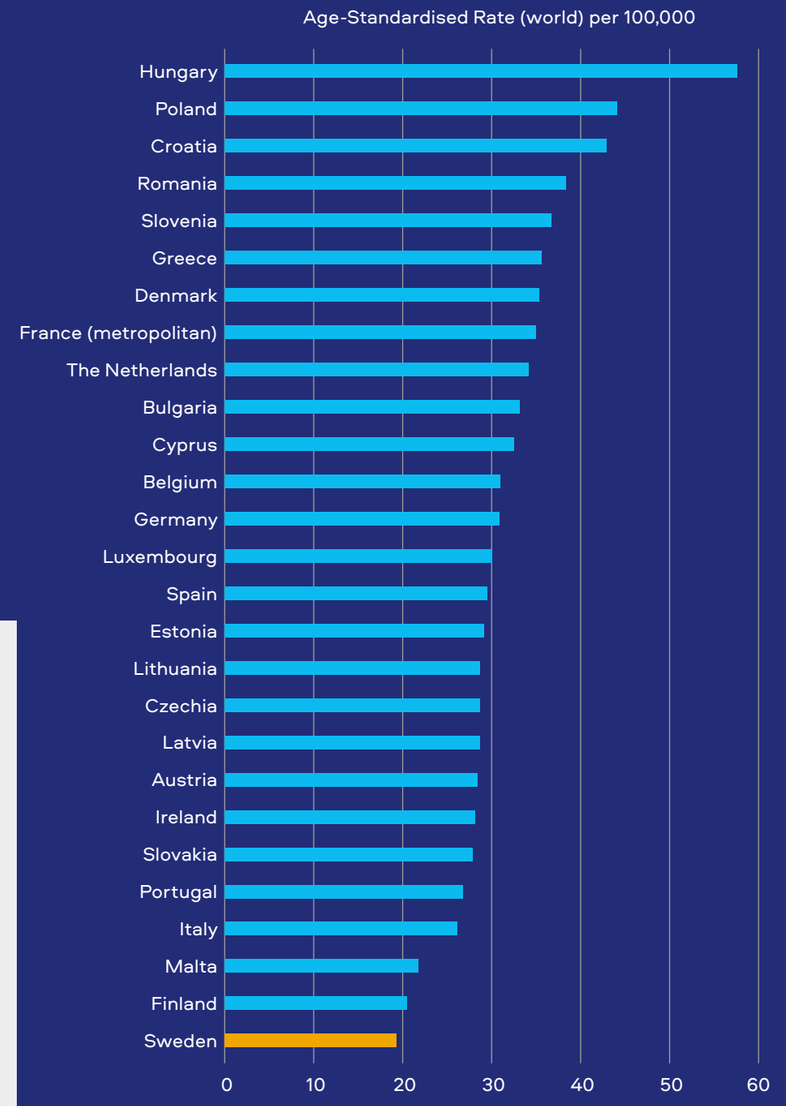
Tobacco Harm Reduction in action

Lowest smoking rate in Europe, 5.6% vs. 23% EU average[1]

Similar usage of tobacco per capita vs. EU

Lowest lung, trachea and bronchus mortality rates in the EU[6]

2022 Lung, Trachea and Bronchus Cancer Deaths



Mortality, Both Sexes, Age 15-85+, in 2022[7]



Snus illegal in the EU

Despite its reduced-risk status relative to cigarettes, snus is illegal in the EU with the exception of Sweden.

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A Case Study: Pakistan

PAKISTAN

Oral Nicotine Pouches in a LMIC*





Pakistan is one of the largest tobacco-consuming countries in the world. It is estimated that 25.4 million people (17%) currently use tobacco products in Pakistan, of which around 56% are cigarette adult smokers (9.6% smoking prevalence).[1] The remaining 44% of the tobacco consumers in Pakistan predominantly use traditional oral tobacco-containing products such as Paan, Naswar and Gutka, which are known to typically have high levels of toxicants.[2]

Thus, the opportunity for Tobacco Harm Reduction (THR) impact in Pakistan is significant. Pakistan has the 7th highest tobacco use globally. And with a significant proportion of that tobacco use being attributed to traditional oral tobacco-containing products often made in cottage industry,[3] the introduction of lower risk profile Oral Nicotine Products could promote THR for Pakistan.

The health impact of Paan, Naswar and Gutka

Traditional oral-tobacco containing products, such as Paan, Naswar and Gutka, contain high levels of carcinogens such as heavy metals and tobacco-specific nitrosamines (TSNAs).[4-9] According to the World Health Organization's (WHO) 'Cancer Today' data, in 2022, Pakistan had the 4th highest lip and oral cavity cancer incidence rate, globally.[10]

The high levels of toxicants in Paan, Naswar and Gutka contrast with Oral Tobacco Products such as snus,[8,11] which in some countries have regulated limits for some toxicants.[12] According to the WHO's data, oral cancer is the second most common in Pakistan and accounted for >8% of all cancer-related deaths in 2022.[13] By contrast, Sweden, a country where Oral Tobacco Product use prevalence is twice as great as Pakistan (16% vs. 8%, respectively),[14,15] has a lip and oral cavity age-standardised mortality rate** that is more than six times lower than Pakistan (1.3 vs. 8.6, respectively).[16]

AT A GLANCE

The introduction of Velo in Pakistan has been used to accelerate THR across developing countries

>25m

Current tobacco consumers in Pakistan

7th

Highest tobacco use, globally

* Low- and Middle-Income Countries

** Age-Standardized Rate (World) per 100 000, Mortality, Both sexes, Cancer Type [Lip, oral cavity], age [15-85+]

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Not all oral tobacco products are the same

Due to the manner in which Paan, Naswar and Gutka are produced, comprehensive chemical analysis of their contents is sparse. However, of the data that is available, it is evident that these oral tobacco-containing products have higher levels of toxicants than Oral Tobacco Products, such as snus, and also much higher levels than are present in Oral Nicotine Pouches (Table 1).

Reducing tobacco consumption through tobacco control

Pakistan's tobacco control initiatives have focused on tobacco taxation and price increases, to decrease tobacco consumption and deter people from starting tobacco use. In February 2023 alone, there was an approximately 150% increase in Federal Excise Duty (FED) on cigarettes, almost doubling the cost of a packet of cigarettes. A major problem in LMICs is the market for illegal cigarettes. More adult consumers are considering illicit tobacco due to increasing retail prices for legal cigarettes. As a result, the illicit trade in cigarettes is expected to grow significantly, shifting the demand from legal cigarettes instead of reducing overall consumption. This illicit trade results in poor quality unregulated products. It is estimated that over 50% of the market in Pakistan is illicit. The National University of Science and Technology (NUST), Islamabad, have reported an estimated illicit trade of approximately 63% of the total market.[19] Lahore University of Management Science (LUMS) have reported an estimated illicit trade of approximately 58%.[20]

Supporting THR through consumer choice

The role of Smokeless Products in THR for Pakistan is essential. Products such as Vapour Products and Oral Nicotine Pouches are lower risk profile alternatives to switch to for adult smokers and consumers of hazardous oral tobacco-containing products such as Paan, Naswar, and Gutka. Oral Nicotine Pouches are gaining popularity among adult tobacco consumers in Pakistan, as they are considered more hygienic and they do not produce as strong an odour as cigarettes, making them more socially acceptable. They are currently available at supermarkets and certain other retail shops.

Given the difference in risk profile between our Smokeless Products relative to these high-toxicant oral tobacco products used in Pakistan, we believe there is a tremendous Tobacco Harm Reduction opportunity for regulators. Providing information regarding the risk profile of our Smokeless Products and programmes that encourage complete switching to them could lead to significant declines in preventable oral cancer deaths over time.[18,21,22]

A model for THR in LMICs

BAT subsidiary Pakistan Tobacco Company launched Velo brand Oral Nicotine Pouches in Pakistan at the end of 2019. Over the last five years, Velo grew in retail volume, in part because the regulation of these products in Pakistan allows us to connect with adult consumers and responsibly market these products to adult tobacco consumers. Pakistan has now become the largest consumer base for Oral Nicotine Pouches in the world and a role model for Smokeless Products in what the World Bank classes Low- and Middle-Income Countries (LMICs [countries with a gross national income per capita of $4,465 or less]***).

Velo is expected to develop and grow among adult tobacco consumers who do not wish to quit, supported by the introduction of new adult-orientated flavours in addition to its core flavours. The introduction of these new flavours that appeal to adult smokers may encourage more adult tobacco consumers, who do not wish to quit, to switch completely to Oral Nicotine Pouches.

A path forward

Our approach in Pakistan could accelerate THR in other LMICs. There will be challenges to overcome, including educating key stakeholders in our vision of A Better Tomorrow™ and encouraging adult smokers who would otherwise continue to smoke, and consumers of traditional oral tobacco-containing products like Paan, Naswar and Gutka, to use alternatives. But taking Pakistan as a case study, we can see that there is a large, and growing, market opportunity for tobacco-free Oral Nicotine Pouches.

Table 1. Levels of selected toxicants in Naswar, Snus, and Oral Nicotine Pouches

Toxicant	IARC Classification[17]	Unit	Naswar[5,9]	Snus[18]	Oral Nicotine Pouch[18]
Lead	Group 2B Carcinogen	µg/g	12.4–111.2[a]	0.19-0.34[c]	<0.02[d]
Arsenic	Group 1 Carcinogen	µg/g	0.2–14.0[a]	0.09-0.13[c]	<0.05[d]
Nickel	Group 1 Carcinogen	µg/g	2.2–64.9[a]	0.89-2.0[c]	<0.05[d]
Chromium	Group 1&3 Carcinogen	µg/g	0.8–54.1[a]	0.82-1.7[c]	<0.08[d]
Cadmium	Group 1 Carcinogen	µg/g	0.3–9.2[a]	0.25-0.46[c]	<0.01[d]
N-nitrosonornicotine (NNN)	Group 1 Carcinogen	µg/g	0.36-0.55[b]	0.56-0.64[c]	<0.01[d]
4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)	Group 1 Carcinogen	µg/g	0.029-0.31[b]	0.09-0.20[c]	<0.01[d]

***2024 values, calculated using the World Bank Atlas method

IARC Group 1: carcinogenic to humans, IARC Group 2B: possibly carcinogenic to humans, IARC Group 3: unclassifiable as to carcinogenicity in humans, [a] 30 products assessed, [b] Two products assessed, [c] Three products assessed, [d] Four products assessed

460k

Our Oral Nicotine Pouch has established 460k active adult consumers since launching in 2019

> Our approach in Pakistan could accelerate Tobacco Harm Reduction in other LMICs.

Ali Akbar
General Manager,
Pakistan Tobacco
Company Limited



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Learnings to be Applied Globally

Displacing traditional cigarettes with reduced-risk*† Smokeless Products requires a multifaceted approach that addresses discrete aspects of the market.

Here are some key factors that need to be considered for successful adoption.

By addressing these factors collectively, the market can create an environment conducive to the displacement of traditional cigarettes with reduced-risk*† alternatives, ultimately benefiting public health by reducing tobacco-related harm.

Scientific evidence	Robust scientific research and transparent dissemination of findings are crucial. Comprehensive studies must demonstrate the reduced-risk potential of these products compared to traditional cigarettes. The evidence should be made accessible to policy makers and public health experts, and to build trust and understanding.
Regulatory environment	Clear and supportive regulations are essential if adult smokers are to be encouraged to switch to Smokeless Products. Governments should develop frameworks that differentiate these products from combustible cigarettes, making them accessible to adult consumers while ensuring they meet safety and quality standards and are not available to the underaged.
Public perception and education	Public perception of Smokeless Products plays a significant role in their adoption. Government-led education campaigns should dispel misconceptions and misperceptions, emphasise the reduced-risk potential and highlight the benefits of switching completely from combustible cigarettes.
Affordability and accessibility	Smokeless Products should be competitively priced to encourage switching. A wide range of retail channels is necessary to make them easily available to adult smokers who would otherwise continue to smoke.
Product diversity and innovation	A diverse range of Smokeless Products can cater to different consumer preferences. Ongoing innovation is crucial to improve product quality, flavours and technology, making them more appealing to adult smokers who would otherwise continue to smoke.
Collaboration with health professionals	Transparently engaging healthcare professionals, including doctors, pharmacists and public health practitioners, can be instrumental in recommending and supporting the adoption of Smokeless Products.
Responsible marketing and advertising regulations	Striking a balance between promoting Smokeless Products to adult smokers and avoiding attractive marketing to non-adult smokers and nicotine consumers, particularly the underaged, is essential. Regulations should prevent misleading claims while allowing informative advertising for adult smokers.
Continuous monitoring and evaluation	The market should be monitored continuously through post-market surveillance to identify potential issues and adjust strategies accordingly. Evaluating the impact of Smokeless Products on public health, tobacco consumption patterns, and smoking-related diseases is crucial.
Stakeholder collaboration	Collaboration with public health organisations and government agencies is vital to develop coherent strategies that encourage smokers, who would otherwise continue to smoke, to choose Smokeless Products instead of cigarettes.

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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07 THR: Global Regulation

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Regulation: Our Views



Regulation: We want to be part of the discussion

We recognise and support the objective of governments in reducing smoking rates and the associated health impacts, as well as the role of regulation in achieving these objectives.

We have consistently been clear in our support for tobacco and nicotine regulation that:

- Is based on robust evidence;
- Is tailored to local circumstances;
- Effectively delivers intended policy goals; and
- Avoids unintended consequences, such as the growth of illegal markets.

Smokeless Products provide compelling alternatives for adult smokers

Although not risk-free, Smokeless Products, such as Heated Products, Vapour Products, Oral Tobacco Products and Oral Nicotine Pouches, offer adult consumers the opportunity to consume nicotine with reduced risks compared to cigarette smoking.*†

Evidence from various countries suggests that the introduction of progressive regulation that encourages adult smokers, who would otherwise continue to smoke, to choose Smokeless Products is associated with a decline in smoking rates. For example, smoking rates in Sweden, the UK, New Zealand, and Canada have decreased at faster rates in recent years relative to other countries.[1,2] We believe this has been driven in large part by policies that have enabled adult smokers to access a wide range of smokeless alternatives to cigarettes.

Progressive regulation can drive Tobacco Harm Reduction

Governments, the public health community as well as manufacturers like BAT and their business partners have a key role to play in maximising the potential of Smokeless Products to contribute to Tobacco Harm Reduction. To achieve this objective, these reduced-risk*† products must be supported by progressive regulatory and policy regimes, that among other things, help to establish responsible marketing practices backed by effective enforcement.



> **Our experience and expertise means that we have much to offer governments and regulators when it comes to helping develop effective policies around Smokeless Products.**

Paul McCrory
Director, Corporate & Regulatory Affairs

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Principle to Guide Regulation of Smokeless Products

We believe that four guiding principles should be applied to the development of any regulation of Smokeless Products that acknowledge their lower risk*† compared to cigarettes.

01



Based on science and evidence

Regulation should be based on the best available science and evidence for each product category and be proportionate to the risk profile of the product relative to combustible tobacco.

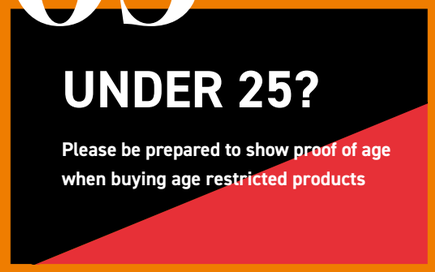
02



Ensure product quality, environmental sustainability, and consumer relevance

Regulation should mandate robust product quality and safety standards to protect adult consumers and allow access to reduced-risk*† products with satisfying nicotine levels and adult-targeted flavours, and encourage circularity and environmental responsibility among manufacturers, retailers, and adult consumers.

03



Allow adult-only access

Regulation should enable adults to access and gain information about the availability of reduced-risk*† products while preventing use by underage individuals.

04



Enable effective enforcement

Regulation should include an effective regime for penalties, sanctions, and enforcement to drive compliance.

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Future Regulatory Framework^

An aspirational 10-point progressive Regulatory Framework for Smokeless Products that reflects these principles

A call for collaborative dialogue

The regulatory landscape is evolving, and we are hopeful that an increasing number of countries will embrace progressive policies and regulations designed to encourage adult smokers to transition to reduced-risk*† alternatives. With the growing body of evidence, we are also hopeful about the broader adoption of these advanced regulations, anticipating a significant decrease in global smoking rates.

At the heart of this evolution is the establishment of a collaborative dialogue that bridges the gap between policy makers, regulators, public health authorities, and the industry. Such a dialogue is crucial for accelerating the momentum towards effective Tobacco Harm Reduction strategies. By fostering mutual understanding, stakeholders can work together to implement regulatory measures that support public health objectives while respecting the choices of adult consumers.



01

Legal access and differentiated regulation

Grant adults legal access to a wide range of smokeless, reduced-risk*† alternatives to cigarettes and apply differentiated regulation.

02

High quality and safety standards

Mandate robust product quality and safety standards to protect adult consumers and enhance circularity of products, specifically through the removability and replaceability of batteries for Smokeless Product devices.

03

Child resistance and tamper-evident

Require manufacturers to ensure that all products are child-resistant and/or tamper-evident, to international standards, to secure product integrity.

04

Nicotine limits

Establish nicotine content ceilings for non-tobacco Smokeless Products while ensuring that nicotine levels remain satisfying for adult smokers.

05

Prohibit underage use

Outlaw the use and sale of nicotine products by and to underage individuals.

06

Age verification

Mandate age-verification mechanisms at the point of purchase or delivery. Regulations should also encourage the integration of underage access prevention features and technologies into the packaging and/or devices.

07

Flavour restrictions

Allow adult-orientated flavours while banning confectionary, candy-like, energy drink, soft drink, and cocktail flavours.

08

Responsible packaging and descriptors

Prohibit packaging designs and descriptors that are predominantly appealing to underage individuals.

09

Adult-targeted communications

Permit communication with adults at adult-targeted touchpoints and ensure they display responsible content, including an adults-only sign and appropriate health warnings.

10

Robust enforcement and sanctions

Provide enforcement authorities with the necessary powers to apply penalties and sanctions to those who fail to comply with regulations, particularly targeting suppliers of non-compliant products and those providing products to underage individuals.

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

^ Subject to market realities, including unintended consequences, e.g. illicit trade, and the requirement for strict enforcement to ensure compliance.

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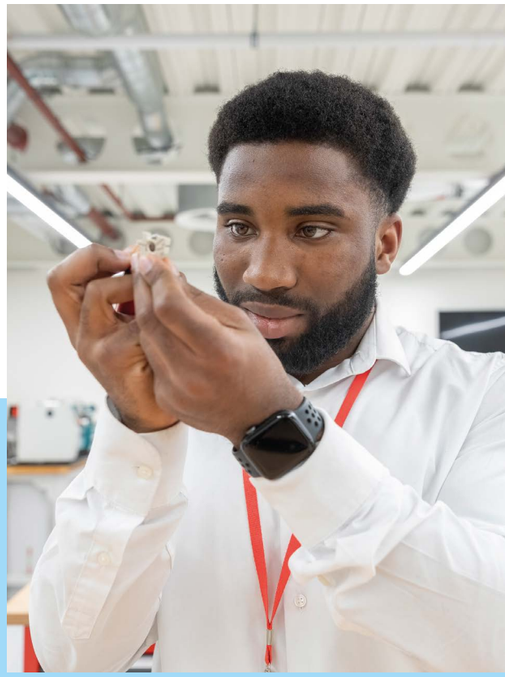
FDA Regulations

The U.S. Food and Drug Administration (FDA)'s Center for Tobacco Products regulates the manufacturing, marketing, and distribution of tobacco products.

The FDA's authority was originally limited to cigarettes, smokeless tobacco, and roll-your-own tobacco. However, in August 2016, it issued a regulation deeming other Smokeless Products, such as Heated Products, Vapour Products and Oral Nicotine Pouches, to be tobacco products under the agency's authority.

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The FDA has recognised the principles of harm reduction, and it weighs the health impact on the public as part of its Premarket Tobacco Product Application (PMTA) process. Additionally, the Modified Risk Tobacco Product (MRTP) process is specifically designed to recognise reduced-risk and reduced-exposure products, by authorising the use of product claims to alert adult consumers to products considered to be of reduced exposure and/or risk, so that they might consider switching.



FDA's Regulatory Process

Smokeless Products, including Heated Products, Vapour Products, Oral Tobacco Products, and Oral Nicotine Pouches, are subject to various statutory and regulatory requirements, including the following:

- Premarket authorisation, including existing products (that have been modified or that were not previously authorised), and future entrants to the market;
- Ban on sales to those under 21 years of age;
- Requirements to place text health warning statements on packaging and advertising; and
- Requirements that manufacturers submit ingredient information and product listings to regulatory authorities.

FDA U.S. FOOD & DRUG ADMINISTRATION

Premarket review requirements

All tobacco and non-medicinal nicotine-containing products not on the market prior to 15 February 2007 require FDA authorisation ('pre-market review') in order to stay on (or enter) the market.

For new-to-market products, manufacturers must submit a PMTA,[1] which must contain sufficient scientific evidence to demonstrate that a product is "appropriate for the protection of the public health." The FDA evaluates the evidence provided to determine whether the potential risks and benefits of the marketing of a product would have a net positive effect on the health of the population, including tobacco product consumers as well as non-consumers. The intention is to prevent the introduction of tobacco products that result in net harm to the population.

Even improvements to devices, such as for safety, ease of use, toxicity, and consistency of delivery, cannot be introduced without a PMTA filing and related marketing order.

Tobacco-flavoured Vuse Solo, Vuse Ciro, Vuse Vibe, and Vuse Alto have all received Market Granted Orders (MGOs) through the PMTA process



Figure 1. Premarket Tobacco Product Application (PMTA) Status[2]

PMTAs received by FDA **26,607,739***	Number of Market Denial Orders (MDOs) **1,263,860***	Combined number of PMTAs refused acceptance and refused filing **24,726,289***
Number of Market Granted Orders (MGOs) **44****	Percent of MGOs for devices **27%**	Percent of MGOs for consumables Heated Products **14%** Vapour Products **52%**
Percent of Heated Product Consumable MGOs, Tobacco Flavoured **67%**	Percent of Heated Products Consumable MGOs, Menthol or Non-Tobacco Flavoured **33%**	
Percent of Vapour Products Consumable MGOs, Tobacco-Flavoured **85%**	Percent of Vapour Products Consumable MGOs, Menthol or Non-Tobacco Flavoured **15%**	

* Note: Totals reflect the FDA's latest metrics covering Oct. 2019 – Mar. 2024 for Heated Products and Vapour Products PMTAs

** Total from 1 October 2019 to 31 July 2024. FDA, Searchable Tobacco Products Database, https://www.accessdata.fda.gov/scripts/searchtobacco/, accessed 3rd August 2024.

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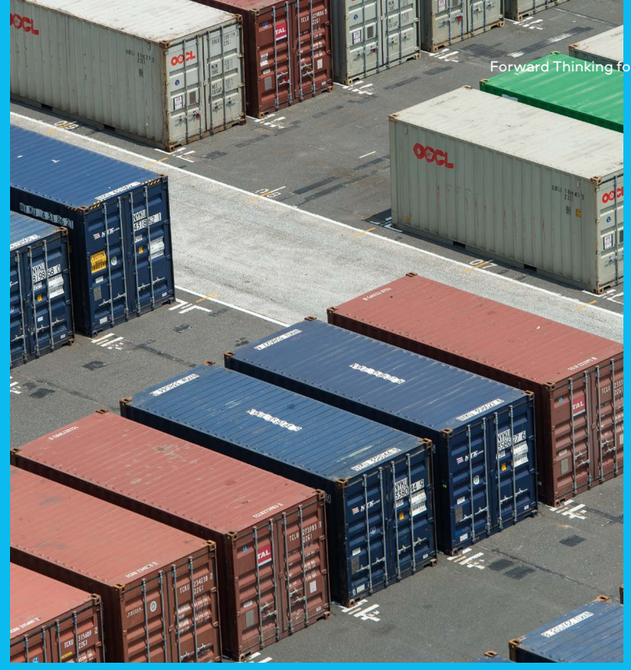
Modified Risk Tobacco Product requirements

The 2009 Family Smoking Prevention and Tobacco Control Act introduced the term 'Modified Risk Tobacco Product' (MRTP), defined as: "any tobacco product that is sold or distributed for use to reduce harm or the risk of tobacco-related disease associated with commercially marketed tobacco products."[3]

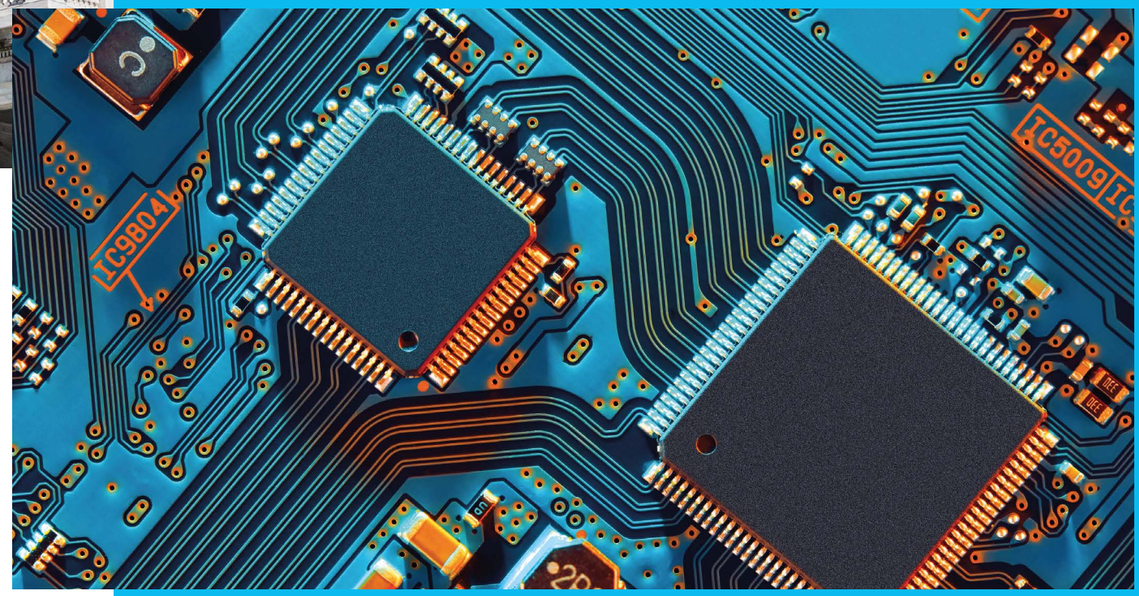
Manufacturers may apply to the FDA for a modified risk order, or a modified exposure order, which necessitates the submission of a vast amount of supporting material – epidemiological data, biomarker data, preclinical toxicology, projected behaviour, marketing impact, and more – to support the application.

Successful applications allow for reduced risk or reduced exposure claims to be made on specific brand variants of tobacco or nicotine-containing products for a time-limited period, subject to ongoing post-market review and reporting requirements. Approved claims can then be placed on advertising materials as well as on packs, as specified in the modified risk order issued by the FDA.





The U.S. MRTP process is a risk and claim substantiation process with specific provisions that allow for the formal recognition of reduced risk and exposure. To date, few products have received MRTP Granted Orders.[4]



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The FDA's Regulatory Process: Our Views

We support the principles behind the PMTA and MRTP processes in that they acknowledge that the marketing of Heated Products, Vapour Products and Oral Nicotine Products in principle can be considered as "appropriate for the protection of the public health" as compared to combustible cigarettes. Any decision regarding the reduced risk and safety of Smokeless Products should be evidence-based and scientifically substantiated. Products that are proven to reduce risk should have marketing and product freedoms in line with their risk.

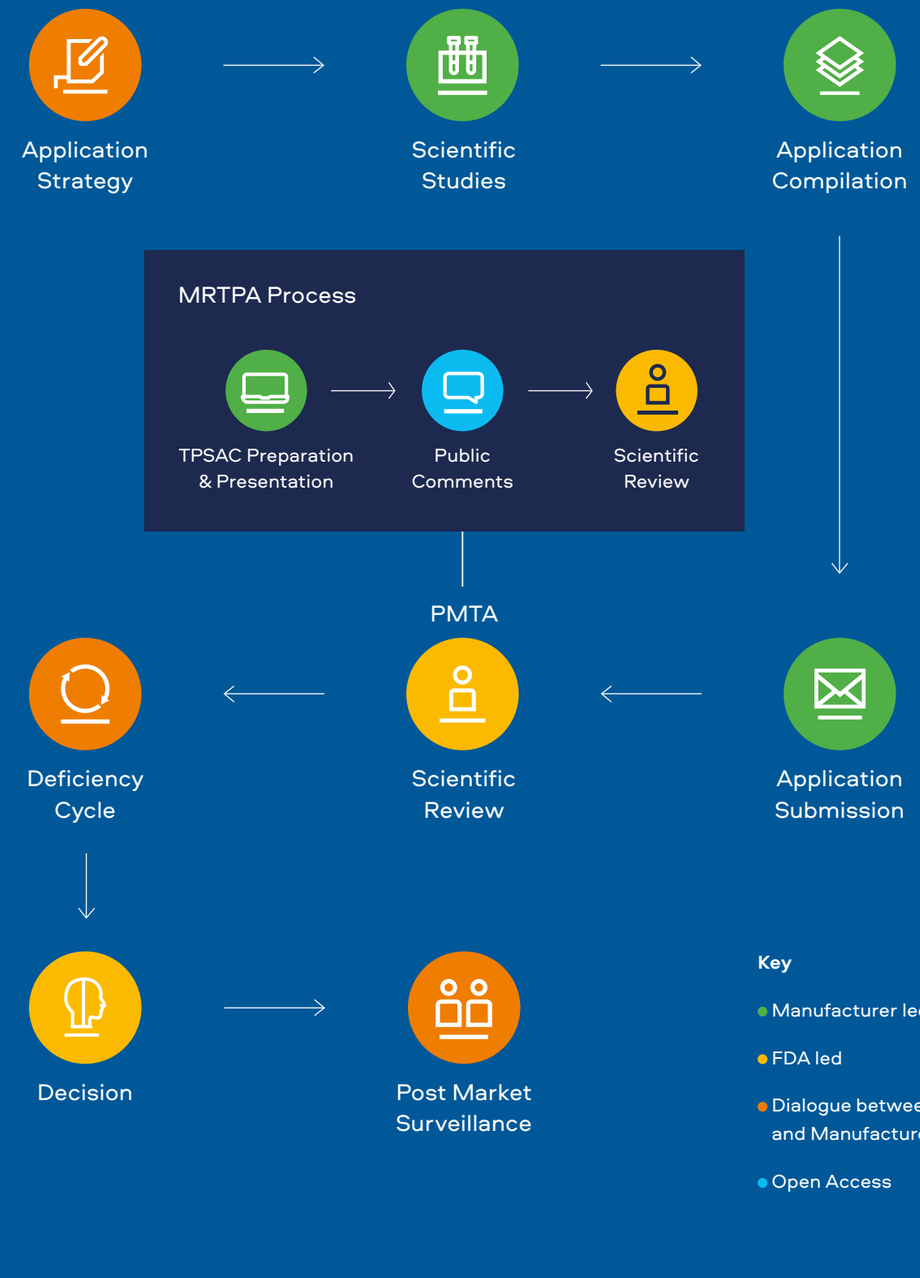
The PMTA process presents a huge opportunity to improve public health by Tobacco Harm Reduction. However, we believe that the process is not yet working as intended—not for the FDA, adult consumers, or manufacturers. The administrative systems in place can be overly burdensome, for both the industry and the regulator, and can constrain innovation by requiring new authorisation for any changes to previously authorised products. Additionally, insufficient enforcement of the relevant laws has allowed dangerous and un-stewarded illegal products to remain on the market. There has been such an influx of unauthorised Vapour Products that the number of different e-cigarette devices sold has nearly tripled to more than 9,000 since 2020, driven by these unlawful products.[5]

> **The FDA's PMTA process should promote—rather than hinder—innovation of potentially less risky Smokeless Products. The FDA should foster innovation to ensure that a greater number of potentially Reduced-Risk Products are made available to adult smokers. This will in turn serve to accelerate Tobacco Harm Reduction and a transition to a smokeless future. At the same time, meaningful enforcement should remain a priority, to curb the continued growth of illicit, unregulated, and underage-appealing products that continue to flood the marketplace.**

Tim Nestor
Executive Vice President, U.S. R&D
RAI Services Company

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PMTA & MRTPA Process



Illicit Trade in Smokeless Products
The risks of it undermining Tobacco Harm Reduction

The prominence of Smokeless Products in many markets has grown rapidly over a relatively short space of time (<10 years), with large numbers of smokers switching to these products. Unfortunately, alongside the Tobacco Harm Reduction (THR) positives from the growth seen in regulated products, there has also been a substantial rise in the availability of illicit products.

Whilst we have seen relatively lower amounts of illicit products in Oral Nicotine Pouches and Heated Products, we have witnessed the substantial rise in unregulated illicit Vapour Products alongside counterfeits of our brands. These unregulated products may pose an additional risk to consumers, as most assume them to be genuine. As these illicit Smokeless Products are not subject to the high-quality manufacturing standards required for regulated products, they are unlikely to be stewarded to optimise their safety profile and, in some cases, the ingredients added to these products may be acutely harmful to human health.

A particularly concerning example of illicit products were those that triggered the EVALI (E-cigarette or Vaping Use-Associated Lung Injury) crisis in 2019,[1] where Vitamin E Acetate was used in an e-liquid solution as a carrier for cannabis-based ingredients. The presence of these illegal Vapour Products in the U.S. caused over 2,800 hospitalisations and 68 deaths.[2]

Typically, illicit products do not conform to regulatory product specifications, with many illicit Oral Nicotine Pouches found to have increased levels of nicotine over that stated on the pack. Illicit Vapour Products can have illegal flavours that particularly appeal to the underaged, as well as nicotine levels or liquid fill volumes that exceed the regulatory market limit. Such products not only present an additional risk to consumers, but also lead to growing calls for greater restrictions and regulations imposed on the relevant Smokeless Product category as a result.

The prominence of Vapour Products has grown significantly across the world, and according to ECigIntelligence, the category is currently worth USD 30 billion, with over 65 million consumers worldwide.[3] A consequence of this growth has also been the growth in illicit Vapour Products.

> **The number of unique e-cigarettes sold in the U.S. has mushroomed to over 9,000 since 2020, when the FDA began restricting vaping flavors and requiring manufacturers to request permission to stay on the market. [...] The increase in e-cigarettes has been almost entirely driven by Chinese-manufactured disposables, with more than 5,800 disposables currently being sold in U.S. stores, according to the IRI data. That number is up more than 1,500% from 356 disposables available in early 2020.**
>
> **Associated Press News**
> '5 takeaways from the AP's report on Chinese disposable e-cigarettes flooding the U.S market' 2023[5]



The illicit vaping market is yet to be fully quantified, a reason for this is the multiple ways in which Vapour Products could be defined as illicit, which creates challenges for law enforcement and other stakeholders. Broadly speaking, illicit vaping can be divided into four segments:

Product restrictions

- Some countries have outright bans on sales of Vapour Products, such as Brazil. In Brazil, all sales of vapes are illicit, but its market value is over USD 800 million, all of which is criminal profits. We do not supply Smokeless Products to Brazil, but the continued growth in the category illustrates how consumers are able to obtain Vapour Products, which are not controlled through regulatory or fiscal measures.
- Many countries around the world have product restrictions, such as vaping tank size and nicotine content limits as well as ingredient bans which restrict flavours. In the UK, it appears that over a quarter of products exceed tank size limits and are therefore illicit, and in many markets such as the U.S., which have not authorised any flavoured products other than tobacco and menthol flavours, most consumers continue to purchase illicit flavoured products. The presence of illicit products undermines Tobacco Harm Reduction efforts across the world.

Retail restrictions

- Some countries ban the online sale of Vapour Products, but this does not stop retailers from outside the country offering illicit products through online retail channels. In some EU countries which ban online sales, more than half of all web traffic relating to Vapour Products is to foreign retailers which is very difficult to enforce against. In the Netherlands, a third of vape consumers continue to purchase illicit products online, and in Belgium, one in five similarly purchase illicit products online.

Administrative review and market authorisations

- A large number of products are often placed onto the market without complying with the relevant administrative controls. This can be identified through reviewing the significant trade gaps that exist between the value of Vapour Products exported to the U.S. and the UK from China, compared with the value of products tracked by Customs authorities. Such analysis indicates that more than 80% of Vapour Products imported into the U.S. are not tracked. This is consistent with an estimate of over 95% of the market lacking FDA authorisation or a court order allowing the product to remain on the market, therefore classifying it as illicit. In the EU, the volume of products notified and listed on a centralised database makes it very difficult for enforcement agencies in each country to check compliance. This leads to high volumes of illicit products. With unauthorised products that often do not comply with product requirements flooding the market, the ability for compliant manufacturers like BAT to compete on level terms is significantly undermined.

Tax

- There is increasing evidence that the amount of tax revenue that should be collected where Vapour Products are taxed goes unpaid. In the EU, of the ten Member States who applied tax to Vapour Products in 2022, seven collected less than half of the tax due. Furthermore, countries which collected less tax often had more complex regulatory regimes, meaning that consumers turned elsewhere to obtain their products.

The fact that existing controls on Vapour Products are undermined in so many ways creates a complex illicit landscape and an unlevel playing field between compliant manufacturers (like BAT and others) and other non-compliant companies who are selling these products illegally. In many of the countries mentioned, illicit trade in Vapour Products can be above 50% (one in every two products, if not totally illicit in prohibition markets, e.g. Brazil), which is significantly higher than global estimates for illicit tobacco at approximately one in every ten cigarettes and tobacco products.[4]

Without proper enforcement of existing regulations and a greater focus on illicit trade of Smokeless Products, efforts to help smokers switch will be compromised. Furthermore, the presence of non-compliant or potentially dangerous products in completely unregulated illicit markets undermine global Tobacco Harm Reduction efforts. This emphasises the importance of developing new policy solutions to help regulators and enforcement to combat illicit trade of Smokeless Products.

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08 THR: Scientific Engagement



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Global THR Science: Stakeholders and Key Research Questions

Tobacco Harm Reduction (THR) involves adult smokers who would otherwise continue smoking moving down the risk continuum towards less risky*† products than traditional cigarettes.



Figure 1. Key Tobacco Harm Reduction Stakeholders



A growing body of global science supports the role of Smokeless Products, yet despite the tradition of harm reduction in public health, the regulatory and political landscape for THR remains complex (Figure 1). A big opportunity exists to bring scientific stakeholders together to unite and align in moving the public health strategy on tobacco forward.

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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Key Research Questions

Figure 2. Summation of key questions from our analysis of U.S./EU/other regulatory bodies

Questions for THR

Tobacco and nicotine product science has evolved rapidly in the past decade, driven by the diversification of the tobacco industry. In turn, this has driven an equally rapid evolution of tobacco and nicotine product science, conducted by those outside the industry.

Through conducting this science, both industry and non-industry scientists are looking for answers to key questions related to THR. These questions can be grouped into five main categories (Figure 2) and include:

ABSOLUTE HEALTH RISK

- What is the risk of tobacco and nicotine Smokeless Products on all users (smokers and non-smokers)?
- What are the health risks of nicotine use?

PUBLIC PERCEPTIONS

- Does the public understand the relative risk of tobacco and nicotine Smokeless Products compared to cigarettes?
- Does the public understand the risks of nicotine?

UNDERAGE ACCESS

- How can retail practices better prevent underage access to tobacco and nicotine Smokeless Products?
- What are the best methods to eliminate underage usage of tobacco and nicotine Smokeless Products?

PRODUCT STANDARDS

- What standards should be applied to nicotine in tobacco and nicotine Smokeless Products?
- What role do menthol and flavours play in encouraging adult smokers who would otherwise continue to smoke to switch completely to tobacco and nicotine Smokeless Products?

ADDICTION

- Do tobacco and nicotine Smokeless Products serve as a gateway to cigarette smoking?
- What are the abuse liability risks of tobacco and nicotine Smokeless Products relative to cigarettes?



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Communicating Our Science: Peer-Reviewed Publications

Science engagement is a key driver of the external discussion on Tobacco Harm Reduction (THR), and central to our efforts towards Building a Smokeless World.

As active participants in this discussion, we champion an open and transparent approach when sharing information about our Smokeless Products. We believe through external peer review and discussion we continue to demonstrate transparency of our science.

Growth in Smokeless Products use has reinvigorated the discussion around Tobacco Harm Reduction, building support for pragmatic public health policies.[1,2,3] Developing the underpinning science for this field is too urgent and too important to be left to any one part of the scientific community. And it is increasingly clear that regulators, academia and industry-funded science all have a role to play.

Our research programmes are strongly focused on the science to substantiate the risk of our Smokeless Products relative to cigarette smoking. We independently validate the science behind our Smokeless Products through publishing it in journals where science undergoes external peer review. Peer review is a process by which an author's research and ideas are critiqued by experts in the same field.

There are some journals that will not consider research that has links to tobacco companies. However, it is heartening that most journal editors and editorial boards believe good science speaks for itself and should be judged objectively by the peer review process. Most journals today have straightforward processes that ensure potential conflicts of interest are clearly disclosed.

We want to contribute to and stimulate the discussion around Tobacco Harm Reduction and have published more than 260 articles relating to Tobacco Harm Reduction and our Smokeless Products in international, peer-reviewed journals. We always choose an open access option, so there are no restrictions on who can read our research, and links to all our publications can be in the back of the Omni™ (see Chapter 11) and in the library of bat-science.com.

To date, we have published >260 publications related to Tobacco Harm Reduction.

	Publication numbers
Cross-category	39
Heated products	84
Vapour products	84
Oral Nicotine Pouches	14
Oral Tobacco Products	44
Total	**265***

*Correct as of 31 July 2024

Peer review process

Ascertaining quality and integrity in science

The process of someone reading, checking, and giving his or her opinion about something that has been written by another scientist or expert working in the same subject area, or a piece of work in which this is done:

01 **Screening & peer review preparation by journal**
Article is scrutinised for compliance with the journal's scope, ethics and guidelines. Editors and reviewers are invited for peer review.

02 **Review by external subject matter experts**
Article is reviewed for novelty, scientific rigour, impact, ethical obedience; and feedback is submitted to the handling editor.

03 **Internal decision by handling editor (journal's editorial board member)**
Editor makes decision on acceptance, revision or rejection of article, based on article quality and peer reviewers' comments.

04 **Revision by author**
In case of a revision decision, the author submits a revised manuscript along with responses to peer reviewers' comments.

05 **Final decision by handling editor**
Handling editor decides to either accept the revised manuscript, request further revision, conduct additional peer review, or reject it.

06 **Production and publication in journal**
Peer review approved manuscript undergoes production and publication in the scientific journal.

Source: Soni, B. and Kumar, A., Peer Review Process - Ascertaining Quality and Integrity in Science, Qualiten Insight, 2021. ID: 09004000002

> **Scientific engagement is vital now more than ever. The science behind these Smokeless Products is what will guide regulation and opinion.**
>
> **Dr Elaine Round**
> Group Head of Life Sciences

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Scientific Conferences: An Opportunity for Discussion and Information Sharing

Conferences bring together professionals, stakeholders, and experts from various sectors. They serve as platforms for knowledge exchange, collaboration, networking and the discussion of emerging trends, challenges, and innovations in the relevant sectors.



Typically, conferences involve presentations; panel discussions; workshops and exhibitions related to subject topics as stipulated by the conference organisers.

We see conferences as an excellent opportunity to be open and transparent with our science that will actively contribute to the dialogue on Tobacco Harm Reduction (THR).

In 2023, we attended more than 50 conferences, presenting on the science behind our Smokeless Products. These conferences ranged from large general conferences on toxicology to more specialist events on nicotine and tobacco science. Like our publications, the material we present externally is made available through the library of our dedicated science website, bat-science.com.

These conferences also represent a fantastic opportunity to engage with other stakeholders that are interested in scientific research into tobacco and nicotine. Discussions amongst conference attendees can lead to new professional connections, diversified viewpoints, and innovative thinking.

While, as with some peer-reviewed journals, there are conferences that do not allow tobacco industry participation, we are gratified that there are many more organisations—from pro-THR organisations to fundamental science groups—that welcome all interested stakeholders to contribute to the discussion of THR and nicotine science. Our science contributes to the larger body of evidence around Smokeless Products, and conference presentation and engagement gives us the opportunity to demonstrate to the wider scientific community the rigour and transparency of our research.

We welcome the opportunity to contribute to an even broader range of open conversations on THR, with interested parties of all viewpoints given both access and a platform to present the evidence that can stimulate further constructive dialogue. In contrast to closed events, which largely involve researchers' sharing opinions and data with other parties with whom they already agree, open participation could allow for industry science to be judged on its merits, rather than simply its source. This, in turn, could lead to an even more robust and scrutinised evidence base relating to THR.

> **Connecting with other sectors of the scientific community, including regulators, by attending conferences is a key part of our commitment to openness and transparency, and the more we engage, the better our science becomes - it's a virtuous circle.**
>
> **Dr Elaine Round**
> Group Head of Life Sciences

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Totality of Scientific Evidence: Communication

Our commitment to sharing the science behind our Smokeless Products goes beyond publication in peer-reviewed journals and presentation at scientific conferences.

We are focused on driving awareness and understanding of our science across multiple scientific and other non-consumer audiences. We believe that by being open and transparent with our data, we can meaningfully contribute to the discussion on Tobacco Harm Reduction.

Introducing our latest Tobacco Harm Reduction resource:

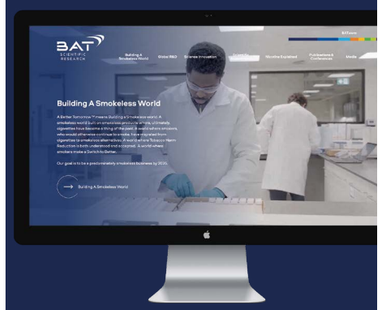
asmokelessworld.com

Our Science Websites

Our scientific websites are a valuable source of information relating to our science. We aim to present clear and concise information on our Smokeless Products, our approach to Tobacco Harm Reduction (THR), and about our scientists. Our peer-reviewed publications and conference presentations are also available for download.

www.bat-science.com

www.reynoldsscience.com



Scientific Engagement on LinkedIn

Our team are keen to share information relating to our strategy to Build a Smokeless World. We see LinkedIn as a great platform to advocate our published science and that of external parties whose science relates to Tobacco Harm Reduction.

BAT – LinkedIn: www.linkedin.com/company/british-american-tobacco/

James Murphy
Director, Research & Science

Danielle Tower
Group Head of Scientific & Regulatory Affairs

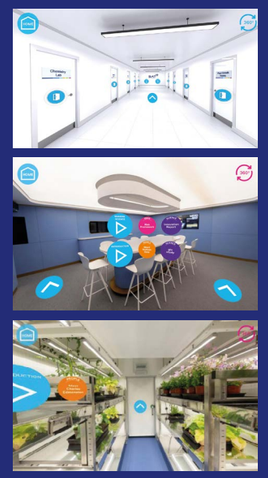
Allen Griffiths
Head of Science Discovery

Elaine Round
Group Head of Life Sciences

Augmented Reality: R&D Experience

We were the first tobacco company to allow external visitors to tour our R&D facilities in 2011. We have since welcomed more than 4,000 visitors, including scientists, academics, regulators, and media. To bring our R&D facilities to a wider audience, we invested in a virtual R&D experience available on our science websites. This virtual experience has allowed a significant number of global visitors to tour through our laboratories and meet some of our world class scientists.

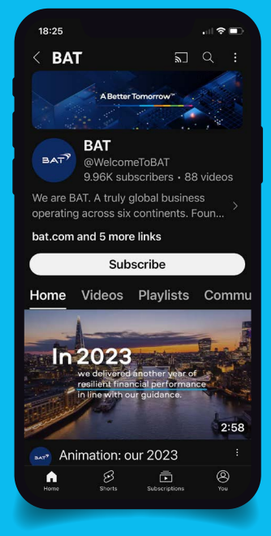
BAT Science - R&D Virtual Visitor Experience (bat-science.com)



@WelcomeToBAT YouTube Channel

To deliver our science across multiple key stakeholders we have developed 'bite-size' and 'explainer' videos as part of our company YouTube channel. Our intention with these videos is to translate the science from our peer-reviewed publications into an engaging and understandable experience for key stakeholders.

BAT - YouTube: www.youtube.com/user/WelcomeToBAT



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Selection of Tobacco Harm Reduction Stakeholders' Views

Harm reduction approaches have produced diverse opinions from numerous stakeholders. We encourage anyone interested in learning more about Tobacco Harm Reduction (THR) to read more and consider the broadest range of available viewpoints.

- The World Health Organization (WHO) takes the view that: "ENDS [(electronic nicotine delivery systems)] contain varying amounts of nicotine and harmful emissions. E-cigarette emissions typically contain nicotine and other toxic substances that are harmful to both users and non-users who are exposed to the aerosols second-hand. Some products claiming to be nicotine-free (ENNDS) [(electronic non-nicotine delivery systems)] have been found to contain nicotine. Nicotine exposure in pregnant women can adversely affect the development of the fetus. Further, the consumption of nicotine in children and adolescents has negative impacts on brain development, leading to long-term consequences for brain development and potentially leading to learning and anxiety disorders."[1]
- In the U.S. the Food and Drug Administration (FDA) has acknowledged a risk continuum of tobacco and nicotine products and has a regulatory pathway to introduce new products and to market products as reduced risk.[2]
- In the UK, Public Health England^ and the Government have adopted harm reduction as a key pillar of tobacco control.[3]
- Te Whatu Ora (Health New Zealand, the primary publicly funded healthcare system of New Zealand) acknowledges Vapour Products to be less harmful than smoking; however, not totally harm free: "The difference between smoking and vaping is that smoking delivers nicotine by burning tobacco which can cause smoking-related illnesses, and vaping can deliver nicotine by heating a liquid in a much less harmful way. There are some risks to vaping, and the biggest is that long term effects are not yet known. While vaping is less harmful than smoking it is unlikely to be totally harm free. Scientists will not be certain for many years of any health risks associated with vaping. Ideally, smokers who are vaping to quit should look to eventually stop vaping too. Vaping is not for children and young people, and people who don't smoke should not vape."[4]
- Australia has taken an opposite view, continuing a prohibition on Vapour Products other than through the pharmacy model. It has maintained that: "Vaping can harm your health. The known health risks of vaping include: irritation of the mouth and airways; persistent coughing; nausea and vomiting; chest pain and palpitations; poisoning and seizures from inhaling too much nicotine or ingestion of e-liquid; burns or injury caused by the vape overheating or exploding; nicotine dependence; respiratory problems and permanent lung damage; harm to a developing adolescent brain; some chemicals in vape aerosols can cause DNA damage. There are other health concerns of vaping: unknown risks of developing lung disease, heart disease and cancer; an increased risk of taking up smoking cigarettes, which has serious health issues, such as cancer; exposure to higher levels of toxic chemicals if you vape and smoke cigarettes."[5]

Finding more common ground between tobacco control advocates and supporters of Tobacco Harm Reduction is crucial for further reductions in smoking rates. Tobacco control advocates primarily focus on policies that aim to reduce tobacco use through regulations, taxes, public education campaigns, and even prohibition. Meanwhile, harm reduction supporters emphasise the role of Smokeless Products as reduced-risk*† alternatives to smoking for those smokers who would otherwise continue to smoke. Both approaches share the common goal of reducing the health impacts associated with smoking, but their methods differ. Increased collaboration between these groups can lead to more comprehensive strategies that address both prevention and harm reduction, thereby reaching a broader population and accelerating progress towards lower smoking rates.



By integrating the strengths of both tobacco control and harm reduction, a more nuanced and effective public health strategy can emerge. Some tobacco control measures like taxation have been effective in reducing smoking rates. However, recognising that some individuals may continue to use tobacco and/or nicotine, harm reduction strategies can provide better alternatives to cigarettes, thereby reducing the associated health impact of smoking.*† Building a bridge between these perspectives can lead to progressive policies that not only discourage smoking initiation and promote cessation but also offer practical solutions for smokers who would otherwise continue to smoke. This balanced approach can harness the full potential of both schools of thought, ultimately leading to a more substantial and sustainable decline in smoking rates and smoking-related health morbidity and mortality.

Those opposed to incorporating Smokeless Products into a harm reduction strategy express a variety of concerns, including that there is insufficient scientific knowledge to determine that Smokeless Products are reduced risk and whether they might introduce new risks. They argue that because such products typically contain nicotine they maintain addiction, and that the products may both stop adult smokers from quitting and encourage underage people to start smoking. These important issues, and others listed below, are recognised by those who believe Smokeless Products are a critical component of a harm reduction strategy, but they tend to think that the potential benefits of Smokeless Products outweigh the potential risks, taking a weight-of-evidence approach to the existing data. They believe that many outstanding issues can be resolved by additional research and by monitoring usage patterns.[6,7]

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

^ Public Health England (PHE) was replaced in Oct 2021 by UK Health Security Agency and Office for Health Improvement and Disparities

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Public Health Strategy on Tobacco

01 Part of the World Health Organization's FCTC

Tobacco Harm Reduction is recognised by the World Health Organization (WHO) as part of tobacco control, referred to as "harm reduction strategies" in the Framework Convention on Tobacco Control, Article 1(d).

02 Mortality Reduction

Tobacco Harm Reduction methods can prevent premature deaths attributed to tobacco use. Having implemented THR policies, Sweden has observed reductions in tobacco-related mortality rates. However, ambiguity surrounding the long-term risk of Smokeless Products remains a prominent concern. There is also a concern regarding the oft-repeated claim that vaping is 95% less harmful than smoking, contending that it lacks empirical evidence. Many policy makers advocate for a cautious regulatory approach until the long-term health implications of Smokeless Products are fully understood.

03 Morbidity Reduction

Sweden, which has had long-standing access to Smokeless Products, exhibits low smoking prevalence rates (5.6%) and significantly lower prevalence of tobacco-related diseases.

04 Smoking Prevalence Reduction

THR is associated with reducing smoking rates. Extensive evidence, including systematic reviews by the Cochrane Collaboration, indicates that Smokeless Products facilitate this. Nevertheless, scepticism remains regarding Smokeless Products and their role in reducing smoking rates.

05 Consumers' Right to Choose

Informed decision-making empowered by accurate risk communication is vital to adult smokers who continue to smoke but are willing to consider alternatives. Adult smokers need the freedom to make informed choices.

06 Banning Smokeless Products = Increased Smoking and Other Unintended Consequences

Bans on Smokeless Products can inadvertently lead to increased smoking rates and other unintended consequences, e.g. flourishing illicit markets. Some argue, however, that THR could undermine comprehensive tobacco control measures, potentially reversing progress.

07 Underage Initiation and Usage

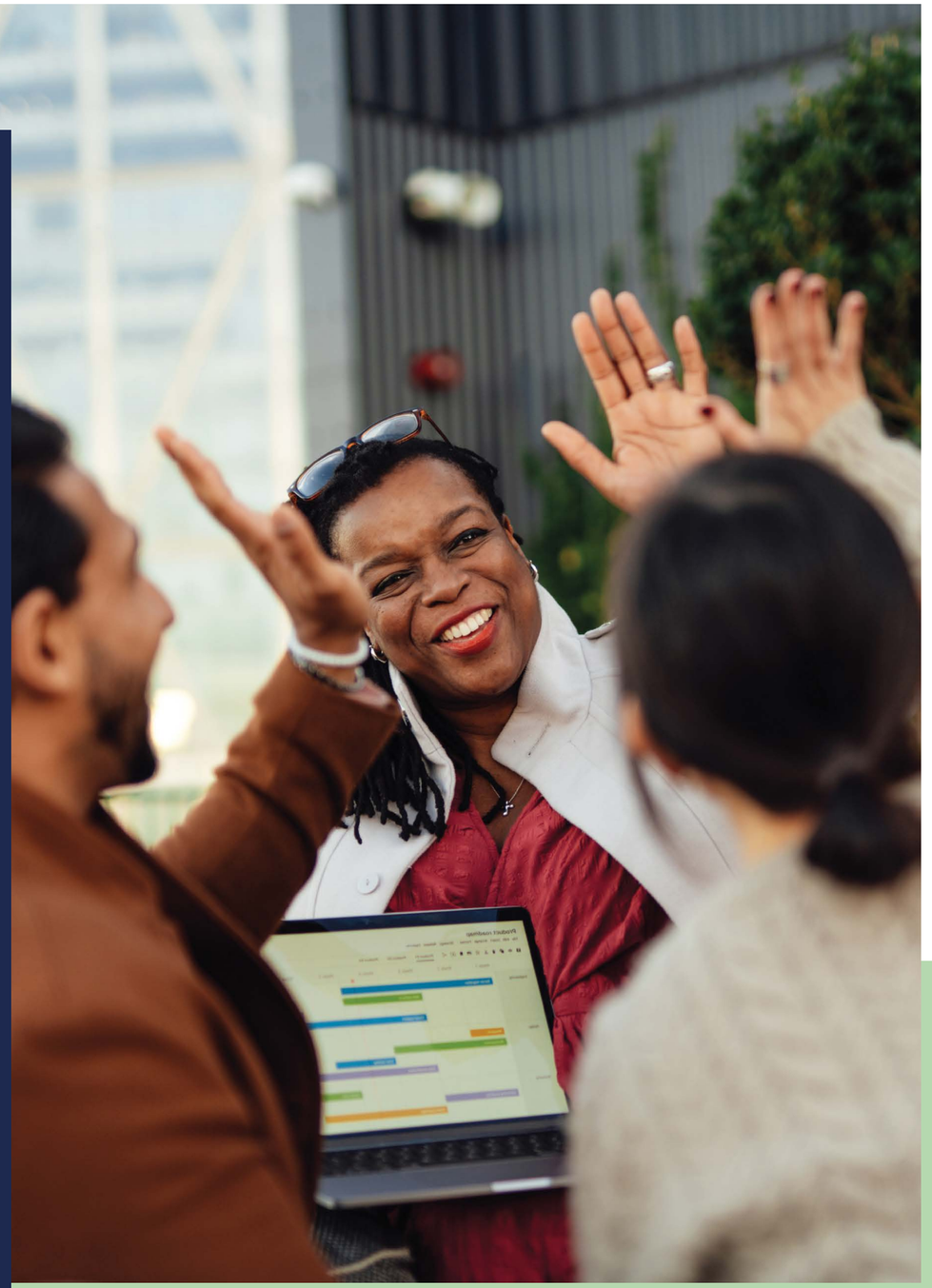
An important concern revolves around underage usage. Some Smokeless Products, notably irresponsibly marketed ones, could attract the underaged and create a new generation addicted to nicotine.

08 Gateway Effect

There is a concern that Smokeless Products could serve as a gateway into smoking, thus thwarting tobacco control efforts and perpetuating tobacco use rather than reducing it.

09 Role of the Tobacco Industry

The tobacco industry's role in THR efforts is complex, and suspicions linger regarding conflicting interests and priorities. Some believe that involvement by industry participants (such as BAT) is part of the problem, while others think industry participants can be part of the solution.



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09 Our Future Outlook

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Our Future Ambitions 326

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Measuring BAT's Transformation

Our ambition is A Better Tomorrow™, which is reducing the health impact of our business by Building a Smokeless World. Tobacco Harm Reduction (THR) is how we will achieve this goal.

THR is minimising smoking-related morbidity and mortality. We will achieve this through encouraging adult smokers, who would otherwise continue to smoke, to switch completely to lower risk profile products, such as Vapour Products, Heated Products, Oral Tobacco Products, and Oral Nicotine Pouches. The success of THR can be defined by an equation where the greater the number of continuing adult smokers who switch to lower risk profile products, the greater the THR outcome (Figure 1).[1] Increasing the availability of lower risk profile products will further increase the impact of THR.

Figure 1.
Tobacco Harm Reduction Equation

Tobacco Harm Reduction =
Scientifically Substantiated Reduced-Risk*† Products
X
The Number of Adult Consumers Using Reduced-Risk*† Products Who Would Otherwise Smoke Cigarettes

The leading country where demonstrable THR has occurred is Sweden, where Oral Tobacco Product and Oral Nicotine Pouch use has nearly replaced cigarette smoking.

The World Health Organization (WHO) considers countries to be smoke-free when smoking prevalence is less than 5% of the population.[2] The European Union (EU) has tasked all its member states with becoming smoke-free by 2040.[3] Barring a dramatic shift in progress, we believe that most will miss this target with the number of smokers likely to increase over the coming decade.[4]

Sweden, however, will achieve this historic milestone as soon as this year - 2024.[5] That is an incredible 16 years ahead of the EU target date, and before every other nation in the bloc is even within sight of the achievement. The country is already reaping the benefits, with cancer rates and tobacco-related deaths significantly lower than all its peers.

In Sweden, because of fewer adult smokers, epidemiological outcomes reveal a significant reduction in all-cause tobacco-related mortality among men (per 100,000 deaths, median provided for EU values) for lung cancer (Swe: 87 versus EU: 220); other cancer (Swe: 63 versus EU: 105); cardiovascular (Swe: 72 versus EU: 170) and all causes (Swe: 222 versus EU: 550).[6]

The opportunity for THR to have a beneficial impact on public health is enormous. The introduction to market over the last decade of three new categories of Smokeless Products (Heated Products, Vapour Products and Oral Nicotine Pouches) has shown that they can penetrate global cigarette markets equally, or more deeply than Oral Tobacco Products like snus.

* 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 FDA regulation and no reduced-risk claims will be made as to these products without agency clearance.

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Additionally, because of different consumer preferences, our multi-category strategy enables us to satisfy the needs of more and different adult smokers. This in turn results in increased penetration of more cigarette markets around the globe, meaning that the potential beneficial global public health impact is even more profound.



Already today, several public health organisations and regulators are supporting the use of Smokeless Products. However, to ensure that the full potential of the THR opportunity is realised, much more focus is required to (i) ensure that adult smokers in all markets across the world have access to Smokeless Products, (ii) improve the accuracy of government sanctioned health-related communications surrounding Smokeless Products and (iii) enable regulatory frameworks that balance product standards to encourage adult smokers to quit while avoiding underage uptake of Smokeless Products.

Dr James Murphy
Director,
Research & Science

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THR: Measuring Progress

As we look forward into the next decade of Building a Smokeless World, it is important to assess how far BAT has come, as well as the progress of THR globally.

Table 1 and Table 2 summarise the metrics by which we assess the progress of transformation.

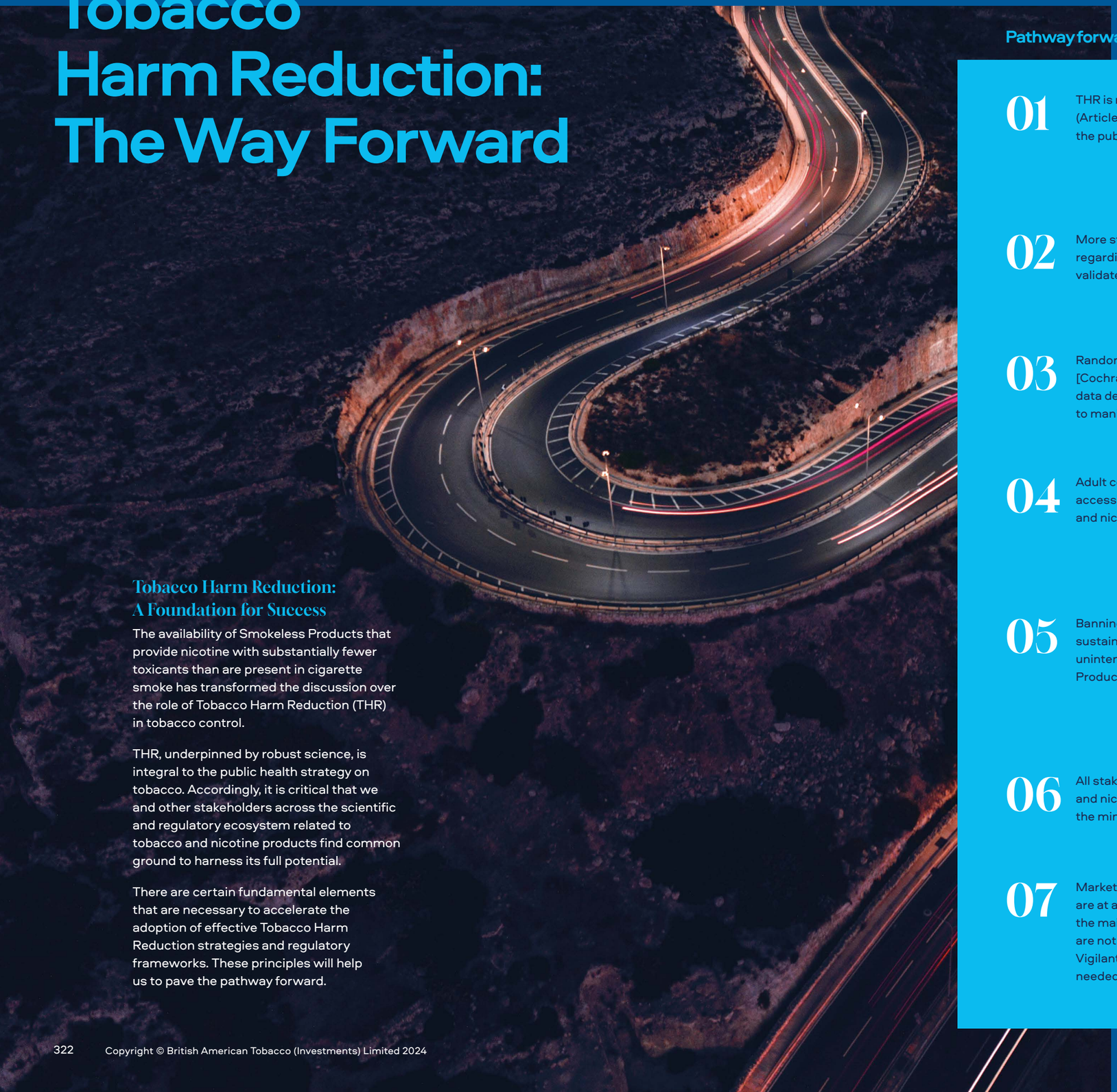
Table 1. Tobacco Harm Reduction Metrics – BAT's Decade of Transformation

Parameter	2013	2023
Cigarette Volume (Billions of Sticks)	676	532
Number of BAT Cigarette Markets	200	145
Lower Risk Profile Smokeless Product Categories	Vapour	Multi-Category
Number of Smokeless Product Markets	2	82
Number of Smokeless Product Consumers (millions)	<1	23.9
Smokeless Product Revenues (£Bn)	<0.1	3.35
Markets where Smokeless Products >30% BAT Revenue	0	25
Smokeless Product Revenue as % of Group Revenue	<0.1%	16.5%
Scientific Publications on Smokeless Products	51	265
Global Consumers of Smokeless Products (Millions)	~10	>100

Table 2. Tobacco Harm Reduction Metrics – Smokeless Products Globally

	Heated Products[7]	Vapour Products[8]	Oral Nicotine Pouches[9]
Total Adult Consumers, 2024 (millions)	40	65	10
Adult Consumer Growth, 2020-2024 (%)	66	55	500
Top Five Markets - Adult Consumers, 2024 (millions)	Japan: 15.37 Russia: 4.91 Italy: 4.36 South Korea: 3.45 Poland: 1.68	U.S.: 17.5 UK: 5.2 Indonesia: 4.2 France: 3.6 China: 3.4	U.S.: 6.14 Russia: 0.65 UK: 0.62 Sweden: 0.57 Poland: 0.54

Tobacco Harm Reduction: The Way Forward



Tobacco Harm Reduction: A Foundation for Success

The availability of Smokeless Products that provide nicotine with substantially fewer toxicants than are present in cigarette smoke has transformed the discussion over the role of Tobacco Harm Reduction (THR) in tobacco control.

THR, underpinned by robust science, is integral to the public health strategy on tobacco. Accordingly, it is critical that we and other stakeholders across the scientific and regulatory ecosystem related to tobacco and nicotine products find common ground to harness its full potential.

There are certain fundamental elements that are necessary to accelerate the adoption of effective Tobacco Harm Reduction strategies and regulatory frameworks. These principles will help us to pave the pathway forward.

Pathway forward

01 THR is recognised in the WHO's FCTC (Article 1(d)). It should be a central part of the public health strategy on tobacco

02 More stakeholder discussion is needed regarding the weight of evidence that validates THR

03 Randomised Clinical Trial data [Cochrane review 2024] and in-market data demonstrate the efficacy of THR to manifest smoking reduction

04 Adult consumers have a right to access legally regulated tobacco and nicotine products

05 Banning Smokeless Products leads to sustaining of smoking rates and the unintended creation of illicit Smokeless Products markets

06 All stakeholders recognise that tobacco and nicotine are never for those below the minimum legal age

07 Market data shows smoking rates are at an all-time low, suggesting in the main, that Smokeless Products are not leading to more smoking. Vigilant post-market surveillance is needed to monitor these trends

08 Data from Sweden confirms mortality and morbidity reduction potential of Smokeless Products alongside more than a decade of usage of Smokeless Products by more than 100 million adult smokers (Chapter 6)

09 While there is a public health risk of sustained or new nicotine usage, more discussion is needed to assess the view that this risk is greatly outweighed by the benefits of THR

10 Public health bodies have confirmed that nicotine is not carcinogenic[1,2]; it is the harmful chemicals generated from the burning of tobacco that cause harm to adult smokers

11 The focus of the public health strategy on tobacco should be to minimise the harm of tobacco on society and this can be achieved via a combination of evidence-based tobacco control measures and THR

12 If adult consumers wish to use Smokeless Products, they should be supplied within a regulatory framework that is enforced to ensure access to legal products without the creation of illicit markets

13 Several public health authorities across the world have stated that THR products present less risk than smoking[3-8]

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Next Generation Science

A future-fit science programme requires the core physical and biological sciences, combined with digital - computer and data science, including AI/Machine Learning, governed by regulatory and ESG compliance.



Dr Allen Griffiths
Head of Science Discovery

The following scientific trends will help us shape our A Better Tomorrow™ ambitions:

Synthetic Biology: a multidisciplinary field combining biology, engineering and computer science that offers an array of applications. These include re-engineering metabolic pathways in micro-organisms to produce more sustainable bioingredients or biopolymers that will simplify supply chains and reduce the use of arable land. This approach unlocks opportunities in life sciences and manufacturing, including co-locating the production of raw materials and ingredients, leading to reductions in shipping and storage.

Our biotechnology company KBio provides us with the opportunity to accelerate the development of plant-based technologies. We aim to deliver increased capabilities at KBio to 1) strengthen and diversify its existing portfolio, 2) increase the opportunity for significant future drug discoveries, and 3) maximise the success of our own tobacco biotechnology ambitions. Through harnessing the power of the tobacco plant, we aim to bring innovation that will have a positive impact on global health.

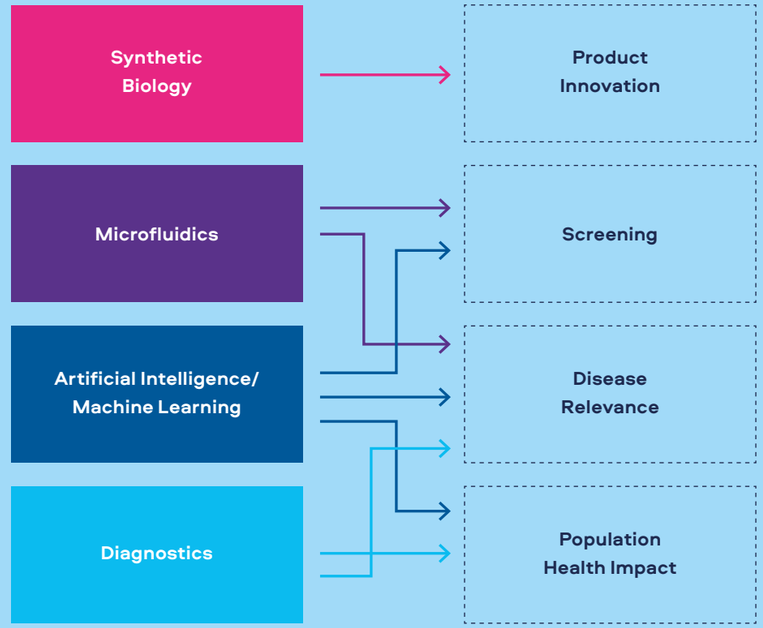
Microfluidics and related emerging technologies: enabling tools for applications in tissue engineering and cell biology. These technologies allow the creation of 'humans on a chip' generating entire micro-scale biological systems based on human cells to recreate anatomical structures of the human body. The aim is for physiological and pharmacological applications in disease modelling and drug evaluation, ultimately replacing animal testing.

There has been considerable investment and innovation in the area, particularly efficacy science, but work remains for these approaches to be accepted by regulators for safety science.

Artificial Intelligence (AI) and Machine Learning (ML): AI is the simulation of human processes by machines e.g. robots or computers. ML is a subcategory of AI that utilises algorithms and statistical models to learn and recognise patterns from data, which can be applied to make faster predictions or decisions. Applying AI/ML into systems and processes can lead to the generation of more efficient data-driven insights, from fundamental science through to final product design.

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Figure 1. Next Generation Science



Diagnostics: advances in diagnostics are being driven by the integration of science and technology along with data analytics. This is characterised by an evolving landscape of personal connected devices, wearables and digital twins used to measure physiological parameters, and via digital health platforms to provide real time data and insights directly to the individual and/or clinicians. Not only are these developments resulting in more personalised approaches to health monitoring and diagnosis, they are also leading to predictive capabilities and opportunities for interventions.

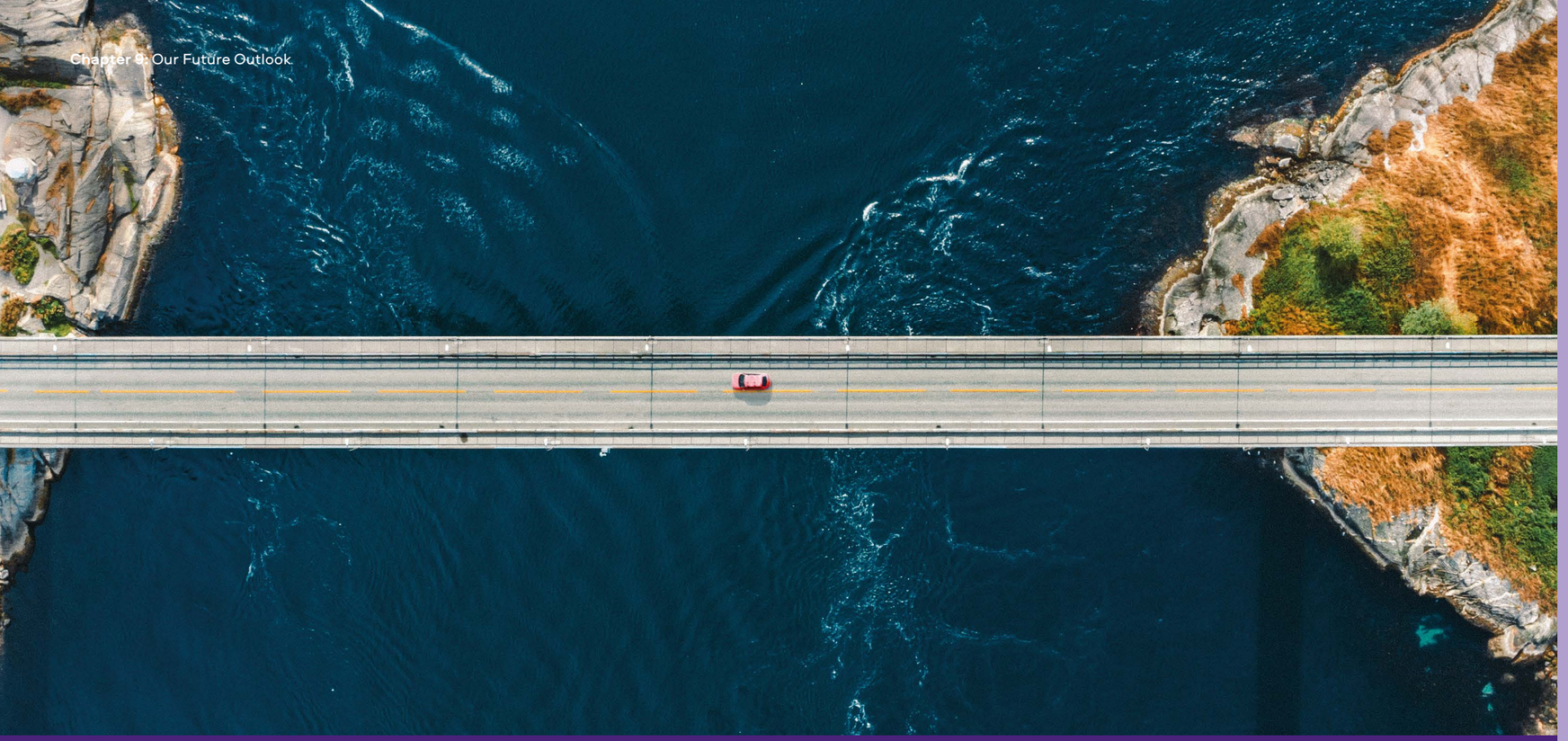
The establishment of a robust and intuitive data management infrastructure is essential to drive developments in predictive capabilities and digital twins - from high throughput chemical analysis to clinical monitoring. A co-ordinated approach to data management and analytics reduces the chances of siloed data. This enables a faster turnaround of results and insights, the removal of bottlenecks, and the minimising of knowledge loss across organisations.

In parallel with investments in infrastructure and data, the development of external scientific networks is crucial. New business models and revenue streams can be created through ecosystems by allowing co-operation and collaboration. The creation of these scientific network 'accelerators' is the perfect vehicle through which to drive technical developments, where cross-functional teams, in combination with external third parties, are tasked with executing complex science or innovation challenges in short sprints.

While co-operative and collaborative accelerators may involve a degree of risk, the adoption of agile practices coupled with the opportunity to pivot quickly and test faster offers significant benefits in terms of outcomes. These include shorter iteration times for technology and product development, greater diversity of ideas, and long-lasting interpersonal and third-party relationships. The accelerator approach not only facilitates networking, idea sharing and collaboration, but also provides the opportunity for personal development and the identification of talent.

Btomorrow Ventures (BTV), our corporate venture capital arm, plays a key role in our science strategy, accelerating change through investments, M&A and venture-building labs. For example, bringing together advances in science with BAT global capabilities to help shape innovative ideas through fast-paced research initiatives. Investments involve longer-term partnerships that go beyond financial investments, combining our global corporate reach with the accelerated innovation of start-ups to generate value for both parties. BTV provides access to innovative technology via minority investments. This unlocks innovation through Research & Development (R&D) collaborations and by enabling a test-and-learn approach, which has been applied in the new Wellbeing & Stimulation product category.

The integration of science into product(s) catalyses innovation, drives differentiation and secures Intellectual Property (IP) protection. Scientific rigour contributes to the validation of product claims and ensures safety, consistency, and reliability. Having agility in our science, being open to the latest ideas, collaborating, and embracing innovative approaches are all key to our continued business transformation.



Our Future Ambitions

As we enter the second decade of our transformation, we have re-articulated our ambitious plans to create A Better Tomorrow™ through Building a Smokeless World. Our aim is to become a high-growth, global consumer goods company: consumer-centric, multi-category, with sustainability at our core. We believe A Better Tomorrow™ will be enabled by our lower risk profile, Smokeless Products that deliver public health benefits via Tobacco Harm Reduction (THR), and our parallel strategy to explore opportunities beyond nicotine.



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Tobacco Harm Reduction

As we move forward, we want to continue to build momentum. We have clear internal goals, as well as five global stakeholder needs, that are essential to successfully delivering our ambition:

Internal goals

- Continue the research to support the THR potential of our Smokeless Products
- Set new expectations for relationships with regulators, public health, and scientific stakeholders
- Continue to publish our studies in peer reviewed scientific journals
- Creation of internal global guidelines that advance THR by restricting underage access and usage of Smokeless Products

Global stakeholder needs

- A global regulatory framework that supports both tobacco control and THR as part of their public health strategy on tobacco and nicotine
- Accurate communication from public health and regulatory authorities on the risk profile of Smokeless Products relative to smoking
- Accurate communication from public health and regulatory authorities on the risk profile of nicotine
- All markets around the world make Smokeless Products available
- A global regulatory framework that is aligned with the pace of innovation in Smokeless Products

Progress has been evident from the first decade of our transformation, in terms of transitioning a significant portion of our legacy cigarette business to our Smokeless Products business. Today, Smokeless Products account for more than 16.5% of our total revenues. This part of our business became profitable in 2023, two years ahead of schedule. Additionally, in 25 of our 82 global Smokeless Products markets, >30% of the total revenues in those markets are from Smokeless Products, demonstrating the THR penetration within those markets.

Our Smokeless Products' contribution to global THR is significant. We have the second largest number of Smokeless Product adult consumers, demonstrating that our multi-category portfolio approach is actively encouraging adult smokers who would otherwise continue to smoke to switch (Figure 1).

Our decade of transformation:

23.9m
consumers of our Smokeless Products

16.5%
of total revenues of BAT accounts for Smokeless Products

82
markets in which our Smokeless Products are available



A representation of our vision to create A Better Tomorrow™ through Building a Smokeless World and our parallel strategy to explore opportunities beyond nicotine.

A Better Tomorrow™

Cigarettes → **A Smokeless World** enabled by Tobacco Harm Reduction → **Smokeless Products**

Adult Smokers Completely Switching

Legacy Business → **Future Business**

Future Growth Accelerator → **Beyond Nicotine**

New Consumer Acquisition

Figure 1. Cross Industry comparison of progress on THR*



* Total number of Smokeless Product (Heated Products, Vapour Products, Oral Tobacco Products, and Oral Nicotine Pouches) consumers, 2023 (millions)

Beyond Nicotine

Alongside our Tobacco Harm Reduction strategy, our future growth accelerator, Beyond Nicotine, was launched in 2021. With Beyond Nicotine we will build a pathway to a new portfolio of non-nicotine-based products that can enhance BAT's future growth. We have clear internal goals but also global stakeholder needs that are essential to our ambition:

Internal goals

- Create a second engine of innovation in Beyond Nicotine
- Create a global science and innovation ecosystem that enables the creation of a consumer-inspired product portfolio
- Creation of a science programme to understand critical principles of safety, quality and efficacy of our new Beyond Nicotine innovations

Our Beyond Nicotine growth accelerator is key to our transformation to become a high-growth, global consumer goods company. We aim to provide even more choice in new and exciting areas of product innovation and meet the evolving needs of adult consumers, through exploring opportunities beyond nicotine, such as 'Wellbeing & Stimulation'.

Our global wellbeing brand 'Ryde' focuses on promoting both wellbeing and stimulation. This range of bioactive-based products is designed to be used by adult consumers throughout the day for specific moments, to improve focus, to boost energy or to relax. To ensure these products are scientifically substantiated in terms of the benefits they provide, we created Ryplenish™ – a scientifically assessed formula designed to deliver the mood state as per the product claim.

We are assessing the market potential of Ryde with pilot tests in Australia, Canada, and the U.S. Early data suggests that there is significant commercial and consumer relevance with Ryde.

We are in the initial phases of our Beyond Nicotine journey and are making significant investments in a global science and innovation ecosystem. This will enable us to leverage our strengths, as well as to develop new ones, in order to better meet the needs of the consumers of tomorrow.

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Moving forward

We are making significant progress on transitioning our business from cigarettes to Smokeless Products, driving our ambition of reducing the health impact of our business via Tobacco Harm Reduction.

Looking to the future

To accelerate the next phase of our transformation, we are committing to Building a Smokeless World - sustainably, responsibly and with integrity. We will continue to engage and collaborate with a broad range of stakeholders on the public health opportunity presented by Tobacco Harm Reduction while we invest in the science and the right multi-category portfolio to actively encourage smokers to switch to Smokeless Products. In turn, this will realise the multi-stakeholder benefits of A Better Tomorrow™.

Table 1. Enterprise metrics for our transition

Metrics	Transitioning our cigarette business	Growing our Smokeless Products business			
Product Categories	Combustibles	Heated Products	Oral Tobacco Products	Vapour Products	Oral Nicotine Pouches
	Dunhill, Newport, Natural American Spirit, Kent, Lucky Strike, Camel, Pall Mall, Rothmans 	glo 	Camel, Lundgrens, Granit 	Vuse 	Velo 
Markets	145	30	4	63	33
Revenues (£bn)	23.94	3.35			
Revenues Contribution(%)	83.5	16.5			
Consumers (millions)	107	23.9			
Category Risk Profile	Higher	Reduced			



Regulators, the public health community and manufacturers like BAT play crucial roles in maximising the potential of Tobacco Harm Reduction. With the right policies in place, and with every adult smoker given the option to choose whether and how to continue using nicotine, we can Build a Smokeless World and reduce the health impact of our business.

Paul McCrory
Director, Corporate & Regulatory Affairs



I am proud to have been part of BAT's transformation journey since day one, and there is no place I would rather be, contributing to Tobacco Harm Reduction on a global scale and Building a Smokeless World.

James Murphy
Director, Research & Science



We have before us a real opportunity to create A Better Tomorrow™ by Building a Smokeless World - the potential to benefit society while providing better options for our consumers and creating a sustainable business for the future.

Tadeu Marroco
Chief Executive



Our vision is to create a future where a wide range of innovative Smokeless Products is accessible to adult smokers, advancing Tobacco Harm Reduction and providing sustainable growth on the path to A Better Tomorrow™.

Kingsley Wheaton
Chief Strategy & Growth Officer

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[1] Adjusting items, as identified in accordance with the Group's accounting policies, represent certain items of income and expense which the Group considers distinctive based on their size, nature or incidence.

[2] Diluted earnings per share before the impact of adjusting items and inorganic adjustments, presented at the prior year's rate of exchange. Reconciliation available at: https://www.bat.com/content/dam/batcom/global/main-nav/investors-and-reporting/reporting/combined-annual-and-esg-report/BAT_Annual_Report_Form_20-F_2023.pdf

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A Better Tomorrow™ for Shareholders (continued)

[4] To supplement the Group's results presented in accordance with International Financial Reporting Standards (IFRS), the Group's Management Board, as the chief operating decision maker, reviews certain of its results, including revenue and adjusted profit from operations, at constant rates of exchange, prior to the impact of businesses sold or held-for-sale. Although the Group does not believe that these measures are a substitute for IFRS measures, the Group does believe that such results excluding the impact of businesses sold or to be held-for-sale provide additional useful information to investors regarding the underlying performance of the business on a comparable basis and in the case of the divestment of the Group's businesses in Russia and Belarus, the impact these businesses had on revenue and profit from operations. Accordingly, the organic financial measures appearing in this document should be read in conjunction with the Group's results as reported under IFRS. The exits referred to in respect of other markets, including in Africa, are not deemed significant to the users' understanding.

[5] Net cash generated from operating activities before the impact of adjusting items and dividends from associates and excluding taxes paid and net capital expenditure, as a proportion of adjusted profit from operations.

[6] Net debt excluding the impact of the revaluation of Reynolds American Inc. acquired debt arising as part of the purchase price allocation process, as a proportion of profit for the year (earnings) before net finance costs/income, taxation on ordinary activities, depreciation, amortisation, impairment costs, the Group's share of post-tax results of associates and joint ventures, translational foreign exchange and other adjusting items. Reconciliation available at: https://www.bat.com/content/dam/batcom/global/main-nav/investors-and-reporting/reporting/combined-annual-and-esg-report/BAT_Annual_Report_Form_20-F_2023.pdf

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Chapter 7: THR: Global Regulation
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Our Published Tobacco Harm Reduction Science

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Year	Title	Journal	Authors	DOI Link	Cross Category	Heated Products	Vapour	Modern Oral	Traditional Oral
2024	An exploratory, randomised, crossover study to investigate the effect of nicotine on cognitive function in healthy adult smokers who use an electronic cigarette after a period of smoking abstinence	Harm Reduction Journal	Green, H.J. et al.	10.1186/s12954-024-00993-0			✓		
2024	An in vitro toxicological assessment of two electronic cigarettes: e-liquid to aerosolisation	Current Research in Toxicology	Bishop, E. et al.	10.1016/j.crtox.2024.100150			✓		
2024	Applying new approach methodologies to assess next-generation tobacco and nicotine products	Frontiers in Toxicology	Thorne, D. et al.	10.3389/ftox.2024.1376118	✓	✓	✓	✓	✓
2024	Comparative toxicological assessment of cigarettes and new category products via an in vitro multiplex proteomics platform	Toxicology Reports	Tsolakos, N. et al.	10.1016/j.toxrep.2024.04.006	✓	✓	✓		
2024	Evaluation of cytotoxicity and oxidative stress of whole aerosol from Vuse Alto ends products	Toxics	Keyser, B.M. et al.	10.3390/toxics12020129			✓		
2024	In vitro toxicological evaluation of glo menthol and non-menthol heated tobacco products	Toxicology	Keyser, B.M. et al.	10.1016/j.tox.2024.153801		✓			
2024	In vitro permeation of nicotine and tobacco specific nitrosamines from smokeless tobacco product extracts in a 3D buccal tissue model	Toxicology Letters	Keyser, B.M. et al.	10.1016/j.toxlet.2023.12.013					✓
2024	Modelling the nicotine pharmacokinetic profile for e-cigarettes using real time monitoring of consumers' physiological measurements and mouth level exposure	BioData Mining	Prasad, K. et al.	10.1186/s13040-024-00375-z			✓		
2024	Multi-endpoint in vitro toxicological assessment of snus and tobacco-free nicotine pouch extracts	Mutation Research: Genetic Toxicology and Environmental Mutagenesis	Yu, F. et al.	10.1016/j.mrgentox.2024.503738	✓			✓	✓
2024	Purchase intent and intended use of the glo heated tobacco product	American Journal of Health Behaviour	Curtin, G.M. et al.	10.5993/AJHB.48.2.10		✓			
2023	A contextualised e-cigarette testing strategy shows flavourings do not impact lung toxicity in vitro	Toxicology Letters	Bishop, E. et al.	10.1016/j.toxlet.2023.03.006			✓		
2023	Abuse liability of two electronic nicotine delivery systems compared with combustible cigarettes and nicotine gum from an open-label randomized crossover study	Randomized Controlled Trial	Campbell, C. et al.	10.1038/s41598-023-45894-7			✓		
2023	Advances in whole aerosol approaches for in vitro e-cigarette testing	Drug Testing and Analysis	Bishop, E. et al.	10.1002/dta.3471			✓		
2023	Assessing the impact of protonating acid combinations in e-cigarette liquids: a randomised, crossover study on nicotine pharmacokinetics	Scientific Reports	Frosina, J. et al.	10.1038/s41598-023-37539-6			✓		
2023	Assessment of biomarkers of exposure and potential harm, and physiological and subjective health measures in exclusive users of nicotine pouches and current, former and never smokers	Biomarkers	Azzopardi, D. et al.	10.1080/1354750X.2022.2148747				✓	
2023	Biomarkers of exposure and potential harm in exclusive users of electronic cigarettes and current, former, and never smokers	Internal and Emergency Medicine	Haswell, L.E. et al.	10.1007/s11739-023-03294-9			✓		
2023	Changes in biomarkers of exposure and potential harm in smokers switched to Vuse Vibe or Vuse Ciro electronic nicotine delivery systems	Toxics	Kanobe, M.N. et al.	10.3390/toxics11070564			✓		

Year	Title	Journal	Authors	DOI Link	Cross Category	Heated Products	Vapour	Modern Oral	Traditional Oral
2023	Comparative study of the effects of cigarette smoke versus next-generation tobacco and nicotine product extracts on inflammatory biomarkers of human monocytes	Pflügers Archiv: European Journal of Physiology	Giebe, S. et al.	10.1007/s00424-023-02809-9	✓	✓	✓		
2023	Identification and quantitation of nicotine polacrilex in nicotine pouches and other oral nicotine delivery products	Contributions to Tobacco & Nicotine Research	Moldoveanu, S.C.	10.2478/cttr-2023-0006				✓	
2023	Key challenges and recommendations for in vitro testing of tobacco products for regulatory applications: consideration of test materials and exposure parameters	Alternatives to Laboratory Animals	Moore, M.M. et al.	10.1177/02611929221146536	✓	✓	✓		
2023	Key challenges for in vitro testing of tobacco products for regulatory applications: Recommendations for the in vitro Mouse Lymphoma Assay	Alternatives to Laboratory Animals	Crooks, I. et al.	10.1177/02611929231219153	✓	✓	✓		
2023	Part two: an unblinded, parallel, randomized study to assess nicotine pharmacokinetics of four Vuse Solo ENDS flavors in smokers	Scientific Reports	Keyser, B.M. et al.	10.1038/s41598-023-35439-3			✓		
2023	Partial vapor pressures, activity coefficients, henry volatility, and infinite dilution activity coefficients of nicotine from binary mixtures with glycerol and with 1,2-propanediol at 298.15 k	ACS Omega	St Charles, F.K. and Moldoveanu, S.C.	10.1021/acsomega.2c07421			✓		
2023	Plasma nicotine pharmacokinetics of oral nicotine pouches across varying flavours and nicotine content*	Contributions to Tobacco & Nicotine Research	McEwan, M. et al.	10.2478/cttr-2023-0016				✓	
2023	Purchase intent and appeal of ends products among current, former and never ever users of tobacco products in the U.S.	Contributions to Tobacco & Nicotine Research	Frost-Pineda, K. et al.	10.2478/cttr-2023-0005			✓		
2023	Purchase intent and product appeal of Velo nicotine pouches among current tobacco users and nonusers of tobacco	Contributions to Tobacco & Nicotine Research	Freeland, R.E. et al.	10.2478/cttr-2023-0009				✓	
2023	Rapid determination of levels of the main constituents in e-liquids by near infrared spectroscopy	Scientific Reports	Hoffmann, A.R.F. et al.	10.1038/s41598-023-40422-z			✓		
2023	Study title: A systematic review of RCTs to examine the risk of adverse cardiovascular events with nicotine use	Frontiers In Cardiovascular Medicine	Kim, M.M. et al.	10.3389/fcvm.2023.1111673				✓	
2023	Two techniques for the analysis of WS-3 with potential application to the analysis of other cooling agents	Contributions to Tobacco & Nicotine Research	Moldoveanu, S.C. and Bussey, R.O.	10.2478/cttr-2023-0004				✓	
2023	Using a novel connected device for the collection of puffing topography data for the Vuse Solo electronic nicotine delivery system in a real-world setting: prospective ambulatory clinical study	JMIR Formative Research	Underly, R. et al.	10.2196/49876			✓		
2022	A 3D in vitro comparison of two undiluted e-cigarette aerosol generating systems	Toxicology Letters	Bishop, E. et al.	10.1016/j.toxlet.2022.01.002			✓		

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Year	Title	Journal	Authors	DOI Link	Cross Category	Heated Products	Vapour	Modern Oral	Traditional Oral
2022	A novel clinical method to measure skin staining reveals activation of skin damage pathways by cigarette smoke	Skin Research and Technology	Dalrymple, A. et al.	10.1111/srt.13108	✓	✓	✓		
2022	A randomised study to assess the nicotine pharmacokinetics of an oral nicotine pouch and two nicotine replacement therapy products	Scientific Reports	Azzopardi, D. et al.	10.1038/s41598-022-10544-x				✓	
2022	A randomised study to investigate the nicotine pharmacokinetics of oral nicotine pouches and a combustible cigarette	European Journal of Drug Metabolism and Pharmacokinetics	McEwan, M. et al.	10.1007/s13318-021-00742-9				✓	
2022	A systematic review and meta-analysis of the association between e-cigarette use among cigarette smokers and quit attempts made to abstain from cigarette smoking	American Journal of Health Behavior	Kim, M.M. et al.	10.5993/AJHB.46.4.2			✓		
2022	Actual use puffing topography and mouth level exposure to aerosol and nicotine for an evolving series of electronic nicotine delivery system	International Journal of Scientific Reports	Prasad, K. et al.	10.18203/issn.2454-2156.IntJSciRep20223033			✓		
2022	An abuse liability assessment of the glo tobacco heating product in comparison to combustible cigarettes and nicotine replacement therapy	Scientific Reports	Hardie, G. et al.	10.1038/s41598-022-19167-8		✓			
2022	An experimental analytical and in vitro approach to bridging between different heated tobacco product variants	Contributions to Tobacco & Nicotine Research	Jaunky, T. et al.	10.2478/cttr-2022-0001		✓			
2022	An exploratory, randomised, crossover study to investigate the effect of nicotine on cognitive function in healthy adult smokers who use an electronic cigarette, after a period of smoking abstinence: study protocol	International Journal of Clinical Trials	Green, H.J. et al.	10.18203/2349-3259.ijct20221114			✓		
2022	Application of ToxTracker for the toxicological assessment of tobacco and nicotine delivery products	Toxicology Letters	Smart, D. E. et al.	10.1016/j.toxlet.2022.01.005	✓	✓	✓		
2022	Assessing consumer use and behaviour patterns of oral nicotine pouches in a multi-country study	International Journal of Scientific Reports	Prasad, K. et al.	10.18203/issn.2454-2156.IntJSciRep20221344				✓	
2022	Biomarkers of exposure and potential harm in exclusive users of electronic cigarettes and current, former and never-smokers: a cross-sectional study protocol	Journal of Health and Environmental Research	Gale, N. et al.	10.11648/j.jher.20220802.17			✓		
2022	Biomarkers of exposure and potential harm in exclusive users of nicotine pouches and current, former, and never smokers: protocol for a cross-sectional clinical study	JMIR Research Protocols	Azzopardi, D. et al.	10.2196/39785				✓	
2022	Bridging: accelerating regulatory acceptance of reduced-risk tobacco and nicotine products	Nicotine & Tobacco Research	Gaca, M. et al.	10.1093/ntr/ntac041	✓	✓	✓	✓	
2022	Changes in biomarkers of exposure and biomarkers of potential harm after 360 days in smokers who either continue to smoke, switch to a tobacco heating product or quit smoking	Internal and Emergency Medicine	Gale, N. et al.	10.1007/s11739-022-03062-1		✓			
2022	Characterization of aerosol deliveries from combustible cigarettes, heated tobacco products, and electronic nicotine delivery systems using the Vitrocell Ames 48	Applied in Vitro Toxicology	Keyser, B.M. et al.	10.1089/aivt.2022.0001	✓	✓	✓		
2022	Characterization of smoke and aerosol deliveries from combustible cigarettes, heated tobacco products and electronic nicotine delivery systems in the Vitrocell® Mammalian 6/48 exposure module	Toxicology Reports	Keyser, B.M. et al.	10.1016/j.toxrep.2022.11.001	✓	✓	✓		
2022	Chemical characterisation of the vapour emitted by an e-cigarette using a ceramic wick-based technology	Scientific Reports	Pinto, M.I. et al.	10.1038/s41598-022-19761-w			✓		
2022	Chemical characterization of tobacco-free "modern" oral nicotine pouches and their position on the toxicant and risk continuums	Drug and Chemical Toxicology	Azzopardi, D. et al.	10.1080/01480545.2021.1925691				✓	
2022	Cytotoxicity, oxidative stress, and inflammatory response of smokeless tobacco extracts and cytotoxicity of combustible cigarette whole smoke in a 3D oral organotypic buccal cell model	Toxicology Mechanisms and Methods	Keyser, B.M.	10.1080/15376516.2021.2009949					✓
2022	Designing studies to inform tobacco harm reduction: learnings from an oral nicotine pouch actual use pilot study	JMIR Formative Research	Campbell, C. et al.	10.2196/37573				✓	
2022	Differential gene expression of 3D primary human airway cultures exposed to cigarette smoke and Electronic Nicotine Delivery System (ENDS) preparations	BMC Medical Genomics	Rayner, R.E.	10.1186/s12920-022-01215-x			✓		
2022	Emissions, puffing topography, mouth level exposure and consumption among Japanese users of tobacco heated products	International Journal of Scientific Reports	Prasad, K. et al.	10.18203/issn.2454-2156.IntJSciRep20222694		✓			
2022	Evaluation of behavioural, chemical, toxicological and clinical studies of a tobacco heated product glo™ and the potential for bridging from a foundational dataset to new product iterations.	Toxicology Reports	Goodall, S. et al.	10.1016/j.toxrep.2022.06.014		✓			
2022	Human abuse liability assessment of tobacco and nicotine products: approaches for meeting current regulatory recommendations	Nicotine & Tobacco Research	Vansickel, A. et al.	10.1093/ntr/ntab183	✓	✓	✓	✓	✓
2022	Interconversion of nicotine enantiomers during heating and implications for smoke from combustible cigarettes, heated tobacco products, and electronic cigarettes	Chirality	Moldoveanu, S.C.	10.1002/chir.23421	✓	✓	✓		

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Year	Title	Journal	Authors	DOI Link	Cross Category	Heated Products	Vapour	Modern Oral	Traditional Oral
2022	Key challenges for in vitro testing of tobacco products for regulatory applications: recommendations for dosimetry	Drug Testing and Analysis	Miller-Holt, J. et al.	10.1002/dta.3344	✓	✓	✓		
2022	Part one: abuse liability of Vuse Solo (G2) electronic nicotine delivery system relative to combustible cigarettes and nicotine gum	Scientific Reports	Campbell, C. et al.	10.1038/s41598-022-26417-2			✓		
2022	Part three: a randomized study to assess biomarker changes in cigarette smokers switched to Vuse Solo or abstinence	Scientific Reports	Kanobe, M.N. et al.	10.1038/s41598-022-25054-z			✓		
2022	Pilot study to determine differences in breath odour between cigarette and e-cigarette consumers	Scientific Reports	Dalrymple, A. et al.	10.1038/s41598-022-06047-4			✓		
2022	Puffing topography and mouth level exposure of two closed-system Vype e-cigarettes	International Journal of Scientific Reports	Prasad, K. et al.	10.18203/issn.2454-2156.IntJSciRep20221343			✓		
2022	Transcriptomic response of primary Human Bronchial Cells to repeated exposures of cigarette and ENDS preparations	Cell Biochemistry and Biophysics	Rayner, R.E. et al.	10.1007/s12013-021-01042-4			✓		
2021	A laboratory method to measure skin surface staining by cigarette smoke, tobacco heating products and e-cigarettes	Contributions to Tobacco & Nicotine Research	Dalrymple A. et al.	10.2478/cttr-2021-0013	✓	✓	✓		
2021	A randomized controlled study in healthy participants to explore the exposure continuum when smokers switch to a tobacco heating product or an e-cigarette relative to cessation	Toxicology Reports	McEwan, M. et al.	10.1016/j.toxrep.2021.05.003	✓	✓	✓		
2021	A screening approach for the evaluation of tobacco-free 'modern oral' nicotine products using Real Time Cell Analysis	Toxicology Reports	East, N. et al.	10.1016/j.toxrep.2021.02.014				✓	
2021	A single-center evaluation of environmental emissions from ENDS and combustible cigarettes	Contributions to Tobacco & Nicotine Research	Caraway, J. W.	10.2478/cttr-2021-0002			✓		
2021	Application of text mining to develop AOP-based mucus hypersecretion genesets and confirmation with in vitro and clinical samples	Scientific Reports	Minet, E. et al.	10.1038/s41598-021-85345-9			✓		
2021	Changes in biomarkers after 180 days of tobacco heating product use: a randomised trial	Internal and Emergency Medicine	Gale N. et al.	10.1007/s11739-021-02798-6		✓			
2021	Changes in biomarkers of exposure on switching from a conventional cigarette to the glo tobacco heating product: a randomized, controlled ambulatory study	Nicotine & Tobacco Research	Gale N. et al.	10.1093/ntr/ntaa135		✓			
2021	Cigarette smoke preparations, not electronic nicotine delivery system preparations, induce features of lung disease in a 3D lung repeat-dose model	American Journal of Physiology-Lung Cellular and Molecular Physiology	Rayner, R.E. et al.	10.1152/ajplung.00452.2020			✓		
2021	Comparative study of the effects of cigarette smoke versus next generation tobacco and nicotine product extracts on endothelial function	Redox Biology	Giebe, S. et al.	10.1016/j.redox.2021.102150	✓	✓	✓		

Year	Title	Journal	Authors	DOI Link	Cross Category	Heated Products	Vapour	Modern Oral	Traditional Oral
2021	Cross-sectional survey to assess tobacco and nicotine product use since the introduction of tobacco heating products in Japan: Wave 1	Tobacco Regulatory Science	Jones, J.D. et al.	10.18001/trs.7.3.6		✓			
2021	Diacetyl and other ketones in e-cigarette aerosols: some important sources and contributing factors	Frontiers in Chemistry	McEwan, M. et al.	10.3389/fchem.2021.742538			✓		
2021	Differences in biomarkers of inflammation and immune responses in chronic smokers and moist snuff users	Cytokine	Tran, Q.T. et al.	10.1016/j.cyto.2020.155299					✓
2021	Enamel staining with e-cigarettes, tobacco heating products and modern oral nicotine products compared with cigarettes and Snus: an in vitro study	American Journal of Dentistry	Dalrymple, A. et al.	Vol. 34, No. 1, Pages 3-9	✓	✓	✓	✓	✓
2021	Estimating the population health impact of recently introduced modified risk tobacco products: a comparison of different approaches	Nicotine & Tobacco Research	Lee, P.N. et al.	10.1093/ntr/ntaa102	✓	✓	✓		✓
2021	Evidence from the scientific assessment of electronic cigarettes and their role in tobacco harm reduction	Contributions to Tobacco & Nicotine Research	Camacho, O.M. et al.	10.2478/cttr-2021-0007			✓		
2021	Impact of cigarette versus electronic cigarette aerosol conditioned media on aortic endothelial cells in a microfluidic cardiovascular model	Scientific Reports	Makwana, O. et al.	10.1038/s41598-021-83511-7			✓		
2021	Investigating the health effects of 3 coexisting tobacco-related products using System Dynamics Population Modeling: an Italian population case study	Frontiers in Public Health	Camacho, O.M. et al.	10.3389/fpubh.2021.700473	✓	✓	✓		
2021	Metabolomic analysis identified reduced levels of xenobiotics, oxidative stress, and improved vitamin metabolism in smokers switched to Vuse Electronic Nicotine Delivery System	Nicotine & Tobacco Research	Liu, G. et al.	10.1093/ntr/ntaa225			✓		
2021	Modeled respiratory tract deposition of smoke aerosol from conventional cigarettes, electronic cigarettes and heat-not-burn products	Aerosol and Air Quality Research	Li, Y.W. et al.	10.4209/aaqr.200241	✓	✓	✓		
2021	Modeling the population health impacts of heated tobacco products in Japan	Tobacco Regulatory Science	Camacho, O.M. et al.	10.18001/trs.7.3.7		✓			
2021	Reporting and methodological quality of systematic literature reviews evaluating the associations between e-cigarette use and cigarette smoking behaviors: a systematic quality review	Harm Reduction Journal	Kim, M.M. et al.	10.1186/s12954-021-00570-9			✓		
2021	The chemical complexity of e-cigarette aerosols compared with the smoke from a tobacco burning cigarette	Frontiers in Chemistry	Margham J. et al.	10.3389/fchem.2021.743060			✓		
2021	The development of an in vitro 3D model of goblet cell hyperplasia using MUC5AC expression and repeated whole aerosol exposures	Toxicology Letters	Haswell, L.E. et al.	10.1016/j.toxlet.2021.04.012		✓			

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Year	Title	Journal	Authors	DOI Link	Cross Category	Heated Products	Vapour	Modern Oral	Traditional Oral
2020	A combined study of headspace volatiles using human sensory, mass spectrometry and chemometrics	Scientific Reports	McAdam, K.G. et al.	10.1038/s41598-020-64491-6					✓
2020	A cross-category puffing topography, mouth level exposure and consumption study among Italian users of tobacco and nicotine products	Scientific Reports	Jones, J. et al.	10.1038/s41598-019-55410-5	✓	✓	✓		
2020	A randomised controlled single-centre open-label pharmacokinetic study to examine various approaches of nicotine delivery using electronic cigarettes	Scientific Reports	Ebajemito, J. K. et al.	10.1038/s41598-020-76610-4			✓		
2020	An approach for the extract generation and toxicological assessment of tobacco-free 'modern' oral nicotine pouches	Food and Chemical Toxicology	Bishop, E. et al.	10.1016/j.fct.2020.111713				✓	
2020	Comprehensive chemical characterization of the aerosol emissions of a vaping product based on a new technology	Chemical Research in Toxicology	Nicol, J. et al.	10.1021/acs.chemrestox.9b00442			✓		
2020	Dependence on e-cigarettes and cigarettes in a cross-sectional study of US adults	Addiction	Shiffman, S. and Sembower, M.A.	10.1111/add.15060			✓		
2020	Development of a novel method to measure material surface staining by cigarette, e-cigarette or tobacco heating product aerosols	Heliyon	Dalrymple, A. et al.	10.1016/j.heliyon.2020.e05012	✓	✓	✓		
2020	Evaluation of a high-throughput in vitro endothelial cell migration assay for the assessment of nicotine and tobacco delivery products	Toxicology Letters	Bishop, E. et al.	10.1016/j.toxlet.2020.07.011		✓			
2020	GC x GC-TOFMS and chemometrics approach for comparative study of volatile compound release by tobacco heating system as a function of temperature	Microchemical Journal	Schwanz, T.G. et al.	10.1016/j.microc.2020.105578		✓			
2020	Optimization of aqueous aerosol extract (AqE) generation from e-cigarettes and tobacco heating products for in vitro cytotoxicity testing	Toxicology Letters	Bozhilova, S. et al.	10.1016/j.toxlet.2020.10.005	✓	✓	✓		
2020	Results from a 2018 cross-sectional survey in Tokyo, Osaka and Sendai to assess tobacco and nicotine product usage after the introduction of heated tobacco products (HTPs) in Japan	Harm Reduction Journal	Adamson, J. et al.	10.1186/s12954-020-00374-3		✓			
2020	Statistical analysis plan for "A randomised, controlled study to evaluate the effects of switching from cigarette smoking to using a tobacco heating product on health effect indicators in healthy subjects"	Contemporary Clinical Trials Communications	Camacho, O.M. et al.	10.1016/j.conctc.2020.100535		✓			
2020	The evolving e-cigarette: comparative chemical analyses of e-cigarette vapor and cigarette smoke	Frontiers in Toxicology	Cunningham, A. et al.	10.3389/ftox.2020.586674			✓		
2020	The genotoxicological assessment of a tobacco heating product relative to cigarette smoke using the in vitro micronucleus assay	Toxicology Reports	Thorne, D. et al.	10.1016/j.toxrep.2020.08.013		✓			

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2020	The in vitro assessment of a novel vaping technology	Toxicology Reports	Breheny, D. et al.	10.1016/j.toxrep.2020.08.016			✓		
2020	Extraction of benzo[a] pyrene from moist snuff with water or artificial saliva (part 2)	Beitrage zur Tabakforschung International/ Contributions to Tobacco Research	Moldoveanu, S.C. and Harrison, A.	10.2478/cttr-2020-0003					✓
2019	Acetoin is a precursor to diacetyl in e-cigarette liquids	Food and Chemical Toxicology	Vas, C.A. et al.	10.1016/j.fct.2019.110727			✓		
2019	An approach to testing undiluted e-cigarette aerosol in vitro using 3D reconstituted human airway epithelium	Toxicology in Vitro	Bishop, E. et al.	10.1016/j.tiv.2018.01.010			✓		
2019	An inter-laboratory in vitro assessment of cigarettes and next generation nicotine delivery products	Toxicology Letters	Ito, S. et al.	10.1016/j.toxlet.2019.08.004	✓	✓	✓		
2019	Biomarkers of tobacco exposure decrease after smokers switch to an e-cigarette or nicotine gum	Nicotine & Tobacco Research	Round, E.K. et al.	10.1093/ntr/nty140			✓		
2019	Changes in biomarkers of exposure on switching from a conventional cigarette to tobacco heating products: a randomized, controlled study in healthy Japanese subjects	Nicotine & Tobacco Research	Gale, N. et al.	10.1093/ntr/nty104		✓			
2019	Cigarette and ENDS preparations differentially regulate ion channels and mucociliary clearance in primary normal human bronchial 3D cultures	American Journal of Physiology-Lung Cellular and Molecular Physiology	Rayner, R.E. et al.	10.1152/ajplung.00096.2019			✓		
2019	Cigarette smoke preparations, not moist snuff, impair expression of genes involved in immune signaling and cytolytic functions	Scientific Reports	Liu, G. et al.	10.1038/s41598-019-48822-w					✓
2019	Combustible cigarette and smokeless tobacco product preparations differentially regulate intracellular calcium mobilization in HL60 Cells	Inflammation	Arimilli, S. et al.	10.1007/s10753-019-01025-x					✓
2019	Distinct gene expression changes in human peripheral blood mononuclear cells treated with different tobacco product preparations	Toxicology in Vitro	Arimilli, S. et al.	10.1016/j.tiv.2019.02.012					✓
2019	Evaluating the effects of switching from cigarette smoking to using a heated tobacco product on health effect indicators in healthy subjects: study protocol for a randomized controlled trial	Internal and Emergency Medicine	Newland, N. et al.	10.1007/s11739-019-02090-8		✓			
2019	Extraction from moist snuff with artificial saliva of benzo[a]pyrene and other polycyclic aromatic hydrocarbons	Beiträge zur Tabakforschung International/ Contributions to Tobacco Research	Moldoveanu, S.C. et al.	10.2478/cttr-2019-0002					✓
2019	Genotoxicity evaluation of tobacco and nicotine delivery products: Part One. Mouse lymphoma assay	Food and Chemical Toxicology	Thorne, D. et al.	10.1016/j.fct.2019.110584	✓	✓	✓		
2019	Genotoxicity evaluation of tobacco and nicotine delivery products: Part Two. In vitro micronucleus assay	Food and Chemical Toxicology	Thorne, D. et al.	10.1016/j.fct.2019.05.054	✓	✓	✓		
2019	Global gene expression profiles from PBMCs treated with reference tobacco product preparations	Data In Brief	Arimilli, S. et al.	10.1016/j.dib.2019.103970					✓

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2019	In vitro mutagenicity of gas-vapour phase extracts from flavoured and unflavoured heated tobacco products	Toxicology Reports	Le Godec, T. et al.	10.1016/j.toxrep.2019.10.007		✓			
2019	Influence of machine-based puffing parameters on aerosol and smoke emissions from next generation nicotine inhalation products	Regulatory Toxicology and Pharmacology	McAdam, K. et al.	10.1016/j.yrtph.2018.11.006	✓	✓	✓		
2019	Non-targeted analysis of the particulate phase of heated tobacco product aerosol and cigarette mainstream tobacco smoke by thermal desorption comprehensive two-dimensional gas chromatography with dual flame ionisation and mass spectrometric detection	Journal of Chromatography A	Savareear, B. et al.	10.1016/j.chroma.2019.06.057		✓			
2019	Randomized trial to compare smoking cessation rates of snus, with and without smokeless tobacco health-related information, and a nicotine lozenge	Nicotine & Tobacco Research	Nelson, P.R. et al.	10.1093/ntr/nty011					✓
2019	The composition of contemporary American and Swedish smokeless tobacco products	BMC Chemistry	McAdam, K.G. et al.	10.1186/s13065-019-0548-0					✓
2019	Urinary leukotriene E4 and 2, 3-dinor thromboxane B2 are biomarkers of potential harm in short-term tobacco switching studies	Cancer Epidemiology, Biomarkers & Prevention	Makena, P. et al.	10.1158/1055-9965.EPI-19-0342	✓		✓		✓
2019	Use of social media to establish vapers puffing behaviour: findings and implications for laboratory evaluation of e-cigarette emissions	Regulatory Toxicology and Pharmacology	McAdam, K. et al.	10.1016/j.yrtph.2019.104423			✓		
2018	A review of electronic cigarette use behaviour studies	Contributions to Tobacco & Nicotine Research	Cahours, X. and Prasad, K.	10.2478/cttr-2018-0009			✓		
2018	Accurate measurement of main aerosol constituents from heated tobacco products (HTPs): implications for a fundamentally different aerosol	Regulatory Toxicology and Pharmacology	Gasparyan, H. et al.	10.1016/j.yrtph.2018.09.016		✓			
2018	An LC-MS method for the analysis of some organic acids in tobacco leaf, snus, and wet snuff	Beiträge zur Tabakforschung International/ Contributions to Tobacco Research	Moldoveanu, S.C. et al.	10.2478/cttr-2018-0004					✓
2018	Analysis of coumarin and angelica lactones in smokeless tobacco products	Chemistry Central Journal	McAdam, K. et al.	10.1186/s13065-018-0506-2					✓
2018	Assessing the likelihood and magnitude of a population health benefit following the market introduction of a modified-risk tobacco product: enhancements to the dynamic population modeler, DPM(+1)	Risk Analysis	Bachand, A.M. et al.	10.1111/risa.12819	✓	✓	✓	✓	✓
2018	Assessment of enamel discoloration in vitro following exposure to cigarette smoke and emissions from novel vapor and tobacco heating products	American Journal of Dentistry	Dalrymple, A. et al.	Vol. 31, No. 5, Pages 227-233	✓	✓	✓		
2018	Assessment of novel tobacco heating product THP1.0. Part 3: Comprehensive chemical characterisation of harmful and potentially harmful aerosol emissions	Regulatory Toxicology and Pharmacology	Forster, M. et al.	10.1016/j.yrtph.2017.10.006		✓			

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2018	Assessment of novel tobacco heating product THP1.0. Part 6: A comparative in vitro study using contemporary screening approaches	Regulatory Toxicology and Pharmacology	Taylor, M. et al.	10.1016/j.yrtph.2017.08.016		✓			
2018	Assessment of novel tobacco heating product THP1.0. Part 7: Comparative in vitro toxicological evaluation	Regulatory Toxicology and Pharmacology	Thorne, D. et al.	10.1016/j.yrtph.2017.08.017		✓			
2018	Assessment of the abuse liability of three menthol Vuse Solo electronic cigarettes relative to combustible cigarettes and nicotine gum	Psychopharmacology	Stiles, M.F. et al.	10.1007/s00213-018-4904-x			✓		
2018	Assessment of tobacco heating product THP1.0. Part 1: Series introduction	Regulatory Toxicology and Pharmacology	Proctor, C.	10.1016/j.yrtph.2017.09.010		✓			
2018	Assessment of tobacco heating product THP1.0. Part 2: Product design, operation and thermophysical characterisation	Regulatory Toxicology and Pharmacology	Eaton, D. et al.	10.1016/j.yrtph.2017.09.009		✓			
2018	Assessment of tobacco heating product THP1.0. Part 4: Characterisation of indoor air quality and odour	Regulatory Toxicology and Pharmacology	Forster, M. et al.	10.1016/j.yrtph.2017.09.017		✓			
2018	Assessment of tobacco heating product THP1.0. Part 5: In vitro dosimetric and cytotoxic assessment	Regulatory Toxicology and Pharmacology	Jaunky, T. et al.	10.1016/j.yrtph.2017.09.016		✓			
2018	Assessment of tobacco heating product THP1.0. Part 8: Study to determine puffing topography, mouth level exposure and consumption among Japanese users	Regulatory Toxicology and Pharmacology	Gee, J. et al.	10.1016/j.yrtph.2017.08.005		✓			
2018	Assessment of tobacco heating product THP1.0. Part 9: The placement of a range of next-generation products on an emissions continuum relative to cigarettes via pre-clinical assessment studies	Regulatory Toxicology and Pharmacology	Murphy, J. et al.	10.1016/j.yrtph.2017.10.001		✓			
2018	Characterisation of the borgwaldt LM4E system for in vitro exposures to undiluted aerosols from next generation tobacco and nicotine products (NGPs)	Food and Chemical Toxicology	Adamson, J. et al.	10.1016/j.fct.2018.02.005	✓	✓	✓		
2018	Characterization of a Vitrocell VC1 using nicotine dosimetry: An essential component toward standardized in vitro aerosol exposure of tobacco and next generation nicotine delivery products	Applied In Vitro Toxicology	Behrsing, H. et al.	10.1089/aivt.2018.0001	✓	✓	✓		
2018	Comprehensive comparative compositional study of the vapour phase of cigarette mainstream tobacco smoke and tobacco heating product aerosol	Journal of Chromatography A	Savareear, B. et al.	10.1016/j.chroma.2018.10.035		✓			
2018	Critical evaluation of several techniques for the analysis of phthalates and terephthalates: application to liquids used in electronic cigarettes	Journal of Chromatography A	Moldoveanu, S. C. and Yerabolu, R.	10.1016/j.chroma.2018.02.001			✓		
2018	Development, qualification, validation and application of the Ames test using a VITROCELL® VC10® smoke exposure system	Toxicology Reports	Fowler, K. et al.	10.1016/j.toxrep.2018.04.003		✓			

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2018	Ethyl carbamate in Swedish and American smokeless tobacco products and some factors affecting its concentration	Chemistry Central Journal	McAdam, K. et al.	10.1186/s13065-018-0454-x					✓
2018	Evaluation of flavourings potentially used in a heated tobacco product: chemical analysis, in vitro mutagenicity, genotoxicity, cytotoxicity and in vitro tumour promoting activity	Food and Chemical Toxicology	Crooks, I. et al.	10.1016/j.fct.2018.05.058		✓			
2018	Extreme testing of undiluted e-cigarette aerosol in vitro using an Ames air-agar-interface technique	Mutation Research-Genetic Toxicology and Environmental Mutagenesis	Thorne, D. et al.	10.1016/j.mrgentox.2018.01.008			✓		
2018	Global methylation profiles in buccal cells of long-term smokers and moist snuff consumers	Biomarkers	Jessen, W.J. et al.	10.1080/1354750X.2018.1466367					✓
2018	*In vitro* RNA-seq-based toxicogenomics assessment shows reduced biological effect of tobacco heating products when compared to cigarette smoke	Scientific Reports	Haswell, L.E. et al.	10.1038/s41598-018-19627-0		✓			
2018	Inflammatory profile analysis reveals differences in cytokine expression between smokers, moist snuff users, and dual users compared to non tobacco consumers	Cytokine	Sgambato, J.A. et al.	10.1016/j.cyto.2017.11.013					✓
2018	Next-generation tobacco and nicotine products: substantiating harm reduction and supporting tobacco regulatory science	Toxicology Research and Application	Peitsch, M.C. et al.	10.1177/2397847318773701	✓	✓	✓	✓	✓
2018	Nicotine pharmacokinetics of electronic cigarettes: a review of the literature	Regulatory Toxicology and Pharmacology	Fearon, I.M. et al.	10.1016/j.yrtph.2018.09.004			✓		
2018	Thermo-oxidative degradation of aromatic flavour compounds under simulated tobacco heating product condition	Journal of Analytical and Applied Pyrolysis	Blazso, M. et al.	10.1016/j.jaap.2018.07.007		✓			
2017	A comparative assessment of e-cigarette aerosols and cigarette smoke on in vitro endothelial cell migration	Toxicology Letters	Taylor, M. et al.	10.1016/j.toxlet.2017.06.001			✓		
2017	A mini-literature review on the science of tobacco heating product THP1.0	Tobacco Science & Technology	Thorne, D. et al.	10.16135/j.issn1002-0861.2017.0565		✓			
2017	A novel hybrid tobacco product that delivers a tobacco flavour note with vapour aerosol (Part 1): Product operation and preliminary aerosol chemistry assessment	Food and Chemical Toxicology	Poynton, S. et al.	10.1016/j.fct.2017.05.022			✓		
2017	A novel hybrid tobacco product that delivers a tobacco flavour note with vapour aerosol (Part 2): In vitro biological assessment and comparison with different tobacco-heating products	Food and Chemical Toxicology	Breheny, D. et al.	10.1016/j.fct.2017.05.023	✓	✓	✓		
2017	A pharmacokinetic study to examine nicotine delivery from e cigarettes and a conventional cigarette in healthy subjects during a brief period of ad libitum use	International Journal of Clinical Trials	Fearon, I.M. et al.	10.18203/2349-3259.ijct20174860			✓		
2017	A randomised, controlled, two-Centre open-label study in healthy Japanese subjects to evaluate the effect on biomarkers of exposure of switching from a conventional cigarette to a tobacco heating product	BMC Public Health	Gale, N. et al.	10.1186/s12889-017-4678-9		✓			
2017	A system dynamics modelling approach to assess the impact of launching a new nicotine product on population health outcomes	Regulatory Toxicology and Pharmacology	Hill, A. and Camacho, O.M.	10.1016/j.yrtph.2017.03.012			✓		
2017	AKR1C1 as a biomarker for differentiating the biological effects of combustible from non-combustible tobacco products	Genes	Woo, S, et al.	10.3390/genes8050132					✓
2017	An approach to allergy risk assessments for e-liquid ingredients	Regulatory Toxicology and Pharmacology	Costigan, S. and Lopez-Belmonte, J.	10.1016/j.yrtph.2017.04.003			✓		
2017	Analysis of traces of tobacco-specific nitrosamines (TSNAs) in usp grade nicotine, e-liquids, and particulate phase generated by the electronic smoking devices	Beiträge zur Tabakforschung International Contributions to Tobacco Research	Moldoveanu, S.C. et al.	10.1515/cttr-2017-0009			✓		
2017	Application of *in vitro* toxicology approaches for the evaluation of next-generation nicotine products	Applied In Vitro Toxicology	Gaca, M. et al.	10.1089/aivt.2017.29010.mgc			✓		
2017	Assessing modified risk tobacco and nicotine products: Description of the scientific framework and assessment of a closed modular electronic cigarette	Regulatory Toxicology and Pharmacology	Murphy, J. et al.	10.1016/j.yrtph.2017.09.008			✓		
2017	Characterization and application of the VITROCELL VC1 Smoke Exposure System and 3D EpiAirway models for toxicological and e-cigarette evaluations	Applied in Vitro Toxicology	Fields, W. et al.	10.1089/aivt.2016.0035			✓		
2017	Chemical characterisation of aerosols emitted by electronic cigarettes using thermal desorption - gas chromatography - time of flight mass spectrometry	Journal of Chromatography A	Rawlinson, C. et al.	10.1016/j.chroma.2017.02.050			✓		
2017	Comparative Tumor Promotion Assessment of e-Cigarette and Cigarettes Using the In Vitro Bhas 42 Cell Transformation Assay	Environmental and Molecular Mutagenesis	Breheny, D. et al.	10.1002/em.22091			✓		
2017	Comprehensive survey of radionuclides in contemporary smokeless tobacco products	Chemistry Central Journal	McAdam, K. et al.	10.1186/s13065-017-0359-0					✓
2017	Differential gene expression using RNA sequencing profiling in a reconstituted airway epithelium exposed to conventional cigarette smoke or electronic cigarette aerosols	Applied in vitro toxicology	Banerjee, A. et al.	10.1089/aivt.2016.0024			✓		
2017	E-cigarette nicotine delivery: data and learnings from pharmacokinetic studies	American Journal of Health Behavior	Fearon, I.M. et al,	10.5993/AJHB.41.1.2			✓		
2017	Gene expression profiles associated with cigarette smoking and moist snuff consumption	BMC Genomics	Arimilli, S. et al.	10.1186/s12864-017-3565-1					✓

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2017	Headspace solid-phase microextraction coupled to comprehensive two-dimensional gas chromatography-time-of-flight mass spectrometry for the analysis of aerosol from tobacco heating product	Journal of Chromatography A	Savareear, B. et al.	10.1016/j.chroma.2017.09.014		✓			
2017	In vitro exposure systems and dosimetry assessment tools for inhaled tobacco products: workshop proceedings, conclusions and paths forward for in vitro model use	Atla-Alternatives to Laboratory Animals	Behrsing, H. et al.	10.1177/026119291704500305			✓		
2017	Nicotine quantification in vitro: a consistent dosimetry marker for e-cigarette aerosol and cigarette smoke generation	Applied In Vitro Toxicology	Adamson, J. et al.	10.1089/aivt.2016.0025			✓		
2017	Pharmacodynamic and pharmacokinetic assessment of electronic cigarettes, combustible cigarettes, and nicotine gum: implications for abuse liability	Psychopharmacology	Stiles, M.F. et al.	10.1007/s00213-017-4665-y			✓		
2017	Reduced biological effect of e-cigarette aerosol compared to cigarette smoke evaluated in vitro using normalized nicotine dose and RNA-seq-based toxicogenomics	Scientific Reports	Haswell, L.E. et al.	10.1038/s41598-017-00852-y			✓		
2017	The comparative in vitro assessment of e-cigarette and cigarette smoke aerosols using the gamma H2AX assay and applied dose measurements	Toxicology Letters	Thorne, D et al.	10.1016/j.toxlet.2016.12.006			✓		
2017	The determination of diacetyl and acetylpropionyl in aerosols from electronic smoking devices using gas chromatography triple quad mass spectrometry	Contributions to Tobacco & Nicotine Research	Moldoveanu, S.C. et al.	10.1515/cttr-2017-0015			✓		
2016	A cross-sectional study of biomarkers of exposure and effect in smokers and moist snuff consumers	Clinical Chemistry and Laboratory Medicine	Prasad, G.L. et al.	10.1515/cclm-2015-0594					✓
2016	Application of dosimetry tools for the assessment of e-cigarette aerosol and cigarette smoke generated on two different in vitro exposure systems	Chemistry Central Journal	Adamson, J. et al.	10.1186/s13065-016-0221-9			✓		
2016	Chemical Composition of Aerosol from an E-Cigarette: A Quantitative Comparison with Cigarette Smoke	Chemical Research in Toxicology	Margham, J. et al.	10.1021/acs.chemrestox.6b00188			✓		
2016	Development, validation and application of a device to measure e-cigarette users' puffing topography	Scientific Reports	Cunningham, A. et al.	10.1038/srep35071			✓		
2016	E-cigarette aerosols induce lower oxidative stress in vitro when compared to tobacco smoke	Toxicology mechanisms and methods	Taylor, M. et al.	10.1080/15376516.2016.1222473			✓		
2016	Electronic cigarette aerosol induces significantly less cytotoxicity than tobacco smoke	Toxicology mechanisms and methods	Azzopardi, D. et al.	10.1080/15376516.2016.1217112			✓		
2016	Simulation of aerosol dynamics and deposition of combustible and electronic cigarette aerosols in the human respiratory tract	Journal of Aerosol Science	Pichelstorfer, L. et al.	10.1016/j.jaerosci.2016.01.017			✓		
2016	The mutagenic assessment of an electronic-cigarette and reference cigarette smoke using the Ames assay in strains TA98 and TA100	Mutation Research-Genetic Toxicology and Environmental Mutagenesis	Thorne, D. et al.	10.1016/j.mrgentox.2016.10.005			✓		
2016	Thermal behaviour of selected flavour ingredients and additives under simulated cigarette combustion and tobacco heating conditions	Journal of Analytical and Applied Pyrolysis	Czégény, Z. et al.	10.1016/j.jaap.2016.07.020		✓			
2016	Thermodynamic and kinetic behavior of glycerol aerosol	Aerosol Science and Technology	Wright, T.P. et al.	10.1080/02786826.2016.1245405			✓		
2015	A validated method to measure benzo a pyrene concentrations in tobacco by high-performance liquid chromatography-fluorescence detection	Analytical Methods	Carradus, K.G. et al.	10.1039/C4AY02499K					✓
2015	An approach to ingredient screening and toxicological risk assessment of flavours in e-liquids	Regulatory Toxicology and Pharmacology	Costigan S. and Meredith C.	10.1016/j.yrtph.2015.05.018			✓		
2015	An experimental method to study emissions from heated tobacco between 100-200 degrees C	Chemistry Central Journal	Forster, M. et al.	10.1186/s13065-015-0096-1		✓			
2015	Analysis of hydrazine in smokeless tobacco products by gas chromatography-mass spectrometry	Chemistry Central Journal	McAdam, K., et al.	10.1186/s13065-015-0089-0					✓
2015	Changes in biomarkers of exposure and subjective effects when smokers switch to dual use of cigarettes and either snus or a dissolvable tobacco product: a summary of three clinical studies	Beitraege zur Tabakforschung International, Contributions to Tobacco Research	Round, E.K. et al.	10.1515/cttr-2015-0013					✓
2015	Consumption patterns and biomarkers of exposure in cigarette smokers switched to Snus, various dissolvable tobacco products, Dual use, or tobacco abstinence	Regulatory Toxicology and Pharmacology	Krautter, G.R. et al.	10.1016/j.yrtph.2014.12.016					✓
2015	Development of an in vitro cytotoxicity model for aerosol exposure using 3D reconstructed human airway tissue; application for assessment of e-cigarette aerosol	Toxicology in Vitro	Neilson, L. et al.	10.1016/j.tiv.2015.05.018			✓		
2015	Particle size distribution of e-cigarette aerosols and the relationship to Cambridge filter pad collection efficiency	Contributions to Tobacco & Nicotine Research	Alderman, S.L. et el.	10.1515/cttr-2015-0006			✓		
2015	Study of cardiovascular disease biomarkers among tobacco consumers, part 1: biomarkers of exposure	Inhalation Toxicology	Campbell, L.R. et al.	10.3109/08958378.2015.1013228					✓
2015	Study of cardiovascular disease biomarkers among tobacco consumers, part 2: biomarkers of biological effect	Inhalation Toxicology	Nordskog, B.K. et al	10.3109/08958378.2015.1013227					✓
2015	Study of cardiovascular disease biomarkers among tobacco consumers. Part 3: evaluation and comparison with the US National Health and Nutrition Examination Survey	Inhalation Toxicology	Marano, K.M. et al.	10.3109/08958378.2015.1009196					✓

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Year	Title	Journal	Authors	DOI Link	Cross Category	Heated Products	Vapour	Modern Oral	Traditional Oral
2015	Switching from usual brand cigarettes to a tobacco-heating cigarette or snus: Part 1. Study design and methodology	Biomarkers	Ogden, M.W. et al.	10.3109/1354750X.2015.1094133	✓	✓			✓
2015	Switching from usual brand cigarettes to a tobacco-heating cigarette or snus: Part 2. Biomarkers of exposure	Biomarkers	Ogden, M.W. et al.	10.3109/1354750X.2015.1094134	✓	✓			✓
2015	Switching from usual brand cigarettes to a tobacco-heating cigarette or snus: Part 3. Biomarkers of biological effect	Biomarkers	Ogden, M.W et al.	10.3109/1354750X.2015.1094135	✓	✓			✓
2015	The acrylamide content of smokeless tobacco products	Chemistry Central Journal	McAdam, K. et al.	10.1186/s13065-015-0132-1					✓
2015	Toxicological evaluation of smokeless tobacco: 2-year chronic toxicity and carcinogenicity feeding study in Wistar Han rats	Experimental and Toxicologic Pathology	Theophilus, E.H. et al.	10.1016/j.etp.2015.09.001					✓
2014	Combusted but not smokeless tobacco products cause DNA damage in oral cavity cells	Environmental Toxicology and Pharmacology	Gao H. et al.	10.1016/j.etap.2014.03.022					✓
2014	Comparison of consumption patterns, biomarkers of exposure, and subjective effects in cigarette smokers who switched to dissolvable tobacco (camel orbs), dual use, or tobacco abstinence	Nicotine & Tobacco Research	Krautter, G.R. and Borgerding, M. F.	10.1093/ntr/ntu082					✓
2014	Regulation of gene expression by tobacco product preparations in cultured human dermal fibroblasts	Toxicology and Applied Pharmacology	Malpass, G.E. et al.	10.1016/j.taap.2014.06.001					✓
2013	Assessment of mouth-level exposure to tobacco constituents in U.S. Snus consumers	Nicotine & Tobacco Research	Caraway, J.W. and Chen, P.X.	10.1093/ntr/nts187					✓
2013	Combustible and non-combustible tobacco product preparations differentially regulate human peripheral blood mononuclear cell functions	Toxicology in Vitro	Arimilli, S. et al.	10.1016/j.tiv.2013.06.015					✓
2013	Determination of nicotine absorption from multiple tobacco products and nicotine gum	Nicotine & Tobacco Research	Digard, H. et al.	10.1093/ntr/nts123					✓
2013	Differential cell-specific cytotoxic responses of oral cavity cells to tobacco preparations	Toxicology in Vitro	Gao H. et al.	10.1016/j.tiv.2012.07.015					✓
2013	Multi-analyte approach for determining the extraction of tobacco constituents from pouched snus by consumers during use	Chemistry Central Journal	Digard, H. et al.	10.1186/1752-153X-7-55					✓
2013	Polycyclic aromatic hydrocarbons in US and Swedish smokeless tobacco products	Chemistry Central Journal	McAdam, K.G. et al.	10.1186/1752-153X-7-151					✓
2013	Survey of GPs' understanding of tobacco and nicotine products	Drugs and Alcohol Today	Patwardhan, S.R. and Murphy, M.A.	10.1108/DAT-02-2013-0010	✓		✓		✓
2012	Electronic cigarette aerosol particle size distribution measurements	Inhalation Toxicology	Ingebrethsen, B.J. et al.	10.3109/08958378.2012.744781			✓		
2012	The chemical composition of smokeless tobacco: a survey of products sold in the United States in 2006 and 2007	Regulatory Toxicology and Pharmacology	Borgerding, M.F. et al.	10.1016/j.yrtph.2012.09.003					✓
2012	Toxicological evaluation of smokeless tobacco: 90-Day rodent feeding studies	Experimental and Toxicologic Pathology	Theophilus, E.H. et al.	10.1016/j.etp.2010.05.013					✓
2011	Acrylamide analysis in tobacco, alternative tobacco products, and cigarette smoke	Journal of Chromatographic Science	Moldoveanu S.C. and Gerardi A.R.	10.1093/chrsci/49.3.234					✓
2011	Differential exposure biomarker levels among cigarette smokers and smokeless tobacco consumers in the National Health and Nutrition Examination Survey 1999-2008	Biomarkers	Naufal, Z.S. et al.	10.3109/1354750X.2010.546013					✓
2009	Patterns and behaviors of snus consumption in Sweden	Nicotine & Tobacco Research	Digard, H. et al.	10.1093/ntr/ntp118					✓
2004	A comparison of in vitro toxicities of cigarette smoke condensate from Eclipse cigarettes and four commercially available ultra low-"tar" cigarettes	Food and Chemical Toxicology	Foy J.W.D. et al.	10.1016/j.fct.2003.08.020		✓			
2004	Comparative study of smoke condensates from 1R4F cigarettes that burn tobacco versus ECLIPSE cigarettes that primarily heat tobacco in the SENCAR mouse dermal tumor promotion assay	Food and Chemical Toxicology	Meckley, D.R. et al.	10.1016/j.fct.2004.01.009		✓			
2003	Quantification of continuous glass filaments on eclipse cigarettes retrieved from the test market	Inhalation Toxicology	Higuchi, M.A. et al.	10.1080/0895837039019772		✓			
2002	Relationship between FTC 'tar' and urine mutagenicity in smokers of tobacco-burning or Eclipse cigarettes	Mutation Research-Genetic Toxicology and Environmental Mutagenesis	Bowman, D.L. et al.	10.1016/s1383-5718(02)00219-x		✓			
2001	Subchronic inhalation by rats of mainstream smoke from a cigarette that primarily heats tobacco compared to a cigarette that burns tobacco	Inhalation Toxicology	Ayres, P.H. et al.	10.1080/089583701300001078		✓			
2001	The role of glutathione in the toxicity of smoke condensates from cigarettes that burn or heat tobacco	Free Radical Biology and Medicine	Waldren C.A. et al.	10.1016/s0891-5849(01)00549-4		✓			
2000	Quantitative analysis of potential transfer of continuous glass filament from eclipse prototype 9-014 cigarettes	Inhalation Toxicology	Higuchi, M.A. et al.	10.1080/08958370050164653		✓			
2000	Analysis of potential transfer of continuous glass filament from eclipse cigarettes	Inhalation Toxicology	Higuchi, M.A. et al.	10.1080/08958370050030985		✓			
2000	Gap junction intercellular communication and cytotoxicity in normal human cells after exposure to smoke condensates from cigarettes that burn or primarily heat tobacco	Toxicology in Vitro	McKarns, S.C. et al.	10.1016/s0887-2333(99)00081-8		✓			
2000	Safety assessment of continuous glass filaments used in eclipse	Inhalation Toxicology	Swauger J.E. and Foy J.W.D.	10.1080/08958370050164662		✓			
1998	Comparative studies of the mutagenicity of environmental tobacco smoke from cigarettes that burn or primarily heat tobacco	Environmental and Molecular Mutagenesis	Bombick B.R. et al.	10.1002/(sici)1098-2280(1998)31:2<169::Aid-em9>3.0.Co;2-h		✓			
1998	Comparative cytotoxicity studies of smoke condensates from different types of cigarettes and tobaccos	Toxicology in Vitro	Bombick B.R. et al.	10.1016/s0887-2333(97)00119-7		✓			

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Year	Title	Journal	Authors	DOI Link	Cross Category	Heated Products	Vapour	Modern Oral	Traditional Oral
1998	Chemical and biological studies of a new cigarette that primarily heats tobacco. Part 1. Chemical composition of mainstream smoke	Food and Chemical Toxicology	Borgerding M.F. et al.	10.1016/S0278-6915(97)00108-7		✓			
1998	Chemical and biological studies of a new cigarette that primarily heats tobacco. Part 2. In vitro toxicology of mainstream smoke condensate	Food and Chemical Toxicology	Bombick B.R. et al.	10.1016/s0278-6915(97)00107-5		✓			
1998	Chemical and biological studies of a new cigarette that primarily heats tobacco. Part 3. In vitro toxicity of whole smoke	Food and Chemical Toxicology	Bombick D.W. et al.	10.1016/s0278-6915(97)00155-5		✓			
1998	Comparative studies of DNA adduct formation in mice following dermal application of smoke condensates from cigarettes that burn or primarily heat tobacco	Mutation Research-Genetic Toxicology and Environmental Mutagenesis	Brown, B. et al.	10.1016/s1383-5718(98)00035-7		✓			
1998	Studies of environmental tobacco smoke generated by different cigarettes	Journal of the Air & Waste Management Association	Nelson, P.R. et al.	10.1080/10473289.1998.10463685		✓			
1997	Comparative study of DNA adduct formation in mice following inhalation of smoke from cigarettes that burn or primarily heat tobacco	Environmental and Molecular Mutagenesis	Brown B.G. et al.	10.1002/(SICI)1098-2280(1997)29:3%3C303::AID-EM11%3E3.0.CO;2-I		✓			
1996	Human urine mutagenicity study comparing cigarettes which burn or primarily heat tobacco	Mutation Research-Environmental Mutagenesis and Related Subjects	Smith C.J. et al.	10.1016/s0165-1161(96)90222-8		✓			
1993	Sensory responses to environmental tobacco smoke from tobacco-burning and tobacco-heating cigarettes	Indoor Air	Walker J.C et al.	10.1111/j.1600-0668.1993.t01-1-00003.x		✓			
1992	DNA adduct formation in mice following dermal application of smoke condensates from cigarettes that burn or heat tobacco	Environmental and Molecular Mutagenesis	Lee C.K. et al.	10.1002/em.2850200410		✓			
1992	2-week and 13-week inhalation studies of aerosolized glycerol in rats	Inhalation Toxicology	Renne R.A. et al.	10.3109/08958379209145307			✓		
1991	A quantitative approach to assessing intercellular communication: Studies on cigarette smoke condensates	Toxicology and Applied Pharmacology	McKarns S.C. and Doolittle D.J.	10.1016/0041-008x(91)90134-z		✓			
1991	Correlations between urinary nicotine or cotinine and urinary mutagenicity in smokers on controlled diets	Environmental and Molecular Mutagenesis	Rahn, C.A. et al.	10.1002/em.2850170405		✓			
1991	The determination of benzo(a)pyrene and benz(a)anthracene in mainstream and sidestream smoke of the Kentucky reference cigarette 1R4F and a cigarette which heats but does not burn tobacco: A comparison	Beitrage Zur Tabakforschung International, Contributions to Tobacco Research	Risner, C.H.	10.2478/cttr-2013-0617		✓			
1990	A comparison of the free radical chemistry of tobacco-burning cigarettes and cigarettes that only heat tobacco	Free Radical Biology and Medicine	Pryor, W.A. et al.	10.1016/0891-5849(90)90075-t		✓			
1990	A high-performance liquid chromatographic determination of major phenolic compounds in tobacco smoke	Journal of Chromatographic Science	Risner, C.H. and Cash, S.L.	10.1093/chromsci/28.5.239		✓			
1990	Analysis of cytogenetic effects in bone-marrow cells of rats subchronically exposed to smoke from cigarettes which burn or only heat tobacco	Mutation Research	Lee, C.K. et al.	10.1016/0165-1218(90)90075-D		✓			
1990	Artifact formation during smoke trapping: an improved method for determination of N-nitrosamines in cigarette smoke	Journal of the Association of Official Analytical Chemists	Caldwell, W.S. and Conner, J.M	10.1093/jaoac/73.5.783		✓			
1990	Cigarette smoke composition. Part 1. Limitations of FTC method when applied to cigarettes that heat instead of burn tobacco	Journal of the Association of Official Analytical Chemists	Borgerding, M.F. et al.	10.1093/jaoac/73.4.605		✓			
1990	Cigarette smoke composition. Part 2. Method for determining major components in smoke of cigarettes that heat instead of burn tobacco	Journal of the Association of Official Analytical Chemists	Borgerding, M.F. et al.	10.1093/JAOAC%2F73.4.610		✓			
1990	Chemical and biological studies of a cigarette that heats rather than burns tobacco	Journal of Clinical Pharmacology	Debethizy, J.D. et al.	10.1002/j.1552-4604.1990.tb03639.x		✓			
1990	Genetic toxicology studies comparing the activity of sidestream smoke from cigarettes which burn or only heat tobacco	Mutation Research	Doolittle, D.J. et al.	10.1016/0165-1218(90)90008-p		✓			
1990	Comparative studies on the genotoxic activity of mainstream smoke condensate from cigarettes which burn or only heat tobacco	Environmental and Molecular Mutagenesis	Doolittle, D.J. et al.	10.1002/em.2850150206		✓			
1990	Comparative subchronic inhalation bioassay in hamsters of a cigarette that only heats tobacco	Inhalation Toxicology	Wehner, A.P. et al.	10.3109/08958379009145258		✓			
1990	Comparative genotoxicity testing of mainstream whole smoke from cigarettes which burn or heat tobacco	Mutation Research	Lee, C.K. et al.	10.1016/0165-1218(90)90097-I		✓			
1990	Histopathology, urine mutacenicity, and bone marrow cytocenetics of mice exposed nose-only to smoke from cigarettes that burn or heat tobacco	Inhalation Toxicology	Coggins, C.R.E. et al.	10.3109/08958379009145266		✓			
1990	Isotope dilution gas chromatography-mass spectrometry in the determination of benzene, toluene, styrene and acrylonitrile in mainstream cigarette smoke	Journal of Chromatography	Byrd, G.D. et al.	10.1016/s0021-9673(01)81515-6		✓			
1990	Separation and quantitation of monovalent anionic and cationic species in mainstream cigarette smoke aerosols by high-performance ion chromatography	Journal of Chromatographic Science	Nanni, E.J. et al.	10.1093/chromsci/28.8.432		✓			
1990	Separation and quantitation of phenolic compounds in mainstream cigarette smoke by capillary gas chromatography with mass spectrometry in the selected-ion mode	Journal of Chromatography	Nanni, E.J. et al.	10.1016/s0021-9673(01)93051-1		✓			
1990	Comparative inhalation study in rats, using a second prototype of a cigarette that heats rather than burns tobacco	Inhalation Toxicology	Coggins, C.R.E. et al.	10.3109/08958378909145229		✓			

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Year	Title	Journal	Authors	DOI Link	Cross Category	Heated Products	Vapour	Modern Oral	Traditional Oral
1989	Ninety-day inhalation study in rats, comparing smoke from cigarettes that heat tobacco with those that burn tobacco	Fundamental and Applied Toxicology	Coggins. C.R.E. et al.	10.1016/0272-0590(89)90283-2		✓			
1989	Human urine mutagenicity study comparing cigarettes which burn or only heat tobacco	Mutation Research	Doolittle, D.J. et al.	10.1016/0165-1218(89)90050-5		✓			
1989	Subchronic nose-only inhalation study of propylene glycol in Sprague-Dawley rats	Food and Chemical Toxicology	Suber, R.L. et al.	10.1016/0278-6915(89)90016-1			✓		
1989	Absorption of nicotine from a cigarette that does not burn tobacco	Pharmacology	DeBethizy, J.D. et al.	10.1159/000138484		✓			

	Cross-Category	Heated Products	Vapour	Modern Oral	Traditional Oral	Total
Total	39	84	84	14	44	265

Cautionary Statement

This resource contains certain forward-looking statements, including “forward-looking” statements made within the meaning of the U.S. Private Securities Litigation Reform Act of 1995. These statements are often, but not always, made through the use of words or phrases such as “believe,” “anticipate,” “could,” “may,” “would,” “should,” “intend,” “plan,” “potential,” “predict,” “will,” “expect,” “estimate,” “project,” “positioned,” “strategy,” “outlook”, “target” and similar expressions.

These include statements regarding our intentions, beliefs or current expectations concerning, amongst other things, our results of operations, financial condition, liquidity, prospects, growth, strategies and the economic and business circumstances occurring from time to time in the countries and markets in which the Group operates. In particular, these forward-looking statements include, among other statements, statements regarding the Group’s future financial performance.

All such forward-looking statements involve estimates and assumptions that are subject to risks, uncertainties and other factors. It is believed that the expectations reflected in this resource are reasonable but they may be affected by a wide range of variables that could cause actual results to differ materially from those currently anticipated.

Among the key factors that could cause actual results to differ materially from those projected in the forward-looking statements are uncertainties related to the following: the impact of competition from illicit trade; the impact of adverse domestic or international legislation and regulation; the inability to develop, commercialise and deliver the Group’s New Categories strategy; the impact of Supply chain disruptions; adverse litigation and dispute outcomes and the effect of such outcomes on the Group’s financial condition; the impact of significant increases or structural changes in tobacco, nicotine and New Categories related taxes; translational and transactional foreign exchange rate exposure; changes or differences in domestic or international economic or political conditions; the ability to maintain credit ratings and to fund the business under the current capital structure; the impact of serious injury, illness or death in the workplace; adverse decisions by domestic or international regulatory bodies; changes in the market position, businesses, financial condition, results of operations or prospects of the Group; direct and indirect adverse impacts associated with Climate Change and the move towards a Circular Economy; and Cyber Security risks caused by the heightened cyber-threat landscape and increased digital interactions with consumers, and changes to regulation. Further details on the principal risks that may affect the Group can be found in the ‘Group Principal Risks’ section of the Strategic Report on pages 121 to 128 of the Annual Report for the year ended 31st December 2023 on form 20-F. A summary of all the risk factors (including the principal risks) which are monitored by the Board through the Group’s risk register is set out in the Additional Disclosures section under the heading ‘Group Risk Factors’ on pages 353 to 374 of the Annual Report on form 20-F.

Past performance is no guide to future performance and persons needing advice should consult an independent financial adviser. The forward-looking statements reflect knowledge and information available at the date of preparation of this resource and the Group undertakes no obligation to update or revise these forward-looking statements, whether as a result of new information, future events or otherwise. Readers are cautioned not to place undue reliance on such forward-looking statements.

No statement in this resource is intended to be a profit forecast and no statement in this resource should be interpreted to mean that earnings per share of BAT for the current or future financial years would necessarily match or exceed the historical published earnings per share of BAT.

Although financial materiality has been considered in the development of our Double Materiality Assessment (DMA), our DMA and any conclusions in this resource as to the materiality or significance of sustainability or ESG matters do not imply that all topics discussed therein are financially material to our business taken as a whole, and such topics may not significantly alter the total mix of information available about our securities.

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