



PMI SCIENCE  
PHILIP MORRIS INTERNATIONAL

# SEE THE SCIENCE FOR YOURSELF

.....  
Delivering a smoke-free future



# DELIVERING A SMOKE-FREE FUTURE

Our goal at Philip Morris International (PMI) is to offer smoke-free alternatives that have the potential to reduce the risk of developing smoking-related diseases as compared with continued smoking. Recent advances in science and technology have made it possible to develop innovative products that current adult smokers accept and that are less harmful alternatives.

## INHALABLE NICOTINE PRODUCTS

### Heated tobacco products

#### Tobacco heating system (THS)

THS uses an electronic heat-control technology to heat tobacco within a specific temperature range. Extensive laboratory and clinical data are available supporting its potential for risk reduction compared with continued cigarette smoking.

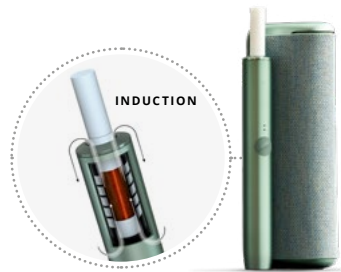


#### THS 2.2 BLADE/RESISTIVE HEATING

A heating blade that heats the tobacco plug in the consumable radially outwards from the center of the tobacco plug.

#### THS 3.0 INDUCTION HEATING

The tobacco is heated from within the tobacco stick through energy transfer to a heating element via a magnetic field.



#### Pin-based heating system (PHS)

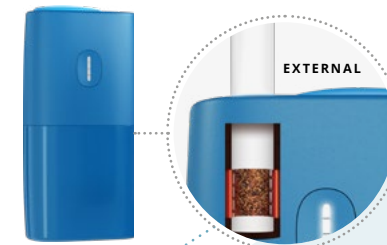
PHS electrically heats the tobacco using either inductive or resistive heating. Developed by KT&G.\*

\*KT&G is the leading tobacco and nicotine company in South Korea.



#### Oven Heating System (OHS)

OHS uses resistive external heating, with no blade, via the ROUNDHEAT TOBACCO SYSTEM™, to heat the tobacco across the external surface of the tobacco stick instead of burning it like a cigarette does.



The products depicted are subject to ongoing development and therefore visuals are illustrative and do not necessarily represent the latest stages of product development.



### Aerosol heated tobacco products

#### Aerosol heating system (AHS)

AHS combines elements of e-cigarettes and heated tobacco products into a single hybrid system. Developed by KT&G.



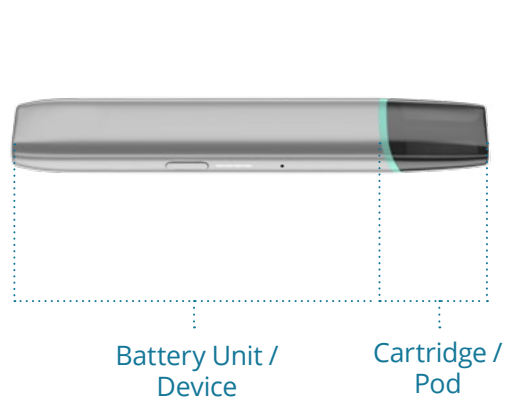


## INHALABLE NICOTINE PRODUCTS

### E-vapor products

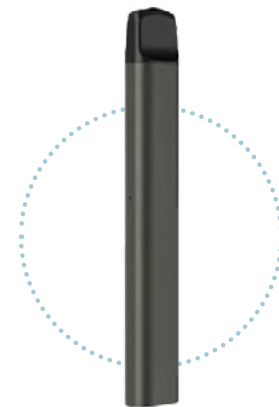
#### Ceramic Vaping System (CVS)

CVS represents our latest advancement in the e-vapor category. The heating technology utilized in CVS is founded on an innovative H-shaped ceramic heater, which features a ceramic microporous substrate with a printed metallic heating track.



#### Disposable Vaping System (DVS)

Our ergonomically designed all-in-one pocket-sized DVS requires no charging, no cleaning, and no refilling. Unlike our THS, which heats real tobacco, these single-use e-cigarettes are battery-powered devices that vaporize a nicotine-containing liquid to create an inhalable aerosol.



## NON-INHALABLE NICOTINE PRODUCTS

### Oral smokeless pouches

#### Nicotine pouches

The oral smokeless category doesn't involve a device, heating, or the inhalation of an aerosol. Instead, a teabag-like pre-portioned pouch that contains nicotine (but not tobacco), is placed between the gum and lip and removed after use. The nicotine is extracted through the action of saliva and is absorbed mainly via the mucous membranes in the mouth before entering the bloodstream. Some nicotine can also reach the gastrointestinal tract if saliva is swallowed.

#### Pouch

#### Nicotine base

#### Binder and/or filler

#### Flavor

#### pH buffer



## KEY FINDINGS

For a deep dive into each section of our assessment program and the references supporting our statements, please consult our PMI Science Booklet, available at [PMIScience.com](https://www.pmis.com/science).

Our smoke-free products are in various stages of development, production or commercialization; all designed to offer better alternatives for adult smokers than continuing to smoke. All newly developed products undergo rigorous testing, including nonclinical and clinical assessment. This leaflet summarizes the key scientific results on the tobacco heating system (THS).

## THERE IS NO BURNING IN THS

Decades of scientific research show that the primary cause of smoking-related disease is the high levels of Harmful and Potentially Harmful Constituents (HPHCs) in smoke formed during the combustion of tobacco.

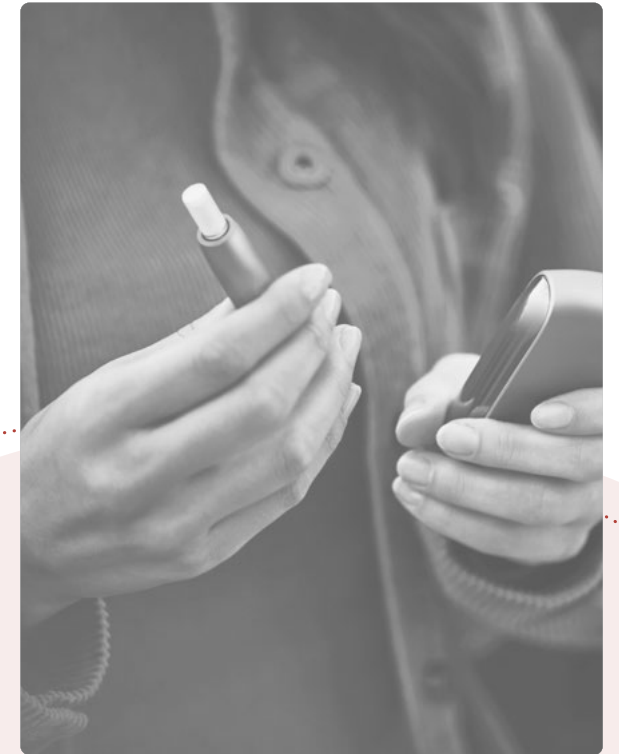
We have conducted several studies to demonstrate the absence of combustion in THS, including temperature measurements, experiments demonstrating the absence of net exothermic processes, and measurements of constituents that represent typical markers of combustion.

Our studies also support that the aerosol of THS does not contain solid particles that are produced when tobacco is burned. In addition, since burning requires oxygen, we have tested THS in an oxygen-free atmosphere. The results showed that oxygen does not play a major role in the thermochemical degradation of the THS tobacco or the aerosol formation. Combustion does not occur during THS use.

## MAJORITY OF THS USERS NO LONGER SMOKE CIGARETTES AND USE THS EXCLUSIVELY

Our repeated post-market cross-sectional surveys show that the majority of THS users no longer smoke cigarettes and use THS exclusively.

These studies also show very low to non-existing tobacco or nicotine-containing products (TNP) initiation with THS among never TNP users (<0.1%). More than 99% of current THS users have a history of TNP use before switching to THS, and only 1% to 2% of current THS users relapsed or re-initiated tobacco use with THS.





# KEY FINDINGS

## REDUCED EMISSIONS OF HARMFUL CHEMICALS

By eliminating combustion, the levels of harmful chemicals are reduced on average by 95% in the THS aerosol compared to those in cigarette smoke.

The average level of HPHCs in the THS aerosol is shown by the red bar and is compared with the average level of HPHCs in smoke from the 3R4F reference cigarette marked as 100% in the graphic.

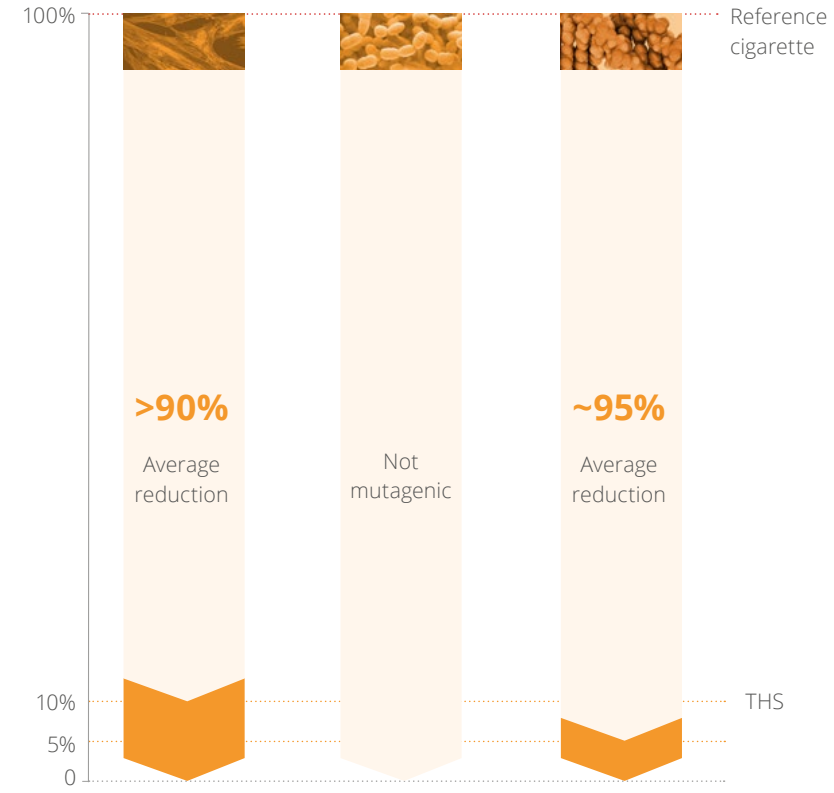


\*Average reductions in levels of a range of harmful chemicals (excluding nicotine) compared to the smoke of a reference cigarette (3R4F). Based on the FDA 18, IARC, and WHO 9 lists of HPHCs.

### Cytotoxicity

### Bacterial mutagenicity

### Mammalian genotoxicity



## REDUCED TOXICITY

Our studies show a substantial reduction in toxicity of the THS aerosol compared to cigarette smoke.

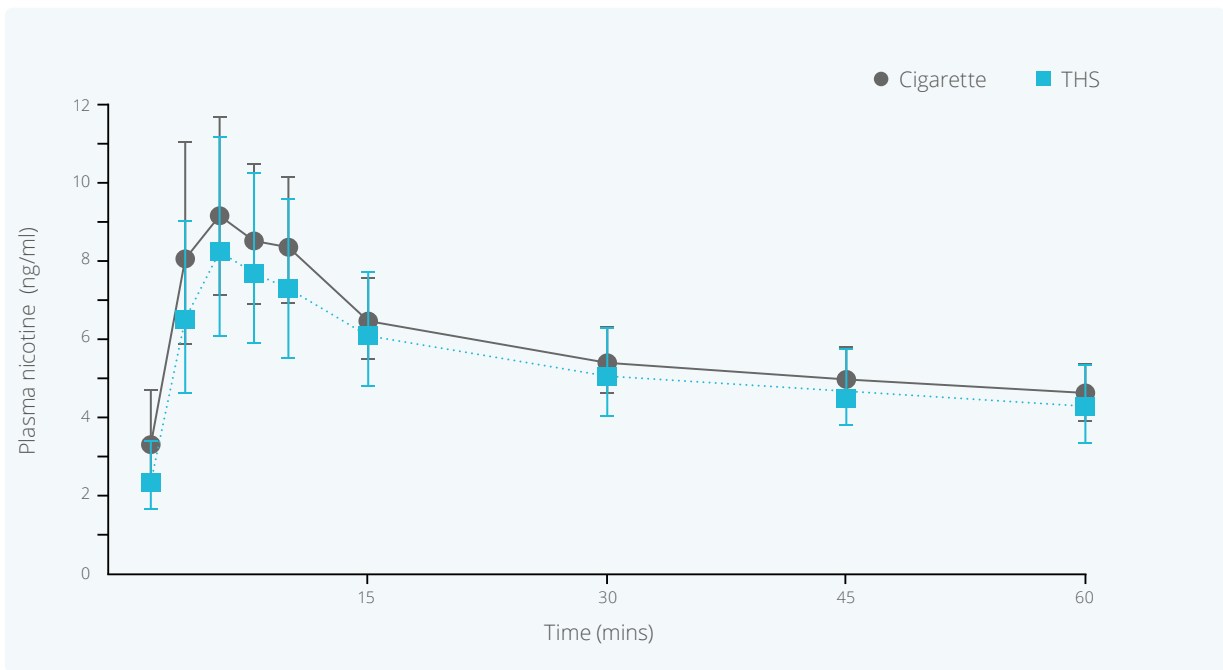
The chart shows our findings concerning the relative *in vitro* toxicity of THS aerosol compared with the smoke from the 3R4F reference cigarette using three *in vitro* assays commonly used to assess cytotoxicity and genotoxicity.

# KEY FINDINGS

## NICOTINE UPTAKE

When switching to THS, the nicotine uptake and urge-to-smoke scores were comparable to those measured in subjects who continued smoking.

This suggests that switchers do not seek to use THS more frequently than smokers seek to use cigarettes and that switchers can find THS acceptable and satisfying.

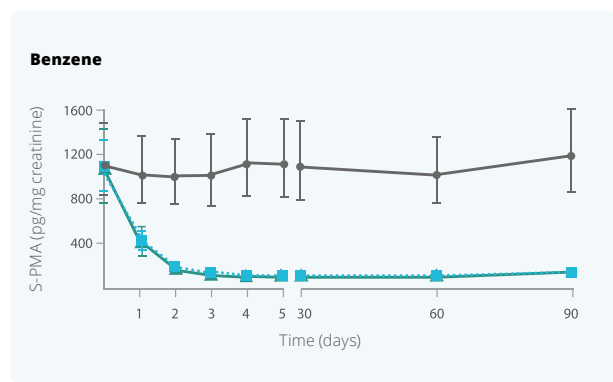
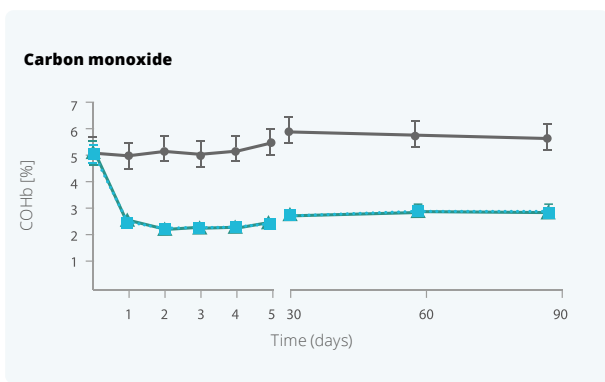
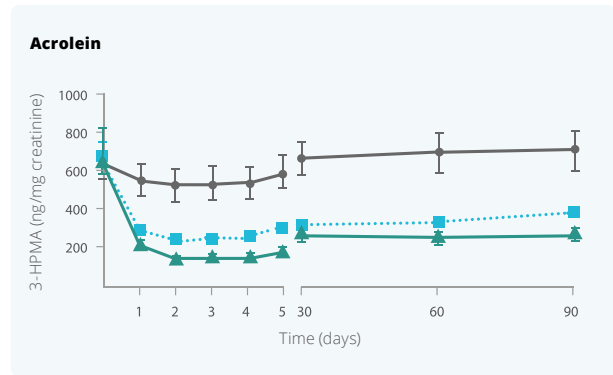
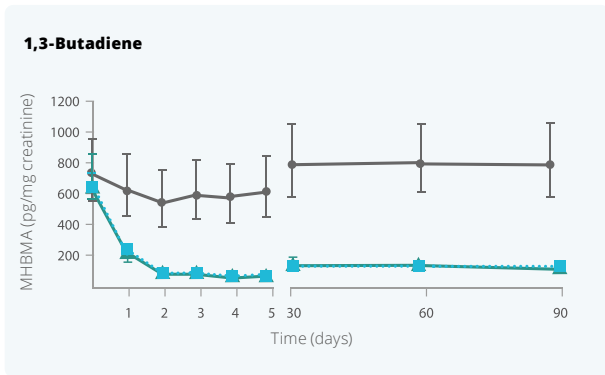


## REDUCED EXPOSURE TO HARMFUL CHEMICALS

Smokers switching completely to THS were exposed to significantly lower levels of harmful chemicals compared to those who continued smoking during the study.



- Cigarette
- THS
- ▲ Cessation



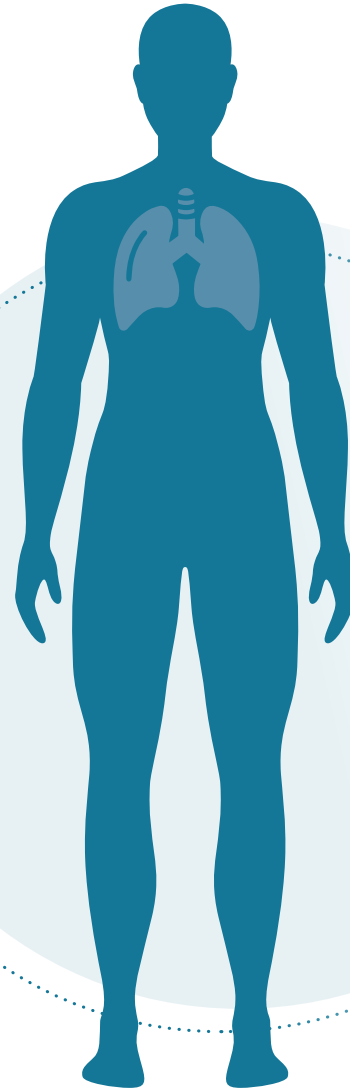


# KEY FINDINGS

## POSITIVE IMPACT ON SMOKERS' HEALTH

Our 1-year exposure response study showed that smokers who switched from cigarettes to THS for 12 months had favorable changes in all eight measured biomarkers of potential harm, in the same direction as upon smoking cessation.

- ✓ INFLAMMATION
- ✓ ENDOTHELIAL FUNCTION
- ✓ OXIDATIVE STRESS
- ✓ OXYGEN DELIVERY
- ✓ LIPID METABOLISM
- ✓ LUNG FUNCTION
- ✓ CLOTTING
- ✓ CARCINOGENICITY



✓ Changes similar to the ones observed following smoking cessation

## INTENTION TO USE, USE BEHAVIOR, AND PERCEIVED RISK

Our pre-market perception and behavior studies showed that substantial proportions of current adult smokers expressed intention to use THS and that low proportions of nonsmokers expressed intention to use THS.

Furthermore, the studies showed that smokers correctly understand that switching to THS presents less risk of harm than continued cigarette smoking.

Our actual use perception and behavior studies showed that a sizeable proportion of smokers were likely to switch from cigarettes to THS exclusive or predominant use.

We also examined the impact of risk-related perceptions of THS on smokers' behavior and its impact on exclusive and stable use over time, highlighting the importance of factual and non-misleading product information capable of enabling informed decision making.

The results showed that individuals who identified perceived reduced formation of harmful chemicals or perceived reduced risk of harm as reasons for using THS were more likely to switch exclusively and did so more quickly than those who did not.

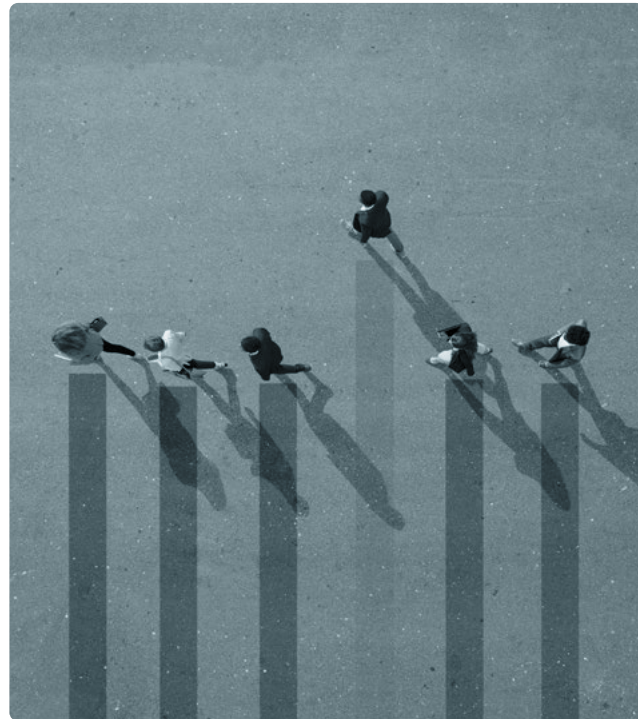


# KEY FINDINGS

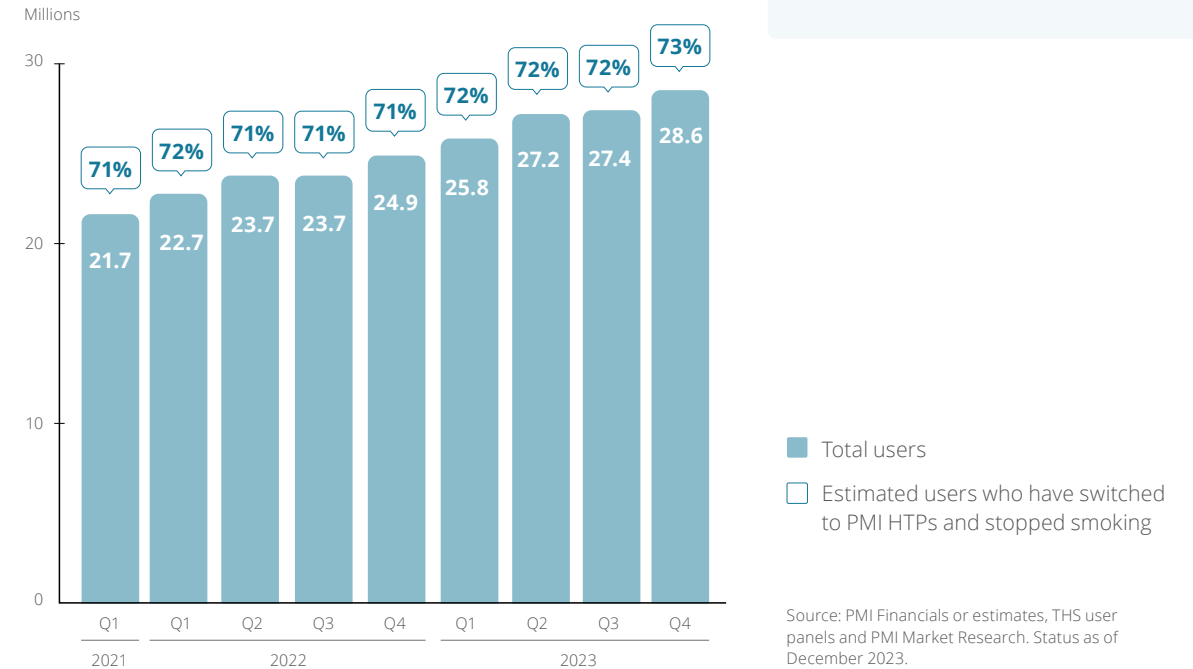
## POPULATION HEALTH IMPACT MODEL

We developed an epidemiological model relying on mathematical simulations using publicly available data, the Population Health Impact Model (PHIM), with the aim to estimate, in the absence of epidemiological data, the potential effects of introducing a smoke-free product on the public health of a whole population.

We have conducted several studies using our PHIM for various countries and while the PHIM has several important limitations, these simulations seem to suggest that the introduction of a smoke-free product as modeled has the possibility to substantially reduce smoking-related deaths.



## SMOKERS WHO HAVE SWITCHED TO PMI HEATED TOBACCO PRODUCTS (HTPs) WORLDWIDE



As of December 2023, there are approximately 28.6 million users of PMI HTPs globally, of which approximately 20.8 million (73%) have switched to PMI HTPs and stopped smoking.

Source: PMI Financials or estimates, THS user panels and PMI Market Research. Status as of December 2023.



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# INDEPENDENT STUDIES AND REVIEWS

## INDEPENDENT REVIEW

Many government bodies have conducted literature reviews or performed research on scientifically substantiated heated tobacco products, finding that they expose users to significantly lower levels of harmful chemicals.

To date, over 50 studies from independent laboratories have results that are in line with our findings on THS.

U.S. FOOD AND DRUG ADMINISTRATION (U.S. FDA)

PUBLIC HEALTH ENGLAND (PHE)

U.K. COMMITTEE ON TOXICITY (COT)

DUTCH NATIONAL INSTITUTE FOR PUBLIC HEALTH AND THE ENVIRONMENT (RIVM)

ALL-RUSSIA SCIENTIFIC RESEARCH INSTITUTE FOR TOBACCO AND TOBACCO PRODUCTS

NATIONAL INSTITUTE OF PUBLIC HEALTH JAPAN

SUPERIOR HEALTH COUNCIL OF BELGIUM

NATIONAL INSTITUTE OF CARDIOLOGY UKRAINE

GERMAN FEDERAL INSTITUTE FOR RISK ASSESSMENT (BFR)

CHINA NATIONAL TOBACCO QUALITY SUPERVISION AND TEST CENTER



# FACTS AND FIGURES

The totality of evidence gathered so far demonstrates that the tobacco heating system (THS) is a better choice for adult smokers who would otherwise continue smoking cigarettes and that switching completely to THS presents less risk of harm than continued smoking. Smoke-free products are not risk free and contain nicotine, which is addictive. The best choice any smoker can make is to quit tobacco and nicotine altogether.

## OUR CONTRIBUTION SO FAR

Our comprehensive body of scientific evidence for our leading smoke-free product THS has been submitted to regulatory bodies in several countries.

We submitted Modified Risk Tobacco Applications (MRTPAs) in December 2016 and Premarket Tobacco Product Applications (PMTAs) in March 2017 to the U.S. FDA. We also submitted technical and scientific dossiers to regulatory authorities in several EU member states. In April 2019, following a rigorous science-based review through the PMTA pathway, the U.S. FDA determined that authorizing THS for the U.S. market is appropriate for the protection of the public health.

In July 2020, the U.S. FDA authorized the marketing of the THS as a modified risk tobacco product with reduced exposure information. The agency found that the issuance of the modified risk tobacco product orders with reduced exposure information would be “appropriate to promote the public health and is expected to benefit the health of the population as a whole.”



\* Data does not include employees of Swedish Match or Vectura Fertin Pharma.

\*\* IP5 jurisdictions are Europe (patents granted by the European Patent Office), China, South Korea, Japan, and the U.S.



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You can find more about our science on  
[PMIScience.com](https://PMIScience.com)



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It is not intended for consumers.

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