

Designed for Addiction

*How the Tobacco Industry Has
Made Cigarettes More Addictive,
More Attractive to Kids and
Even More Deadly*



June 23, 2014



Tobacco use remains the number one cause of preventable death and disease in the United States.

Smoking kills 480,000 Americans each year, sickens millions more and costs the nation at least \$289 billion annually in health care bills and economic losses.

The latest Surgeon General's report found that cigarettes today pose an even greater risk of disease than the cigarettes sold when the first Surgeon General's report was issued in 1964.

The report concludes: "The evidence is sufficient to infer that the relative risk of dying from cigarette smoking has increased over the last 50 years in men and women in the United States."

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Bronchodilators

Added chemicals expand the lungs' airways, making it easier for tobacco smoke to pass into the lungs.

Flavorings

Added flavors like licorice and chocolate mask the harshness of smoke and make products more appealing to new users, especially kids.

Increased Nicotine

Tobacco companies control the delivery and amount of nicotine to ensure addiction

Tobacco-specific Nitrosamines

American-style cigarettes are made with blended tobacco that has much higher levels of cancer-causing nitrosamines.



Ammonia Compounds

Adding ammonia compounds increases the speed with which nicotine hits the brain.

Menthol

Menthol cools and numbs the throat to reduce irritation and make smoke feel smoother.

Ventilated Filters

Ventilation holes in the filters cause smokers to inhale more vigorously, drawing carcinogens more deeply into the lungs.

Sugars and Acetaldehyde

Added sugars make tobacco smoke easier to inhale and form acetaldehyde, which enhances nicotine's addictive effects.

Levulinic Acid

Added organic acid salts reduce harshness of nicotine and make smoke smoother, less irritating.

Executive Summary

In the 50 years since the first Surgeon General's report on smoking and health alerted Americans to the deadly consequences of cigarette smoking, the United States has made enormous progress in reducing tobacco use. The adult smoking rate has been cut by more than half – from 42.4 percent in 1965 to 18.1 percent in 2012. After climbing to 36.4 percent in 1997, the high school smoking rate has been cut by 57 percent, to 15.7 percent in 2013. Annual per capita cigarette consumption has fallen by more than 70 percent since peaking in 1963.

Nevertheless, tobacco use remains the nation's number one cause of preventable, premature death. In fact, the new Surgeon General's report released in January 2014, *The Health Consequences of Smoking – 50 Years of Progress*, found that cigarette smoking takes an even greater toll on health, lives and dollars than has previously been reported. The report found that smoking currently kills 480,000 Americans each year, sickens millions more and costs the nation at least \$289 billion annually in health care bills and economic losses.¹

About 42 million adults and nearly 3 million children still smoke in the U.S. Approximately half of continuing smokers will die prematurely as a result of their addiction, losing at least a decade of life on average compared to nonsmokers.

Shockingly, the latest Surgeon General's report found that cigarettes today pose an even greater risk of disease than the cigarettes sold when the first Surgeon General's report was issued in 1964. The report concludes, "The evidence is sufficient to infer that the relative risk of dying from cigarette smoking has increased over the last 50 years in men and women in the United States."

Specifically, the report found that "today's cigarette smokers – both men and women – have a much higher risk for lung cancer and chronic obstructive pulmonary disease (COPD) than smokers in 1964, despite smoking fewer cigarettes." The report finds that "changes in the design and composition of cigarettes since the 1950s" are responsible for smokers' increased risk of developing lung cancer.²

This key conclusion of the Surgeon General helps to answer a critical question: Why does tobacco use remain such an enormous public health problem?

Prior reports have highlighted the role of tobacco marketing, especially in causing kids to start and continue using tobacco. The tobacco industry continues to spend huge sums – \$8.8 billion a year, or \$1 million every hour – to market its products, according to the latest data from the Federal Trade Commission.

What was not known until recently is the public health impact of design changes the tobacco industry has made to the cigarette itself.

The evidence is now clear: Over the past 50 years, tobacco manufacturers have designed and marketed ever more sophisticated products that are highly effective at creating and sustaining addiction to nicotine, more appealing to new youth smokers and more harmful. They took a deadly and addictive product and made it worse, putting smokers at even greater risk of addiction, disease and death.

This report describes key ways in which tobacco companies design and manipulate their products to attract new youth smokers, create and sustain addiction, mislead consumers to think that they are reducing their risk of disease and make it more difficult for users to quit. In addition, as the latest

"The evidence is sufficient to infer that the relative risk of dying from cigarette smoking has increased over the last 50 years in men and women in the United States."

– 2014 Surgeon General's Report

Surgeon General's report found, the design changes during the past 50 years have also made cigarettes even more dangerous.

This report is based on an extensive review of scientific studies and tobacco industry documents made public as a result of litigation against the industry. It also draws on the conclusions of Surgeon General's reports and the 2006 Final Opinion of U.S. District Court Judge Gladys Kessler, who in *U.S. v. Philip Morris, Inc.*, found the major cigarette manufacturers had violated civil racketeering laws by deceiving the American people about the addictiveness and health risks of their products.³

This evidence makes clear that tobacco products – and cigarettes in particular – are highly engineered to expand the appeal of these products and facilitate the consumption of and addiction to nicotine, a highly addictive drug. Tobacco companies also know that almost all new smokers begin their addiction as children and that smoking is distasteful for new smokers, so they carefully design the product to appeal to this important market. The companies have spent huge sums to research the design of their products and ensure they achieve these goals, even if the impact of these changes also makes the product more dangerous.

INCREASING THE ADDICTIVENESS OF CIGARETTES

Independent evidence and the tobacco industry's own documents make clear that the tobacco companies have used design features and chemical additives in the manufacturing process in ways that increase the impact of nicotine, the addictive agent in tobacco products. Some of the ways the addictiveness of cigarettes has been increased include:

- **Increasing nicotine levels**
- **Adding ammonia or ammonia compounds**, which increase the speed at which nicotine is delivered to the brain
- **Adding sugars**, which increase the addictive effects of nicotine and make it easier to inhale tobacco smoke.

As Judge Kessler concluded in her final opinion, "Defendants have designed their cigarettes to precisely control nicotine delivery levels and provide doses of nicotine sufficient to create and sustain addiction."⁴

Similarly, the 2010 Surgeon General's report, *How Tobacco Smoke Causes Disease – the Biology and Behavioral Basis for Smoking-Attributable Disease*, found that cigarettes are designed for addiction. The Surgeon General's Fact Sheet summarizing the key findings of the report stated:

"The design and contents of tobacco products make them more attractive and addictive than ever before. Cigarettes today deliver nicotine more quickly from the lungs to the heart and brain. While nicotine is the key chemical compound that causes

and sustains the powerful addicting effects of cigarettes, other ingredients and design features make them even more attractive and more addictive.”⁵

MAXIMIZING THE APPEAL OF TOBACCO PRODUCTS TO YOUTH AND OTHER GROUPS

In addition to controlling the addictive properties of their products, tobacco companies also manipulate their products in ways that attract new smokers and increase the likelihood that they will become regular smokers. By altering the taste, smell and other sensory attributes of their products, tobacco manufacturers make it easier for new users – the vast majority of whom are kids – to start and continue smoking. Since the nicotine can make tobacco smoke harsh and difficult to smoke, manufacturers use chemical additives to alter the taste and smoothness of tobacco use in ways that make tobacco products more appealing to the young, novice smoker.

Additives the industry uses to attract new tobacco users include:

- **Levulinic acid** reduces the harshness of nicotine and makes the smoke feel smoother and less irritating.
- **Flavorings, such as chocolate and liquorice**, boost the sweetness of tobacco, mask the harshness of the smoke and make tobacco products more appealing to young people.
- **Bronchodilators** expand the lungs’ airways, making it easier for tobacco smoke to pass into the lungs.
- **Menthol** cools and numbs the throat to reduce throat irritation and makes the smoke feel smoother.

DESIGN CHANGES IN RECENT DECADES HAVE MADE CIGARETTES MORE LETHAL

As noted previously, the latest Surgeon General’s report established that cigarette smokers today have a much higher risk of developing lung cancer and COPD than smokers in 1964, and it attributed the increased risk of lung cancer to the tobacco industry’s changes in the design and composition of cigarettes. The report identified two specific changes as the most likely reason for the increased risk of developing lung cancer:

- **An increase in the levels of highly carcinogenic tobacco-specific nitrosamines (TSNAs) in U.S. cigarettes.** The new Surgeon General’s report linked this increase to tobacco blends used in U.S. cigarettes compared to cigarettes sold in Australia and Canada, as well as the curing process now being used. As a result, exposure to tobacco-specific nitrosamines is much higher among U.S. smokers than among their counterparts in Australia and Canada.
- **The introduction of ventilation holes in cigarette filters that caused smokers to inhale more frequently and vigorously, thereby drawing**

carcinogens in the smoke more deeply into the lungs. Tobacco companies developed ventilated filters to dilute the smoke and reduce machine-measured levels of tar and nicotine. They marketed such cigarettes as less hazardous despite knowing there was in fact no health benefit because smokers changed their smoking patterns to take in more nicotine. Now there is an emerging recognition that the very design changes that lowered machine-measured tar and nicotine ratings are likely a reason for the increased risk of smoking-related disease.

THE FDA MUST REGULATE HOW TOBACCO PRODUCTS ARE MADE

It is deeply disturbing that 50 years after the first Surgeon General's report found that smoking causes lung cancer and other serious diseases, cigarettes are even more dangerous and pose an even greater risk to health.

Until recently, no government agency had the power to require the tobacco industry to disclose what it was doing to its products or to do anything about it. That changed in 2009 when Congress enacted the Family Smoking Prevention and Tobacco Control Act (Tobacco Control Act), which granted the Food and Drug Administration (FDA) the authority to regulate the manufacturing, marketing and sale of tobacco products. Under this law, the FDA has the power to regulate the design and contents of tobacco products and to stop the tobacco industry's harmful practices that increase the number of people who die from tobacco use.

The Surgeon General's report makes clear that the FDA must act quickly, calling for "[e]ffective implementation of FDA's authority for tobacco product regulation in order to reduce tobacco product addictiveness and harmfulness." The report also notes, ***"above all, if the risk of lung cancer has increased with changes in the design and composition of cigarettes, then the potential exists to reverse that increase in risk through changes in design and composition."***⁶

On the 50th anniversary of the first Surgeon General's report on tobacco, it is time for a national commitment to finally end the tobacco epidemic. Smoking has killed 20 million Americans since the first Surgeon General's report on smoking and health. We cannot allow the tobacco industry to continue to make their cigarettes in ways that cause hundreds of thousands of Americans to die prematurely every year.



Increasing the Addictiveness of Cigarettes

“Increasing the addictive potential of cigarettes with additives increases the likelihood that new smokers will become addicted and that current smokers will have more difficulty quitting.” — Rabinoff, M, et al., “Pharmacological and Chemical Effects of Cigarette Additives,” American Journal of Public Health, Nov. 2007

Independent evidence and the tobacco industry’s own documents make clear that the tobacco companies have used design features and chemical additives in the manufacturing process in ways that increase the impact of nicotine, the addictive agent in tobacco products. Products have been engineered to create and sustain addiction by controlling their physical properties. Some of the ways the addictiveness of cigarettes has been increased include:⁷

- Increasing nicotine levels
- Adding ammonia or ammonia compounds which increase the speed at which nicotine is delivered to the brain
- Adding sugars that increase the addictive effects of nicotine and make it easier to inhale tobacco smoke.

According to the 2010 Surgeon General's Report, *How Tobacco Smoke Causes Disease – The Biology and Behavioral Basis for Smoking-Attributable Disease*, cigarettes are designed for addiction. The report cites changes over the past 50 years that have made cigarettes more addicting, such as chemical additives, tobacco blends, control of pH and control of nicotine dose. According to the Surgeon General's factsheet summarizing the report's findings:

“The design and contents of tobacco products make them more attractive and addictive than ever before. Cigarettes today deliver nicotine more quickly from the lungs to the heart and brain. While nicotine is the key chemical compound that causes and sustains the powerful addicting effects of cigarettes, other ingredients and design features make them even more attractive and more addictive.”⁸

An expert study group of the World Health Organization concluded in a 2012 report that “the industry actively investigated the effects of nicotine and other substances on the nervous system in an effort to increase the addictiveness... of their products.”⁹ The Committee specifically found:

“The approaches used by the tobacco industry included manipulation of the nicotine dosing capacity of its products, products designed to increase the speed of nicotine delivery and hence its addictive ‘impact’ or ‘kick’, control of tobacco and smoke pH to increase the unprotonated (‘free base’) fraction of nicotine in the smoke, control of smoke particle size to increase lung penetration efficiency, product engineering to increase stimulation of the trigeminal nerves of the oral cavity and upper airways, and the use of a broad range of chemical additives to make smoke feel smoother, cooler and more pleasant, in order to facilitate deep inhalation and the transition to addiction.”¹⁰

NICOTINE

Nicotine, a chemical that exists naturally in tobacco plants, is an extremely addictive drug. Tobacco products, and cigarettes in particular, are highly engineered and designed to facilitate the consumption of and addiction to nicotine.

When someone smokes, nicotine is delivered into the lungs where it is absorbed into the bloodstream and carried to the brain in a matter of seconds. According to a 2010 report prepared for the European Union (EU) by a group of distinguished scientists, tobacco has a substantially higher risk of causing addiction than heroin, cocaine, alcohol, or cannabis.¹¹ A study by a scientific expert who has testified in court on behalf of Lorillard Tobacco Company asserts that “there’s a greater likelihood that a person who starts smoking will become dependent than a person who starts using heroin...”¹² When smokers continue to expose themselves to nicotine, their brains will change and as a result they often will experience withdrawal symptoms within hours after quitting smoking.¹³

The tobacco industry’s own documents show that the tobacco companies have spent billions of dollars studying the effects of nicotine and precisely how to control the delivery and amount of nicotine to ensure that smokers become addicted and stay addicted. The documents demonstrate that they have known for decades that the key to their business is creating and sustaining dependence on nicotine, and they have purposely designed their products to do this effectively and efficiently. As U.S. District Judge Gladys Kessler concluded in her landmark 2006 civil racketeering judgment against the major cigarette manufacturers, *U.S. v. Philip Morris, Inc.*, “Defendants have designed their cigarettes to precisely control nicotine delivery levels and provide doses of nicotine sufficient to create and sustain addiction.”¹⁴

Internal company documents from as far back as the 1950s expose the tobacco industry’s extensive research on the importance of nicotine and how best to deliver nicotine to smokers and optimize its effects.¹⁵ These documents became public over the objection of the tobacco companies as a result of litigation against the tobacco companies. The voluminous findings and overwhelming evidence contained in Judge Kessler’s 2006 opinion demonstrate that for decades, the major tobacco companies have manipulated the design of cigarettes to ensure the level of nicotine delivered to the consumer would sustain addiction. Judge Kessler concluded:

“... [C]igarette company defendants researched, developed, and implemented many different methods and processes to control the delivery and absorption of the optimum amount of nicotine which would create and sustain smokers’ addiction. These methods and processes included, but were not limited to: altering the physical and chemical make-up of tobacco leaf blends and filler;

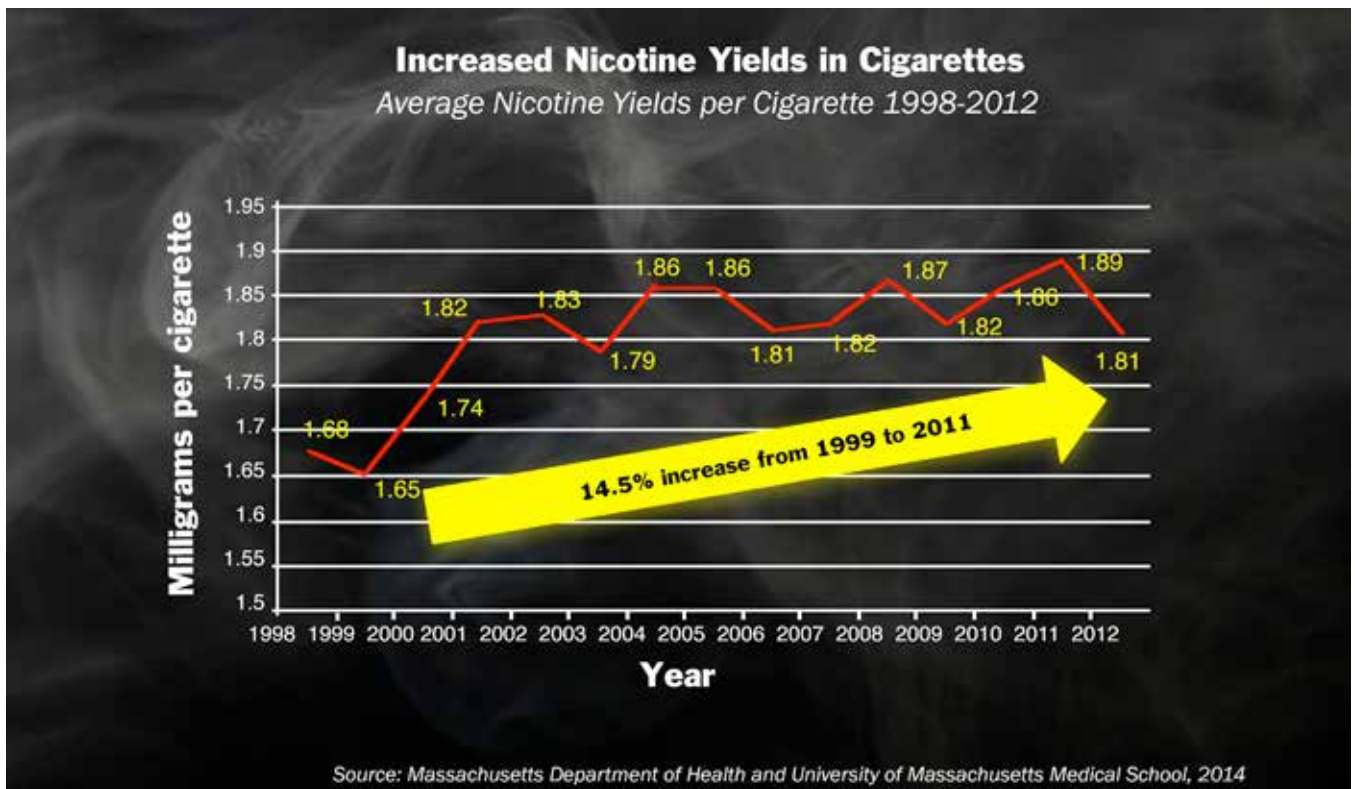
“No one has ever become a cigarette smoker by smoking cigarettes without nicotine.”

— W.L. Dunn, Phillip Morris, 1972

maintaining or increasing the nicotine to tar ratio by changing filter design, ventilation and air dilution processes, and the porosity and composition of filter paper; altering smoke pH by adding ammonia to speed nicotine absorption by the central nervous system; and using other additives to increase the potency of nicotine.”¹⁶

A study published in 2014 by the Massachusetts Department of Public Health and the University of Massachusetts Medical School found that while the nicotine content of cigarettes remained fairly stable between 1998 and 2012, the nicotine yields – the amount of nicotine delivered via smoke – increased significantly. These findings were based on an analysis of data from four major cigarette manufacturers.¹⁷

Specifically, the study found that average nicotine yield increased by 14.5 percent between 1999 and 2011, from 1.65 mg per cigarette to 1.89 mg per cigarette. Researchers conclude that the increase in nicotine yield cannot be explained by natural agricultural variations and that nicotine yield and yield-to-content ratio are factors controlled by the manufacturers. Further, the authors conclude that these results are likely due to tobacco manufacturers’ attempts to increase the efficiency with which nicotine is delivered to a smoker’s lungs.



These findings build on earlier research by the Harvard School of Public Health released in 2007, which found that tobacco companies increased nicotine levels in their cigarettes between 1997 and 2005.¹⁸ Both studies found that nicotine levels in the three cigarette brands that are most

popular among youth smokers – Marlboro, Newport and Camel – increased significantly between 1997 and 2005. For years the tobacco industry succeeded in hiding these increases from federal officials, including the Federal Trade Commission (FTC). The contrast between these findings and the mandated ratings using the FTC method for measuring nicotine delivery, which had found that nicotine delivery was the same or declining over the same time period, was one factor that led the FTC to conclude that its testing method was so flawed that it rescinded its method for nicotine ratings in 2008.

Given that virtually all new tobacco users start as youth or adolescents, the addictiveness of tobacco products – and the manipulation of tobacco products by cigarette manufacturers to maximize their addictiveness – is particularly troubling. Youth and adolescence are critical periods of growth and development; as a result, young people are more susceptible and sensitive to the effects of nicotine and can become dependent quicker than adults.¹⁹ In fact, the Surgeon General concluded, “the evidence is suggestive that nicotine exposure during adolescence, a critical window for brain development, may have lasting adverse consequences for brain development.”²⁰

There is considerable variation in the amount of time young people report it takes to become addicted to using tobacco, but key symptoms of dependence – withdrawal and tolerance – can be apparent after just minimal exposure to nicotine.²¹ As a result of nicotine addiction, about three out of four teen smokers end up smoking into adulthood, even if they intend to quit after a few years.²²

According to *Tobacco: The Smoking Gun*, a white paper by The National Center on Addiction and Substance Abuse (CASA) at Columbia University, nicotine poses a significant danger of structural and chemical changes in developing brains. Some of these changes include increased levels of dopamine in the brain which may make the reward associated with nicotine stronger and increasingly compulsive; changes in serotonin levels receptors that are associated with depression; and changes to brain receptors that are associated with an increased preference for other addictive drugs.²³

Although nicotine is the main addicting chemical in tobacco, it is the combination of nicotine and design features of modern cigarettes and other tobacco products that contribute to their addiction risk actually exceeding that of cocaine and heroin.²⁴ These design features have been extensively researched in the laboratory as well as in test markets using consumers themselves as the “guinea pigs” to refine the designs in ways to heighten the risk of establishing and maintaining addiction.

An old-fashioned cigarette of the early 20th century was indeed deadly and addictive, but tobacco industry research, engineering and manufacturing approaches undertaken over the last 50 years have promoted addiction more

effectively and easily. Numerous additives are now used and manipulated in the manufacturing process to enhance the delivery of nicotine to the brain.²⁵ This increases the efficiency with which nicotine is extracted from the product and the speed with which it is absorbed in the lungs and at the peripheral trigeminal nerve endings in the upper airways, which also contribute to the impact of the cigarette.

The EU report cited previously concludes that additives, including those described below, contribute to the addictiveness of tobacco products: “[A] part from naturally occurring substances in tobacco leaves, a number of ingredients in the final product may create or increase dependence.”²⁶ Other scientific experts have reached similar conclusions.²⁷

Nicotine

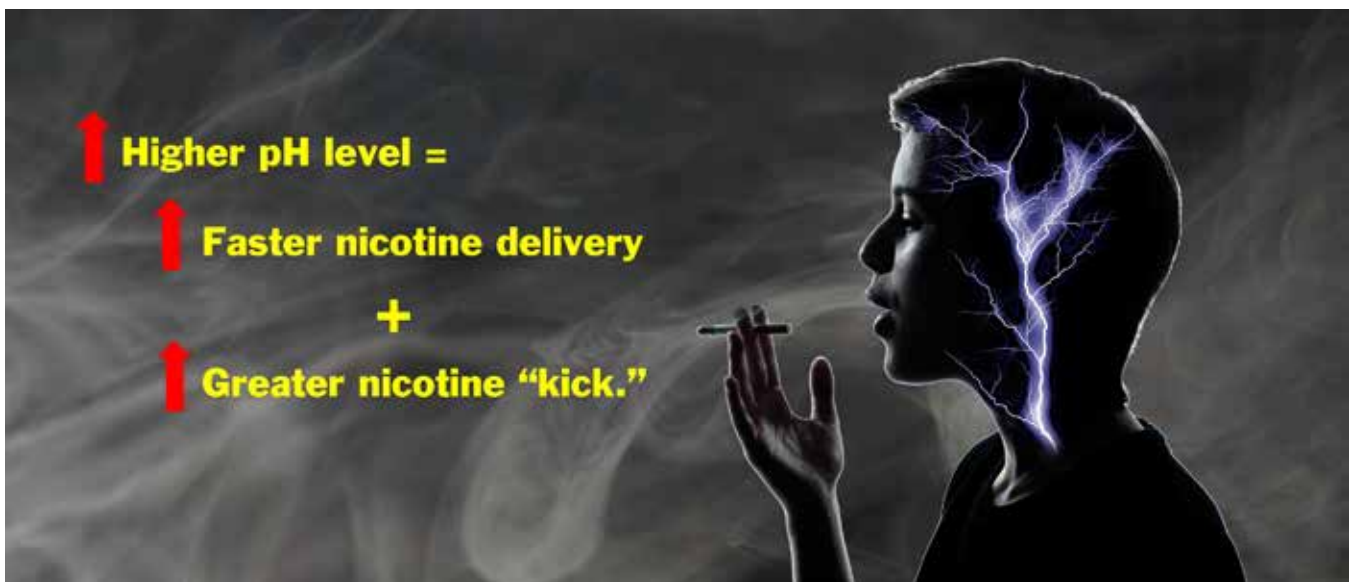
Nicotine is the major component of tobacco products responsible for addiction. Nicotine is the fundamental reason people continue to use tobacco products. Tobacco Industry documents indicate the companies precisely control the delivery and amount of nicotine to create and sustain addiction.

AMMONIA

Tobacco manufacturers have conducted extensive research on ammonia technology and its effect on nicotine. Through complex chemical reactions, ammonia compounds can produce soothing effects that make the naturally harsh and burning smoke of the tobacco leaf more readily inhalable. But ammonia compounds do much more than this. They also help control the nicotine dosing and generate increased levels of freebase nicotine to cause addiction.

Philip Morris was the first tobacco manufacturer to discover that adding ammonia or ammonia-based compounds during the manufacturing process alters the chemical composition of nicotine and smoothes the smoke.²⁸ Ammonia compounds increase the pH or the alkalinity of smoke and convert the nicotine molecules into a form often referred to as “freebase” nicotine. Freebase nicotine is more readily absorbed by the smoker, offering a faster and more intense fix of nicotine, and the smoother smoke can be more easily inhaled deeply into the lung.²⁹ Like the freebase forms of other drugs, such as freebase cocaine (“crack”), freebase nicotine is recognized as more addictive than its non-freebase counterparts because of the speed with which it reaches the brain.

Increasing the pH and thus the level of free nicotine via ammonia technology delivers more “kick” per milligram of nicotine – increasing the speed and efficiency of nicotine absorption – thus increasing the addictiveness of the product.³⁰ The role of ammonia has been summarized by Dr. Jack Henningfield, an expert in pharmacology and tobacco addiction, in the following way:



“A third thing that ammonia-like compounds can do is increase the pH, increase the amount of freebase nicotine... the free-based form of cocaine or the free based form of nicotine is more rapidly absorbed, has a more explosive effect on the nervous system. Ammonia is one of the ways that you can provide free-based cocaine or free-based nicotine.”³¹

Previously confidential industry documents also contain an explanation of the role of ammonia in increasing the pH level and thus the amount of “free” nicotine:

“As the smoke pH increases above about 6.0, an increasing proportion of the total smoke nicotine occurs in ‘free’ form, which is volatile, rapidly absorbed by the smoker, and believed to be instantly perceived as a nicotine ‘kick’.”³²

“When a cigarette is smoked, nicotine is released momentarily in the free-form. In this form, nicotine is more readily absorbed through the body tissue. Hence it is the free nicotine which is associated with IMPACT, i.e. the higher the free nicotine, the higher the IMPACT.”³³ (emphasis in the original)

Ammonia compounds are among the most frequently used additives, by volume, in the tobacco industry.³⁴ In her final opinion, Judge Kessler found that the cigarette companies were “well aware of the particular chemical characteristics and effects of free nicotine, and undertook efforts to exploit these features.”³⁵

Ammonia technology, not just the Marlboro Man, played a pivotal role in turning Marlboro from a relatively marginal brand in the 1960s and early 1970s into the world’s best-selling cigarette.³⁶ After Marlboro was introduced with higher pH and increased levels of “free” nicotine, sales for the cigarette brand rose sharply and have remained at high levels for decades.³⁷

The tobacco industry devoted significant resources to reverse engineering the chemistry of Marlboro cigarettes to discover what was behind their popularity. Other tobacco manufacturers eventually discovered the role that ammonia played in catapulting Marlboro to the top. By the end of the 1980s, five of the six big tobacco companies were using ammonia technology.³⁸

“This freebase version of Marlboro cigarettes was one of the greatest triumphs in the history of modern drug design and one reason the brand became the world’s most popular cigarette.”

—“The Secret and Soul of Marlboro, Philip Morris and the Origins, Spread, and Denial of Nicotine Freebasing,”

American Journal of Public Health, July 2008

Philip Morris' competitors have acknowledged the critical role that ammonia played in the rapid rise of Marlboro's popularity. In a 1992 document, Brown & Williamson acknowledged, "Looking at all the technology employed in Marlboro on a world-wide basis, ammonia technology remains the key factor."³⁹ Tobacco manufacturers clearly understood the link between increased sales and higher pH.⁴⁰

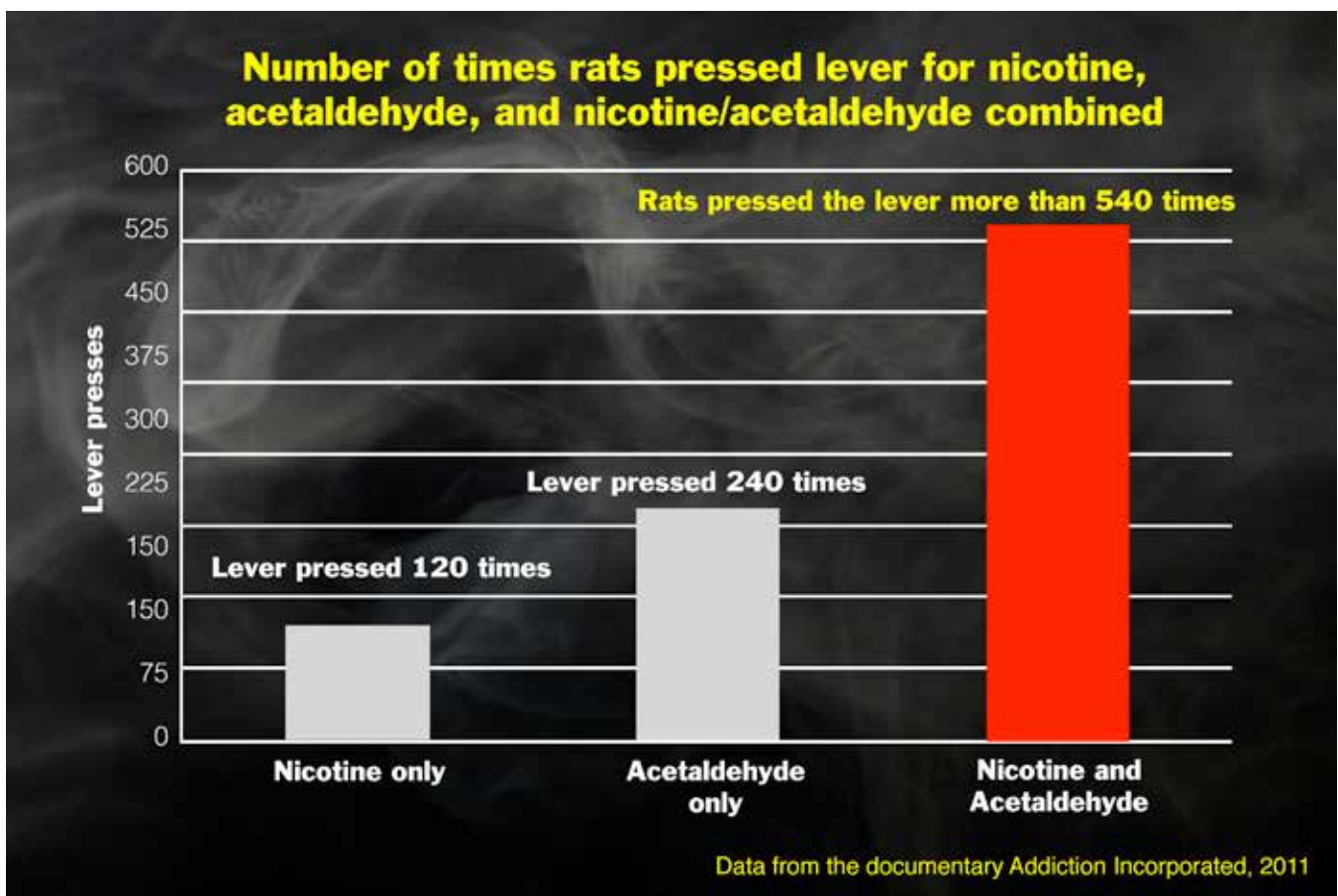
The Critical Role of Ammonia Technology

Ammonia compounds increase the amount of "free" nicotine, which leads to greater and quicker nicotine absorption. Ammonia also smoothes the smoke, which enables smoke to be inhaled more deeply into the lung.

These factors contribute to increased likelihood of addiction.

SUGARS AND ACETALDEHYDE

Sugars like glucose, fructose and sucrose are naturally present in tobacco leaf, but tobacco companies have also added sugars to their products in substantial quantities. For some cigarettes, including Marlboro, sugar is the main constituent after tobacco. When sugars are burned in cigarettes, they form the addiction-enhancing, cancer-causing chemical acetaldehyde.⁴¹ While only minor amounts of acetaldehyde are absorbed into the bloodstream, acetaldehyde is believed to interact with nicotine to enhance nicotine's addictive effects by making receptors in the brain more receptive to nicotine. In fact, animal research conducted by Philip Morris demonstrated a synergistic interaction between nicotine and acetaldehyde – rats pressed the lever more for the combination of nicotine and acetaldehyde than for either substance by itself.⁴²



A report by scientists for the European Union reached the following conclusion:

"... Sugars, polysaccharides and cellulose fibres which are naturally present in tobacco, or sugars added in high quantities to most tobacco products, give rise to numerous aldehydes, such as acetaldehyde, in tobacco smoke. Acetaldehyde given intravenously is self-administered and enhances the addictiveness of nicotine in experimental animals."⁴³

Tobacco companies also add sugars to their products to neutralize tobacco's harsh taste and make the smoke seem milder and easier to inhale. By making cigarettes more palatable to first time users, sugars ultimately increase the risk for addiction because they encourage initiation.⁴⁴ Researchers have concluded that sugars and how they are manipulated in tobacco also significantly contribute to the adverse health effects of smoking.⁴⁵

Why Add Sugars?

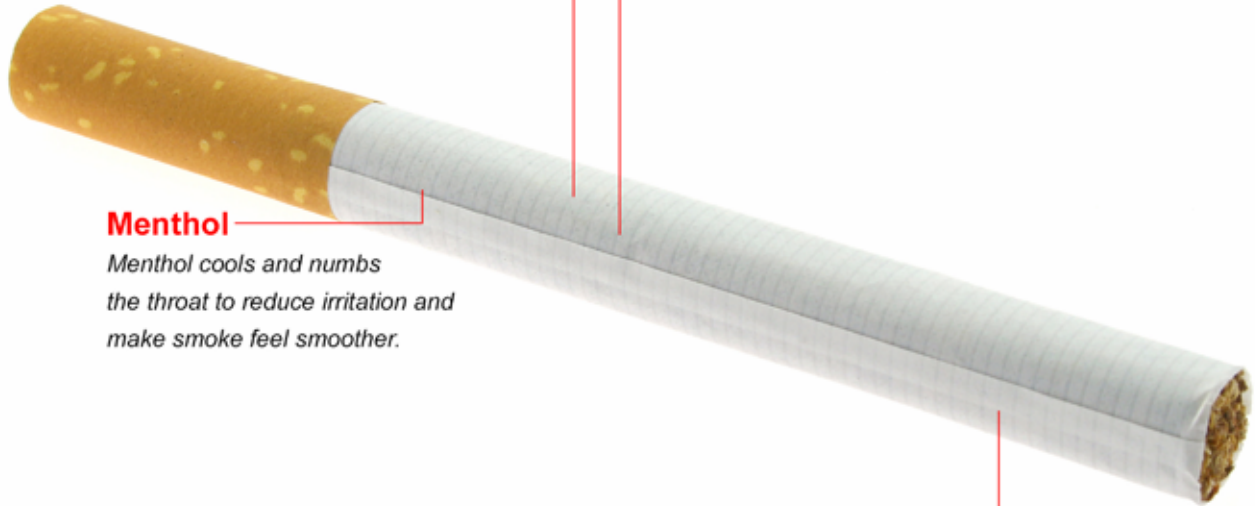
Sugars make it easier to become addicted by making the smoke easier to inhale and by enhancing the impact of nicotine.

Bronchodilators

Added chemicals expand the lungs' airways, making it easier for tobacco smoke to pass into the lungs.

Flavorings

Added flavors like liquorice and chocolate mask the harshness of smoke and make products more appealing to new users, especially kids.



Menthol

Menthol cools and numbs the throat to reduce irritation and make smoke feel smoother.

Levulinic Acid

Added organic acid salts reduce harshness of nicotine and make smoke smoother, less irritating.

Maximizing the Attractiveness of Tobacco Products

“... the close marriage among these sensations (taste, odor, feel) ... gives rise to the smoking enjoyment in the form of desirable blend of sensations or flavor bouquet” — 1975 RJR document — Sensory Testing of Cigarette Smoke

Tobacco companies not only manipulate the addictive properties of their products, they also manipulate the product in ways that both attract starter smokers and enhance the likelihood that they will become regular smokers. Thus, the number of people who become addicted is not just the result of design features and chemical additives that impact nicotine. It is also impacted by design features and additives that affect taste, smell and sight.⁴⁶

For decades, tobacco manufacturers have manipulated these sensory characteristics in ways that increase their products' appeal to specific demographic groups. Many brands are designed to appeal to specific target groups, like youth, women and African Americans. By altering the taste,

smell and other sensory attributes, tobacco manufacturers are able to make it easier to start smoking and create a better experience for the smoker.⁴⁷

Tobacco manufacturers have exploited the distinct sensory preferences among various demographic groups by tailoring products specifically to these preferences.⁴⁸ Decisions regarding product manufacture and design have been made following intensive research on how to make the product appealing to non-smokers, experimenters and specific subgroups.⁴⁹ For example, research suggests that women are most attracted to flavors such as coconut and spearmint and products with a fresh aftertaste and pleasant aroma. As a result, companies have created products with these characteristics.⁵⁰

The evidence demonstrates that tobacco manufacturers undertook extensive research that looked at which characteristics appeal to young people. Tobacco industry documents indicate the companies are aware that attracting new young customers is key to their survival, and they have designed products that appeal to this important market.⁵¹ Tobacco companies have admitted in their own internal documents that, if they don't capture new users by the age of 21, it is very unlikely that they ever will. Indeed, 90 percent of adult smokers began smoking at or before the age of 18.⁵² In 1982, one RJ Reynolds researcher stated:

*"If a man has never smoked by age 18, the odds are three-to-one he never will. By age 21, the odds are twenty-to-one."*⁵³

Since the nicotine in tobacco makes tobacco smoke harsh and difficult to smoke, tobacco manufacturers use chemical additives to alter the taste and the smoothness of tobacco smoke in ways that make tobacco products more appealing to the young, novice smoker.⁵⁴ Additives that increase the attractiveness of the products ultimately increase the risk for addiction and disease by encouraging initiation and repeated use.⁵⁵ Many of them also increase the impact of nicotine, which, in turn, makes the products even more addictive.⁵⁶ Tobacco companies' own documents demonstrate the considerable efforts manufacturers take to determine what characteristics are most likely to attract new customers and make it easier for new users to tolerate tobacco smoke.⁵⁷



This 1969 ad depicts a tobacco company's attempt to associate cigarettes with "freshness." Salem advertised its cigarettes as "Springtime Fresh" in the 1960s and 1970s promoting the idea that these cigarettes were a symbol of purity and vitality. (Source: Stanford Research into the Impact of Tobacco Advertising.)



These Merit ads from the 1990s associated smoking with being in the fresh outdoors. Both ads evoke a sense of relaxation and freedom. (Source: Stanford Research into the Impact of Tobacco Advertising. tobacco.stanford.edu)

A 1973 RJR document (*Some Thoughts About New Brands of Cigarettes for the Youth Market*) demonstrates how tobacco companies design products to attract youth smokers and make it easier for new users to tolerate tobacco smoke. The document details a number of product features that make smoking more tolerable for beginning and learning smokers. For example, it discusses methods of reducing harshness, making the flavor bland since new smokers don't like the taste of the smoke, and improving the "mouth feel" by reducing negatives like hotness and dryness.⁵⁸

Below are several specific examples that demonstrate how the tobacco industry uses additives to attract new tobacco users.

"Tobacco products have been extensively manipulated to make them attractive to target populations, to promote initiation and maintenance of tobacco use."

— 2012 World Health Organization TobReg Report

LEVULINIC ACID

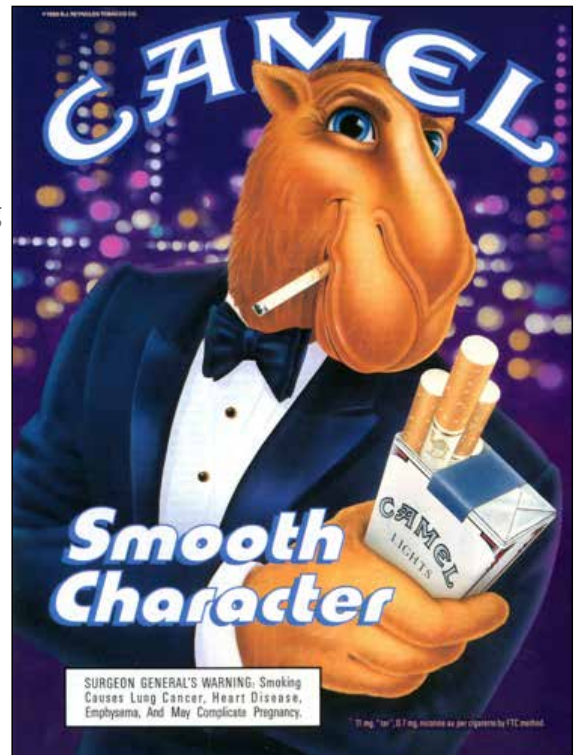
Tobacco companies have discovered that adding organic acid salts, like levulinic acid, reduces the harshness of nicotine. It makes the smoke feel smoother and less irritating.⁵⁹ Levulinic acid also desensitizes the upper respiratory tract, increasing the potential for cigarette smoke to be inhaled deeper into the lungs.⁶⁰ An analysis of tobacco industry documents related to levulinic acid indicates that the levulinic acid also changes the chemistry of the brain to make it more receptive to nicotine by enhancing the binding of nicotine in the brain. As a result, it contributes to increased nicotine absorption and enhances nicotine's impact.⁶¹

According to a review of tobacco industry documents:

“On December 24, 1987, R. J. Reynolds filed for a patent for incorporating levulinic acid as an additive into cigarettes. The principle of the invention was to increase the smoke impact strength by raising the delivered nicotine in smoke, while reducing the inherent harshness of nicotine through levulinic acid or nicotine levulinate. The patent application claimed that cigarettes ‘composed of high nicotine tobaccos and levulinic acid and cigarettes having a salt such as nicotine levulinate incorporated therein can exhibit low U.S. Federal Trade Commission (FTC) ‘tar’ to nicotine ratios while providing a smooth, palatable and flavorful taste.’”⁶²

The Joe Camel campaign, launched by R.J. Reynolds (RJR) in the 1980s, clearly demonstrates that the tobacco industry recognizes the importance of reducing harshness to attract the first-time smokers. Few people realize that it was not just the advertising campaign with the Joe Camel character that was so appealing to young people – it was also the product itself. Through extensive consumer testing and product analysis, R.J. Reynolds determined that the most important characteristic for cigarettes designed for young people was its smoothness and mildness.⁶³ According to a 1985 summary of an RJR product development plan:

“Two key areas identified for improvement were smoothness and sweetness delivery. Smoothness is an identified opportunity area for improvement versus Marlboro, and sweetness can impart a different delivery taste dimension which younger adult smokers may be receptive to.”⁶⁴



1990 magazine ad. (Source: Stanford Research into the Impact of Tobacco Advertising.)

RJR's research and analysis led to the introduction of Camel cigarettes that were less harsh and smoother tasting, making them easier to smoke. RJR was also able to increase nicotine levels during this time period, even though the overall harshness was reduced. The introduction of Camel's "Smooth Character" advertising campaign, which focused on the smoothness of the product, coincided with these design changes.⁶⁵ Following these product changes, Camel's share among 18 year olds increased dramatically from 2.5 percent in 1985 to 14 percent in 1993.⁶⁶ Today, Camel cigarettes remain one of the three most popular brands among youth.⁶⁷

The Role of Levulinic Acid

Levulinic acid reduces the harshness of nicotine and contributes to increased nicotine absorption, enhancing nicotine's impact.

FLAVORINGS

Liquorice and chocolate, in addition to other flavors and additives, reduce the harshness of tobacco products and make them more appealing to new users. Many flavors that are not present in large enough quantities to be considered characterizing flavors still boost the sweetness of tobacco, making it smoother and more appealing, particularly to young people.⁶⁸ Some additives like chocolate and liquorice, when burned in a lit cigarette, produce additional toxins, including carcinogens.

The evidence is clear that tobacco companies have used flavorings, such as liquorice and chocolate, to attract non-smokers:

"Although each tobacco manufacturer carefully guards the secrets of his casing (and flavor) formulas, it is well known that casings for smoking products often contain sugar, liquorice, cocoa, or chocolate liquor and sometimes natural extracts. Of these, liquorice deserves special mention. Just as sugar is used in 'casing' the tobacco to mellow and smooth the smoke, liquorice is used as an adjunct to boost the sweetness of tobacco products. The taste of liquorice to the smoker is that of a mellow sweet woody note which, at proper use levels, greatly enhances the quality of the final product."⁶⁹

"Although by no means conclusive, the results now presented lend some support to the claim that treatment of tobacco with cocoa butter reduces the harshness of the smoke."⁷⁰

The 2009 Family Smoking Prevention and Tobacco Control Act prohibited sales of cigarettes with “characterizing flavors” other than menthol. However, it did not prohibit the use of flavorings in cigarettes that are not present in large enough quantities to be considered characterizing flavors or the use of characterizing flavors in other tobacco products.

A 2014 analysis published in *The New England Journal of Medicine* found that tobacco companies are using the same flavor chemicals in sweet-flavored tobacco products, including cigars of various sizes and smokeless tobacco, that are used in popular candy and drink products such as LifeSavers, Jolly Ranchers and Kool-Aid. The researchers found that several of the tobacco products contained flavor chemicals at much higher concentrations than in the non-tobacco products. According to the researchers, “The same, familiar, chemical-specific flavor sensory cues that are associated with fruit flavors in popular candy and drink products are being exploited in the engineered designs of flavored tobacco products. What we are seeing is truly candy-flavored tobacco.”⁷¹

Why Add Flavorings?

Flavorings boost the sweetness of tobacco, mask the harshness of the smoke and make tobacco products more appealing to young people.

BRONCHODILATORS

Bronchodilators are chemicals that help open the airways of the lungs to allow more air to flow through them. In cigarettes, certain additives are used as bronchodilators to expand the lungs' airways, making it easier for tobacco smoke to pass into the lungs.⁷² Some of these additives also have sweet flavors so they also reduce the harshness and improve the taste of the tobacco. For example, cocoa and chocolate, which contain the bronchodilator theobromine, expand the lungs' airways and make the smoke feel less irritating, making it easier to inhale.⁷³ Glycerin, which is found in the commonly used additive liquorice, also acts as a bronchodilator.⁷⁴



3-D rendering of bronchi. (Source: iStockPhoto.com)

Bronchodilators expand the lungs' airways, allowing tobacco smoke to pass more easily into the lungs.

MENTHOL

Menthol cools and numbs the throat to reduce throat irritation and make the smoke feel smoother.⁷⁵ The U.S. Food and Drug Administration's Tobacco Product Scientific Advisory Committee (TPSAC) in 2011 released a comprehensive report on the use of menthol in cigarettes. TPSAC found that menthol delivered a pleasant minty taste and imparted cooling and smoothing sensations.⁷⁶ These sensations mask the harshness of tobacco smoke and make it easier for beginner smokers to tolerate smoking. The report also found that young people who initiate using menthol cigarettes are more likely to become addicted and become long-term daily smokers.

TPSAC's report concluded that:

"Menthol cannot be considered merely a flavoring additive to tobacco. Its pharmacological actions reduce the harshness of smoke and the irritation from nicotine, and may increase the likelihood of nicotine addiction in adolescents and young adults who experiment with smoking. Furthermore, the distinct sensory characteristics of menthol may enhance the addictiveness of menthol cigarettes, which appears to be the case among youth. TPSAC has found that the availability of menthol cigarettes has adverse impact on public health by increasing the numbers

of smokers with resulting premature death and avoidable morbidity.”⁷⁷

The TPSAC report also concluded that the availability of menthol cigarettes reduces smoking cessation, especially among African-Americans, and increases the overall prevalence of smoking among African-Americans. It found that “menthol cigarettes are marketed disproportionately to younger smokers” and “disproportionately marketed per capita to African-Americans.”⁷⁸

In July, 2013, the FDA released its own scientific analysis of the public health impact of menthol. The report, *Preliminary Scientific Evaluation of the Possible Public Health Effects of Menthol Versus Nonmenthol Cigarettes*, also included strong scientific conclusions regarding the harmful impact of menthol cigarettes on the nation’s health. Specifically, FDA’s report reached three key conclusions regarding the health impact of menthol cigarettes. It found that menthol cigarettes lead to:⁷⁹

- 1) increased smoking initiation among youth and young adults;
- 2) greater addiction; and
- 3) decreased success in quitting smoking.

These extensive scientific reviews leave no doubt that menthol cigarettes have had a profound adverse impact on public health in the United States. The tobacco industry’s manipulation of menthol cigarettes to appeal to specific target markets has resulted in more smoking and more death and disease from tobacco use.

Menthol

Menthol cools and numbs the throat to reduce throat irritation and make the smoke feel smoother.



Design Changes in Recent Decades Have Made Cigarettes More Lethal

“In fact, today’s cigarette smokers – both men and women – have a much higher risk for lung cancer and chronic obstructive pulmonary disease than smokers in 1964, despite smoking fewer cigarettes.” – 2014 Surgeon General’s Report

Not only have design changes in cigarettes over the past several decades made them both more likely to attract new underage users and more addictive, they have also made cigarettes more lethal. As the 2014 Surgeon General’s report concluded, “today’s cigarette smokers – both men and women – have a much higher risk of lung cancer and chronic obstructive pulmonary disease (COPD) than smokers in 1964, despite smoking fewer cigarettes.”⁸⁰ The report further establishes that the increased risk of lung

cancer is the result of tobacco industry changes to the design and composition of cigarettes.

The Surgeon General relied on evidence from large epidemiological studies which demonstrate that there has been a progressive increase in lung cancer and COPD among smokers in the United States between 1959 and 2010. The Surgeon General found that, between 1959 and 2010, the risk of lung cancer to smokers increased tenfold for women and doubled for men. The risk increased despite the fact that the prevalence of smoking and the number of cigarettes consumed per smoker decreased over the same time period.⁸¹

Moreover, the epidemiological evidence demonstrates that the increased rates of lung cancer have only occurred in smokers; there has been no comparable increase for non-smokers. This disparity leaves no doubt that the increase is directly linked to cigarette smoking and points to changes in the cigarette as the likely cause.⁸²

The Surgeon General's report finds that the increase in lung cancer risk from smoking has been accompanied by a change in the type of lung cancer experienced by smokers in the years since the 1960s.⁸³ There has been a dramatic increase in the proportion of lung cancers in the United States that are adenocarcinoma (i.e., cancer of the lining of the lungs). Moreover, the strength of the association between smoking and adenocarcinoma in the United States has also risen dramatically. In the 1950s, the risk of smokers developing adenocarcinoma was only slightly higher than the risk of non-smokers.⁸⁴ Since that time, the risk of developing adenocarcinoma in smokers compared to never smokers has risen dramatically and the increase in the death rate from adenocarcinoma has largely been confined to smokers. By contrast, the death rate from adenocarcinoma for non-smokers has remained unchanged.⁸⁵

The Surgeon General's Report concludes: "The evidence is sufficient to conclude that the increased risk of adenocarcinoma of the lung in smokers results from changes in the design and composition of cigarettes since the 1950s."

The increased risk of adenocarcinoma is the reason for the overall increase in lung cancer. The report identifies two specific changes in the design and composition of cigarettes as the most likely reasons for the increased risk of developing and dying from lung cancer: an increase in the levels of highly carcinogenic tobacco-specific nitrosamines (TSNAs) in U.S. cigarettes and the introduction of ventilation holes in cigarette filters.⁸⁶

"The evidence is sufficient to conclude that the increased risk of adenocarcinoma of the lung in smokers results from changes in the design and composition of cigarettes since the 1950s."

– 2014 Surgeon General's Report

TOBACCO-SPECIFIC NITROSAMINES

Tobacco-specific nitrosamines (TSNAs) are a group of carcinogens formed during tobacco processing that are present in tobacco and tobacco smoke.⁸⁷ The level of TSNAs in different cigarettes varies significantly and depends on the type of tobacco and the curing process used. The two most important TSNAs are NNN and NNK, both of which the FDA has placed on its list of harmful and potentially harmful constituents in cigarettes and smokeless tobacco products. TSNAs are extremely potent carcinogens that cause adenocarcinoma in the lungs of animals. Since the 1960s, the level of TSNAs in American-style cigarettes has increased substantially and the level of TSNAs in the most popular US cigarette brands remains high.⁸⁸

American-style cigarettes contain blends of different tobaccos, including substantial amounts of burley tobacco, which is air dried and blended, whereas cigarette brands in Australia and Canada predominantly contain flue-cured, unblended tobacco. The blended cigarettes in the United States now have dramatically higher levels of TSNAs.⁸⁹ Moreover, in recent years, American cigarette manufacturers have increasingly used reconstituted and expanded tobaccos that utilize tobacco stems. These stems have a high content of nitrates, the building blocks of nitrosamines. In addition, American manufacturers employ propane gas in the curing process, thereby increasing the formation of nitrosamines during curing. All these factors have increased the levels of TSNAs in the tobacco and in the smoke in American-style cigarettes.

As a result, exposure to tobacco-specific nitrosamines is much higher among U.S. smokers than among their counterparts in Australia and Canada.⁹⁰ According to the Surgeon General's report,

“Adenocarcinoma in the United States has increased more steeply, represents a much higher fraction of lung cancer, and has higher absolute incidence rates than those of Australia or Canada.”⁹¹

What is most significant is not that the risk of one form of lung cancer (adenocarcinoma) among smokers has increased over the last 50 years in

“Compared with unblended cigarettes, U.S.-style blended cigarettes have dramatically higher levels of tobacco-specific nitrosamines – an organ-specific carcinogen of adenocarcinoma of the lung in animals. ... Levels of a metabolite of NNK, a tobacco-specific nitrosamine, are an independent risk predictor for the occurrence of lung cancer after controlling for the intensity and duration of smoking.” – 2014 Surgeon General's Report

the United States, it is that the risk of adenocarcinoma in the United States among smokers has increased so substantially that the overall risk of lung cancer among both male and female smokers today is higher – far higher – than it was when the first Surgeon General’s report was issued in 1964. The variation in the change in overall lung cancer rates between the U.S. and other countries point to design changes in U.S. cigarettes, including high levels of TSNAs, as a likely cause.⁹²

Tobacco-Specific Nitrosamines (TSNAs)

TSNAs are potent carcinogens. Changes in cigarette design over the last 50 years have dramatically increased TSNA levels in American cigarettes. The use of burley tobacco in U.S.-style blended cigarettes contributes substantially to the differences in tobacco-specific nitrosamines between U.S.-style cigarettes and those of Canada and Australia. Blended cigarettes in the U.S. have dramatically higher levels of TSNAs compared to flue-cured cigarettes from Australia and Canada.

VENTILATED FILTERS

The Surgeon General identified ventilated filters as another design change that is a likely cause of the increase in smokers' lung cancer risk since the 1960s. Ironically, cigarettes incorporating this design change were successfully marketed by the major cigarette manufacturers as less hazardous than other cigarettes.⁹³ During the 1950s, tobacco industry researchers developed machines capable of measuring the quantity of tar and nicotine produced by cigarettes under standardized conditions. In the 1960s, procedures for such machine testing were adopted by the FTC. The machine test method simulates a standardized puffing protocol, with uniform puff size, rate and cigarette butt size. Beginning in 1968 the FTC reported sales-weighted standard tar and nicotine yield based on this machine-smoking protocol (commonly called the FTC Test Method).

Cigarette manufacturers began using ventilation holes in the filter that diluted the smoke and lowered machine-measured tar and nicotine levels.⁹⁴ The ventilation holes also made the smoke feel lighter and masked the harshness of the smoke. Numerous studies have found that while ventilation holes reduced the amount of tar and nicotine measured by smoking machines, the amounts measured did not accurately reflect the actual amount or even the relative amount of tar and nicotine delivered to the smoker. A landmark 2001 report by the National Cancer Institute evaluated all of the evidence and concluded that cigarettes with lower tar and nicotine levels in these standardized tests did not reduce the risks of disease and premature mortality in smokers.⁹⁵ The primary reason for this is that the machine-smoking protocols did not accurately reflect the smoking behavior of consumers.

As the internal documents of the tobacco industry now show, cigarette manufacturers were aware that smokers who shifted to brands with lower machine-measured tar and nicotine yields with ventilated filters changed their smoking patterns to compensate for the lower standard yields of nicotine. For example, ventilated filters led smokers to block the filter vents, increase puff volume and velocity, and inhale more deeply.⁹⁶ Smokers engaged in this compensatory behavior often without consciously intending

The design changes that lowered tar levels on the standardize machines prompted smokers to smoke in a way that caused the lung to be exposed to greater amounts of toxicants and carcinogens. According to the Surgeon General's report, this change in smoking patterns likely increased the deposition of smoke particles deep in the lung, which in turn, led to an increase in the risk of adenocarcinoma of the lung.

– 2014 Surgeon General's Report

to do so. The result was that there was little or no difference in the intake of nicotine or tar regardless of whether the cigarettes smoked ranked low or high in machine-measured nicotine levels. Moreover, the design changes that lowered tar levels on the standardized machines prompted smokers to smoke in a way that caused cells in the alveoli of the lung (where adenocarcinoma develops) to be exposed to greater amounts of toxicants and carcinogens.⁹⁷ These alveolar cells are the cells that transform into adenocarcinoma. According to the 2014 Surgeon General's report, this change in smoking patterns likely increased the deposition of smoke particles deep in the lung, which in turn led to an increase in the risk of adenocarcinoma of the lung.⁹⁸

Numerous internal documents demonstrate that the tobacco companies also knew that the FTC machine measurements did not accurately reflect the actual or even the relative amount of the tar and nicotine ingested by human smokers or even the relative amount of tar and nicotine ingested by smokers of different cigarettes.⁹⁹ A 1969 Philip Morris report of a study of filter smokers' intake patterns stated that the FTC Test Method has "no practical value for predicting smoke intake."¹⁰⁰ A 1974 Philip Morris document, stated under the heading "SUMMARY": "People do not smoke like the machine [referring to the FTC Test Method] ... generally people smoke in such a way that they get much more than predicted by machine. This is especially true for dilution cigarets [sic]."¹⁰¹ After acknowledging that human smokers get much more tar than indicated by the FTC testing methodology, the document stated in the "CONCLUSION" section: "The FTC standardized test should be retained: 1) It gives low numbers."¹⁰²

Cigarette manufacturers misused and exploited the machine test results to mislead smokers and potential smokers into believing that there was an alternative to quitting even if you were concerned about your health and that you could smoke without suffering the same level of risk as traditional cigarettes. The result: many smokers switched instead of quitting and many people started smoking who might have remained tobacco-free. Cigarette manufacturers marketed cigarettes as "light" or "ultra-light" and implemented extensive marketing campaigns that persuaded smokers that such cigarettes presented a lower risk of disease than full-flavored cigarettes and that the use of such cigarettes represented a preferable alternative to quitting.

"Existing evidence suggest that changes in the pattern of smoking, with a shift to lower tar-yield cigarettes, will likely increase the fraction of cigarette smoke particles deposited in the alveolar region of the lung. This shift may also have played a role in increasing the risk of adenocarcinoma of the lung over time." – 2014 Surgeon General Report

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Whether it's the paper... or the filter... or the tobacco blend...
Kent's the best... from end to end!

KENT has reduced tars and nicotine to the
lowest level among all leading brands.

KENT CIGARETTES

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1959 magazine ad. (Source: Stanford Research into the Impact of Tobacco Advertising.)

NEWEST RELEASE!

U.S. GOV'T REPORT

Herald Gazette

**U.S. GOV'T REPORT:
CARLTON
IS LOWEST.**

U.S. Government laboratory tests confirm
no cigarette lower in tar than Carlton.

**CARLTON
IS LOWEST.**

Box -
less than
0.01 mg. tar,
0.002 mg.
nicotine.

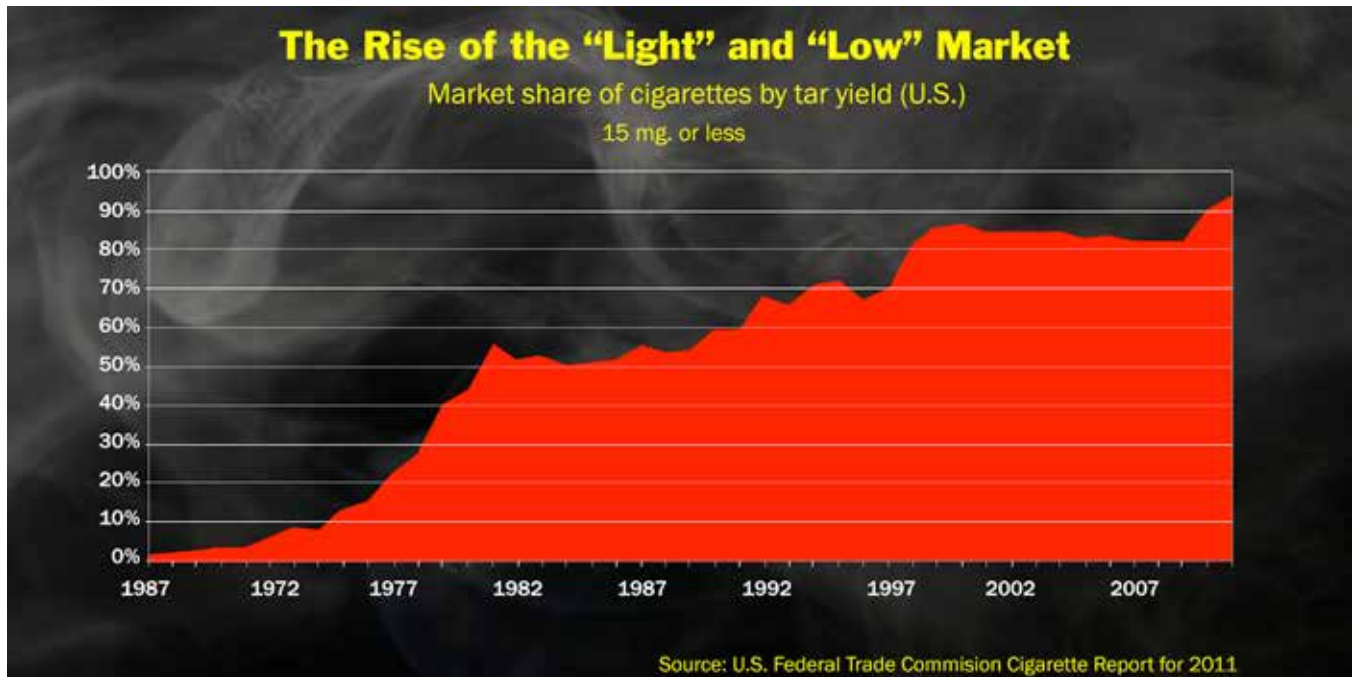
Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

1981 magazine ad. (Source: Stanford Research into the Impact of Tobacco Advertising.)

These marketing campaigns were spectacularly successful. There was a sharp and rapid rise in the use of these cigarettes following their introduction. Rather than quit smoking, millions of smokers switched to “light” and “low-tar” cigarettes under the false impression that they were protecting their health. In one study, 44 percent of smokers indicated that they had switched to a “low-tar” or “low nicotine” cigarette just to reduce their health risk. Half of the smokers of “light” cigarettes and nearly three-fourths of “ultra light” smokers said that they smoke these cigarettes to reduce the tar and nicotine they get from smoking.¹⁰³ According to another survey, smokers believed that, on average, “light” cigarettes presented a 25 percent reduction in risk and “ultra lights” presented a 33 percent reduction in risk compared to regular cigarettes.^{104, 105} By the early 2000s, the numerous varieties of cigarettes with a tar yield of 15 mg or less (many of which were also labeled as “light” and “low-tar”) accounted for the vast majority of cigarettes sold in the United States.

There is now a universal consensus among public health leaders and organizations that smoking cigarettes with lower machine-measured yields of tar and nicotine provides no meaningful benefit to health.¹⁰⁶ The Surgeon

General's 2010 Report stated, "the evidence indicates that changing cigarette designs over the last five decades, including filtered, low-tar, and "light" variations, have not reduced overall disease risk among smokers and may have hindered prevention and cessation efforts."¹⁰⁷ What is new is the emerging recognition that the very design change that lowered machine tar and nicotine ratings has in all likelihood increased the risk of smoking-related disease.



The role of the major tobacco companies in perpetrating the "light" cigarette fraud has been proven beyond any reasonable doubt. After an exhaustive trial and the presentation of a massive amount of evidence, U.S. District Court Judge Gladys Kessler found, and the U.S. Court of Appeals for the DC Circuit upheld, that the companies have known for decades that there is no health benefit from smoking low-tar or low nicotine cigarettes as opposed to conventional, full-flavored cigarettes; that the machine test method for measuring tar and nicotine was unreliable for measuring the amount of tar and nicotine a smoker would absorb in part because it did not take into account addiction and the phenomenon of smoker compensation; and that smokers were concerned and anxious about the health effects of smoking and chose light cigarettes because they relied on the health claims that the companies falsely made for light cigarettes as a reason for not quitting.¹⁰⁸ Despite this knowledge, the companies extensively – and successfully – marketed and promoted their low-tar and light cigarettes in ways that led consumers to believe they were less harmful alternatives to full-flavor cigarettes.¹⁰⁹

As a result of this evidence, the 2009 Tobacco Control Act prohibited the use of descriptors such as "light," "smooth," or "mild" for cigarettes sold in the United States beginning in 2010. The same prohibition is included in the

WHO Framework Convention on Tobacco Control, a global treaty that has been ratified by 178 nations. Despite this prohibition, cigarette manufacturers continue to market such cigarettes and communicate the same misleading messages by color-coding their packs.¹¹⁰ Thus, products incorporating the same cigarette design elements responsible for increasing the risk of lung cancer to smokers remain dominant in the marketplace.

Ventilated Filters

Ventilation holes in the filters dilute the smoke and lower machine-measured yields of tar and nicotine. As a result, tobacco companies marketed these products as less risky and less harmful to health, despite knowing this was not in fact the case.

Bronchodilators

Added chemicals expand the lungs' airways, making it easier for tobacco smoke to pass into the lungs.

Increased Nicotine

Tobacco companies control the delivery and amount of nicotine to ensure addiction

Flavorings

Added flavors like liquorice and chocolate mask the harshness of smoke and make products more appealing to new users, especially kids.

Tobacco-specific Nitrosamines

American-style cigarettes are made with blended tobacco that has much higher levels of cancer-causing nitrosamines.

Ammonia Compounds

Adding ammonia compounds increases the speed with which nicotine hits the brain.

Menthol

Menthol cools and numbs the throat to reduce irritation and make smoke feel smoother.

Ventilated Filters

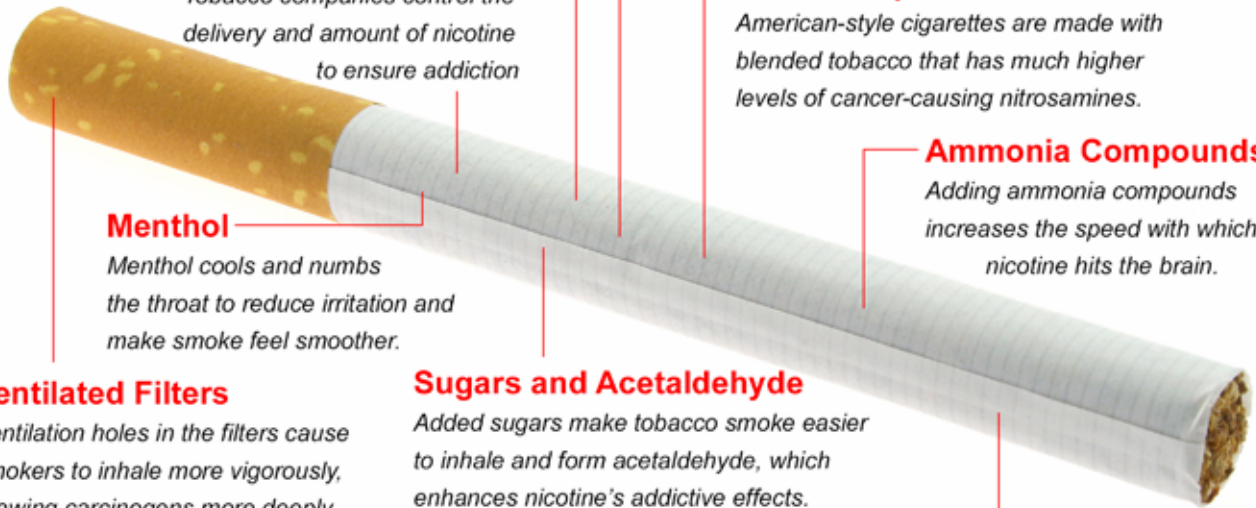
Ventilation holes in the filters cause smokers to inhale more vigorously, drawing carcinogens more deeply into the lungs.

Sugars and Acetaldehyde

Added sugars make tobacco smoke easier to inhale and form acetaldehyde, which enhances nicotine's addictive effects.

Levulinic Acid

Added organic acid salts reduce harshness of nicotine and make smoke smoother, less irritating.



Conclusion

Fifty years ago, the U.S. Surgeon General concluded that cigarettes were a major cause of cancer and other serious diseases. In the absence of government oversight, what has been the response of the tobacco industry? Instead of redesigning its products to reduce the number of people who die prematurely from using them, this report details how the tobacco industry has used the last 50 years to make cigarettes more dangerous, more addictive and more appealing to youth and other non-smokers. They took a bad product and made it worse with design changes and ingredients that:

- Increased the risk of disease to cigarette smokers;
- Made it easier to become addicted and harder to quit; and
- Made cigarettes more appealing to youth, women and other populations.

The challenge is what to do in light of these facts. It is the responsibility of government to act. As the Surgeon General's report notes, **"above all, if the risk of lung cancer has increased with changes in the design and composition of cigarettes, then the potential exists to reverse that increase in risk through changes in design and composition."**

In 2009 Congress passed the Family Smoking Prevention and Tobacco Control Act (Tobacco Control Act). This law gives the FDA authority to finally address this long history of product manipulation by the tobacco industry.

For the first time, a government agency – the FDA – has the authority to regulate the tobacco product itself. The FDA must use this authority to regulate the design and contents of cigarettes and other tobacco products to reduce the number of Americans who become sick and die from using them. In light of the findings of the latest Surgeon General’s report, it is especially critical that the FDA move quickly to establish product standards that would end practices that make tobacco products more harmful, more addictive and more attractive to kids. There is no justification for allowing tobacco companies to make product changes that cause more people to die from cancer and other serious diseases. There is no justification for allowing cigarette manufacturers to manipulate nicotine levels and delivery in ways that make their products more addictive or that lead to another generation of youth becoming addicted.

To accelerate progress in reducing tobacco use, the latest Surgeon General’s report calls for a series of specific actions, including “effective implementation of FDA’s authority for tobacco product regulation in order to reduce tobacco product addictiveness and harmfulness.” It is critical that FDA begin the process immediately to require manufactures to reduce the toxicity of their products, reduce nicotine levels to minimize addiction; and prevent tobacco companies from adding ingredients that attract youth. If used effectively, the FDA’s new regulatory power has the potential to have a dramatic impact in reducing tobacco use and its terrible health and financial toll in the United States.

Sources

- ¹ U.S. Department of Health and Human Services. The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014. <http://www.surgeongeneral.gov/library/reports/50-years-of-progress/index.html>.
- ² U.S. Department of Health and Human Services. The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General, 2014.
- ³ U.S. v. Philip Morris, USA, Inc., 449 F. Supp. 2d (D.D.C. 2006).
- ⁴ U.S. v. Philip Morris, USA, Inc., 449 F. Supp. 2d (D.D.C. 2006) at 309.
- ⁵ U.S. Department of Health and Human Services, A Report of the Surgeon General: How Tobacco Smoke Causes Disease – The Biology and Behavioral Basis for Smoking-Attributable Diseases, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2010.
- ⁶ U.S. Department of Health and Human Services. The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General, 2014.
- ⁷ Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), Addictiveness and Attractiveness of Tobacco Additives, 2010.
- ⁸ U.S. Department of Health and Human Services, A Report of the Surgeon General: How Tobacco Smoke Causes Disease – The Biology and Behavioral Basis for Smoking-Attributable Diseases, 2010.
- ⁹ World Health Organization (WHO), Study Group on Tobacco Product Regulation (TobReg), Report on the Scientific Basis of Tobacco Product Regulation, WHO Technical Report Series 967, 2012.
- ¹⁰ WHO, TobReg, Report on the Scientific Basis of Tobacco Product Regulation, WHO Technical Report Series 967, 2012.
- ¹¹ SCENIHR, Addictiveness and Attractiveness of Tobacco Additives, 2010.
- ¹² Evans v. Lorillard, 990 N.E. 2d 997 (Mass. 2013).
- ¹³ Evans v. Lorillard, 990 N.E. 2d 997 (Mass. 2013).
- ¹⁴ U.S. v. Philip Morris, USA, Inc., 449 F. Supp. 2d (D.D.C. 2006) at 309.
- ¹⁵ Wayne, GF & Carpenter, CM, “Tobacco Industry Manipulation of Nicotine Dosing,” Handbook of Experimental Psychology (192):457-85, 2009.
- ¹⁶ U.S. v. Philip Morris, USA, Inc., 449 F. Supp. 2d (D.D.C. 2006) at 383-84.
- ¹⁷ Land, Thomas, et al., “Recent Increases in Efficiency in Cigarette Nicotine Delivery: Implications for Tobacco Control,” Nicotine & Tobacco Research, January 13, 2014.
- ¹⁸ Connolly, GN, et al., “Trends in Smoke Nicotine Yield and Relationship to Design Characteristics Among Popular U.S. Cigarette Brands, 1997-2005,” Tobacco Control 16(5):e5, 2007.
- ¹⁹ U.S. Department of Health and Human Services (USDHHS), Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General, 2012; USDHSS, How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General, 2010.
- ²⁰ U.S. Department of Health and Human Services. The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General, 2014.
- ²¹ USDHHS, How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General, 2010.
- ²² USDHHS, Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General, 2012.
- ²³ Tobacco: The Smoking Gun, Prepared for The Citizens’ Commission to Protect the Truth, CASA White Paper, October 2007.
- ²⁴ SCENIHR, Addictiveness and Attractiveness of Tobacco Additives, 2010.
- ²⁵ Bates, C, Jarvis, M, & Connolly, G, Tobacco additives: Cigarette engineering and nicotine addiction, ASH UK, July 14, 1999.
- ²⁶ SCENIHR, Addictiveness and Attractiveness of Tobacco Additives, 2010.
- ²⁷ WHO, TobReg, Report on the Scientific Basis of Tobacco Product Regulation, WHO Technical Report Series 945, 2008; Bates C, Jarvis M, & Connolly GN, Tobacco Additives, Cigarette Engineering and Nicotine Addiction, ASH UK, July 14, 1999, http://www.ash.org.uk/files/documents/ASH_623.pdf.
- ²⁸ Stevenson, T & Proctor, RN, “The Secret and Soul of Marlboro, Philip Morris and the Origins, Spread and Denial of Nicotine Freebasing,” American Journal of Public Health 98(7):1184-94, July 2008.
- ²⁹ WHO, TobReg, Report on the Scientific Basis of Tobacco Product Regulation, WHO Technical Report Series 945, 2008.
- ³⁰ Henningfield, JE & Zeller, M, “Could Science-Based Regulation Make Tobacco products Less Addictive?” Yale Journal of Health Policy Law Ethics 3(1):127-38, 2002.

- ³¹ Bates, C, Jarvis, M, & Connolly, G, Tobacco additives: Cigarette engineering and nicotine addiction, ASH UK, July 14, 1999.
- ³² Bates, C, Jarvis, M, & Connolly, G, Tobacco additives: Cigarette engineering and nicotine addiction, ASH UK, July 14, 1999; McKenzie, JL, Product characterization definitions and implications, R.J. Reynolds memo, September 21, 1976, Bates No. USX4621082-5.
- ³³ Bates, C, Jarvis, M, & Connolly, GN, Tobacco Additives, Cigarette Engineering and Nicotine Addiction, ASH UK, July 14, 1999.
- ³⁴ U.S. v. Philip Morris, USA, Inc., 449 F. Supp. 2d (D.D.C. 2006) at 356.
- ³⁵ U.S. v. Philip Morris, USA, Inc., 449 F. Supp. 2d (D.D.C. 2006) at 355.
- ³⁶ Bates, C, Jarvis, M, & Connolly, G, Tobacco additives: Cigarette engineering and nicotine addiction, ASH UK, July 14, 1999.http://newash.org.uk/files/documents/ASH_623.pdf
- ³⁷ Stevenson, T & Proctor, RN, "The Secret and Soul of Marlboro, Philip Morris and the Origins, Spread and Denial of Nicotine Freebasing," American Journal of Public Health 98(7):1184-94, July 2008.
- ³⁸ Stevenson, T & Proctor, RN, "The Secret and Soul of Marlboro, Philip Morris and the Origins, Spread and Denial of Nicotine Freebasing," American Journal of Public Health 98(7):1184-94, July 2008.
- ³⁹ Gordon, DL, "PM's Global Strategy: Marlboro Product Technology," Brown & Williamson Tobacco Corporation Research & Development R&D-B000-92, August 26, 1992, Bates No. 620943165-3216.
- ⁴⁰ Bates, C, Jarvis, M, & Connolly, G, Tobacco additives: Cigarette engineering and nicotine addiction, ASH UK, July 14, 1999.
- ⁴¹ Talhout, R, et al., "Sugars as tobacco ingredient: effects on mainstream smoke composition," Food and Chemical Toxicology 44(11):1789-1798, 2006.
- ⁴² Rabinoff, M, et al., "Pharmacological and Chemical Effects of Cigarette Additives," American Journal of Public Health 97(11):1981-91, November 2007; SCENIHR, Addictiveness and Attractiveness of Tobacco Additives, 2010.
- ⁴³ SCENIHR, Addictiveness and Attractiveness of Tobacco Additives, 2010.
- ⁴⁴ Talhout, R, et al., "Sugars as tobacco ingredient: effects on mainstream smoke composition," Food and Chemical Toxicology 44(11):1789-1798, 2006.
- ⁴⁵ Talhout, R, et al., "Sugars as tobacco ingredient: effects on mainstream smoke composition," Food and Chemical Toxicology 44(11):1789-1798, 2006.
- ⁴⁶ Carpenter, CM, et al., "The role of sensory perception in the development and targeting of tobacco products," Addiction 102:136-147, 2007; WHO, TobReg, Report on the Scientific Basis of Tobacco Product Regulation, WHO Technical Report Series 945, 2008.
- ⁴⁷ SCENIHR, Addictiveness and Attractiveness of Tobacco Additives, 2010.
- ⁴⁸ Carpenter, CM, et al., "The role of sensory perception in the development and targeting of tobacco products," Addiction 102:136-147, 2007.
- ⁴⁹ Bates C, Jarvis M, Connolly GN, Tobacco Additives, Cigarette Engineering and Nicotine Addiction, ASH UK, July 14, 1999; Rabinoff, M, et al., "Pharmacological and chemical effects of cigarette additives," American Journal of Public Health 97:1981-91, 2007.
- ⁵⁰ Carpenter, CM, et al., "Designing cigarettes for women: new findings from the tobacco industry documents," Addiction 100:837-851, 2005.
- ⁵¹ WHO, TobReg, Report on the Scientific Basis of Tobacco Product Regulation, WHO Technical Report Series 967 (2012).
- ⁵² Calculated based on data in the National Survey on Drug Use and Health (NSDUH), 2012.
- ⁵³ RJ Reynolds, "Estimated Change in Industry Trend Following Federal Excise Tax Increase," September 10, 1982, Bates No. 513318387/8390.
- ⁵⁴ SCENIHR, Addictiveness and Attractiveness of Tobacco Additives, 2010; Rabinoff, M, et al., "Pharmacological and chemical effects of cigarette additives," American Journal of Public Health 97:1981-91, 2007.
- ⁵⁵ Rabinoff, M, et al., "Pharmacological and chemical effects of cigarette additives," American Journal of Public Health 97:1981-91, 2007; SCENIHR, Addictiveness and Attractiveness of Tobacco Additives, 2010.
- ⁵⁶ WHO, TobReg, Report on the Scientific Basis of Tobacco Product Regulation, WHO Technical Report Series 967, 2012.
- ⁵⁷ Teague, CE, "Research Planning Memorandum on Some Thoughts About New Brands of Cigarettes for the Youth Market," R.J. Reynolds memo, February 2, 1973, Bates No. 502987357-7368; Wayne, GF & Connolly, GN, "How Cigarette Design Can Affect Youth Initiation into Smoking: Camel Cigarettes, 1983-1993," Tobacco Control 11:i32 - i39, March 2002.
- ⁵⁸ Teague, CE, "Research Planning Memorandum on Some Thoughts About New Brands of Cigarettes for the Youth Market," R.J. Reynolds memo, February 2, 1973, Bates No. 502987357-7368.
- ⁵⁹ Bates, C, Jarvis, M, & Connolly, G, Tobacco additives: Cigarette engineering and nicotine addiction, ASH UK, July 14, 1999.
- ⁶⁰ Keithly, L, et al., "Industry research on the use and effects of levulinic acid: A case study in cigarette additives," Nicotine & Tobacco Research 7(5):761-71, October 2005; Bates, C, Jarvis, M, & Connolly, G, Tobacco additives: Cigarette engineering and nicotine addiction, ASH UK, July 14, 1999.

⁶¹ Keithly, L, et al., "Industry research on the use and effects of levulinic acid: A case study in cigarette additives," *Nicotine & Tobacco Research* 7(5):761-71, October 2005; Bates C, Jarvis M, Connolly GN, Tobacco Additives, Cigarette Engineering and Nicotine Addiction, ASH UK, July 14, 1999; Rabinoff, M, et al., "Pharmacological and chemical effects of cigarette additives," *American Journal of Public Health* 97:1981-91, 2007.

⁶² Keithly, L, et al., "Industry research on the use and effects of levulinic acid: A case study in cigarette additives," *Nicotine & Tobacco Research* 7(5):761-71, October 2005.

⁶³ Wayne, GF & Connolly, GN, "How Cigarette Design Can Affect Youth Initiation into Smoking: Camel Cigarettes, 1983-1993," *Tobacco Control* 11:i32 - i39, March 2002.

⁶⁴ Gemma, JL, RESULTS OF MDM COMMITTEE MEETING - AUGUST 13, 1985, R.J. Reynolds memo, August 16, 1985, Bates No. 509600313-18.

⁶⁵ Wayne, GF & Connolly, GN, "How Cigarette Design Can Affect Youth Initiation into Smoking: Camel Cigarettes, 1983-1993," *Tobacco Control* 11:i32 - i39, March 2002.

⁶⁶ Wayne, GF & Connolly, GN, "How Cigarette Design Can Affect Youth Initiation Into Smoking: Camel Cigarettes, 1983-1993," *Tobacco Control* 11:i32 - i39, March 2002.

⁶⁷ Calculated based on data from the 2012 NSDUH.

⁶⁸ Bates C, Jarvis M, & Connolly GN, Tobacco Additives, Cigarette Engineering and Nicotine Addiction, ASH UK, July 14, 1999; SCENIHR, Addictiveness and Attractiveness of Tobacco Additives, 2010.

⁶⁹ British American Tobacco, Tobacco Flavoring For Smoking Products, Bates No. 104805407, FN F1500.

⁷⁰ British American Tobacco, Cocoa Butter As A Tobacco Additive, October 1967, Bates No. 105534584, FN B4263.

⁷¹ Brown, Jessica, et al., "The Candy Flavorings in Tobacco," *Research Letter*, *New England Journal of Medicine*, May 7, 2014.

⁷² Bates C, Jarvis M, & Connolly GN, Tobacco Additives, Cigarette Engineering and Nicotine Addiction, ASH UK, July 14, 1999.

⁷³ Bates C, Jarvis M, & Connolly GN, Tobacco Additives, Cigarette Engineering and Nicotine Addiction, ASH UK, July 14, 1999; WHO, TobReg, Report on the Scientific Basis of Tobacco Product Regulation, WHO Technical Report Series 967, 2012.

⁷⁴ Bates C, Jarvis M, & Connolly GN, Tobacco Additives, Cigarette Engineering and Nicotine Addiction, ASH UK, July 14, 1999; Rabinoff, M, et al., "Pharmacological and chemical effects of cigarette additives," *American Journal of Public Health* 97:1981-91, 2007.

⁷⁵ WHO, TobReg, Report on the Scientific Basis of Tobacco Product Regulation, WHO Technical Report Series 967, 2012; SCENIHR, Addictiveness and Attractiveness of Tobacco Additives, 2010.

⁷⁶ Tobacco Products Scientific Advisory Committee, Menthol Cigarettes and Public Health: Review of the Scientific Evidence and Recommendations, July 21, 2011, <http://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/TobaccoProductsScientificAdvisoryCommittee/UCM269697.pdf>.

⁷⁷ Tobacco Products Scientific Advisory Committee, Menthol Cigarettes and Public Health: Review of the Scientific Evidence and Recommendations, July 21, 2011.

⁷⁸ Tobacco Products Scientific Advisory Committee, Menthol Cigarettes and Public Health: Review of the Scientific Evidence and Recommendations, July 21, 2011.

⁷⁹ U.S. Food and Drug Administration (FDA), Preliminary Scientific Evaluation of the Possible Public Health Effects of Menthol Versus Nonmenthol Cigarettes, July 2013, <http://www.fda.gov/down->

[loads/ScienceResearch/SpecialTopics/PeerReviewofScientificInformationandAssessments/UCM361598.pdf](http://www.fda.gov/downloads/ScienceResearch/SpecialTopics/PeerReviewofScientificInformationandAssessments/UCM361598.pdf).

⁸⁰ U.S. Department of Health and Human Services. The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General, 2014. <http://www.surgeongeneral.gov/library/reports/50-years-of-progress/index.html>

⁸¹ U.S. Department of Health and Human Services. The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General, 2014; Thun, MJ, et al., "50-Year Trends in Smoking-Related Mortality in the United States," *New England Journal of Medicine* 368(4):351-64, January 24, 2013; Thun MJ, Heath, Jr., CW, "Changes in mortality from smoking in two American Cancer Society prospective studies since 1959," *Preventive Medicine* 26(4):422-6, 1997.

⁸² Thun, MJ, et al., "50-Year Trends in Smoking-Related Mortality in the United States," *New England Journal of Medicine* 368(4):351-64, January 24, 2013; Burns, DM, et al., "Do changes in cigarette design influence the rise in adenocarcinoma of the lung?" *Cancer Causes Control* 22:13-22, 2011. Thun, MJ, et al., "Lung cancer occurrence in never-smokers: an analysis of 13 cohorts and 22 cancer registry studies," *PLoS Medicine* 5(9):e185, 2008; Thun, MJ, et al., "Lung cancer death rates in lifelong nonsmokers," *Journal of the National Cancer Institute* 98(10):691-9, 2006.

⁸³ HHS, The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General, 2014; Wingo, PA, et al., "Annual report to the nation on the status of cancer, 1973-1996, with a special section on lung cancer and tobacco smoking," *Journal of the National Cancer Institute* 91(8):675-90, 1991; Burns, DM, et al., "Do changes in cigarette design influence the rise in adenocarcinoma of the lung?" *Cancer Causes Control* 22:13-22, 2011.

⁸⁴ Kreyberg, L, "Histological lung cancer types. A morphological and biological correlation," *Acta Pathologica et Microbiologica Scandinavica, Supplementum* 157:1-92, 1962.

⁸⁵ Thun, MJ, et al., "Cigarette smoking and changes in the histopathology of lung cancer," *Journal of the National Cancer Institute* 89(21):1580-6, 1997.

⁸⁶ HHS, *The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General*, 2014; Burns, DM, et al., "Do changes in cigarette design influence the rise in adenocarcinoma of the lung?" *Cancer Causes Control* 22:13-22, 2011.

⁸⁷ Hecht, SS and Hoffmann D., "Tobacco-specific nitrosamines, an important group of carcinogens in tobacco and tobacco smoke," *Carcinogenesis* June 9(6):875-84, 1988.

⁸⁸ Stepanov, I, et al., "Carcinogenic tobacco-specific N-nitrosamines in US cigarettes: three decades of remarkable neglect by the tobacco industry," *Tobacco Control* 21(1):44-8, January 2012.

⁸⁹ HHS, *The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014.

⁹¹ HHS, *The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General*, 2014; Yuan, JM, et al., "Urinary levels of the tobacco-specific carcinogen N'-nitrosonornicotine and its glucuronide are strongly associated with esophageal cancer risk in smokers," *Carcinogenesis* 32(9):1366-71, September 2011. Yuan, JM, et al., "Urinary levels of cigarette smoke constituent metabolites are prospectively associated with lung cancer development in smokers," *Cancer Research* 71(21):6749-57, November 1, 2011; Yu, MC, et al., "Urinary levels of tobacco-specific nitrosamine metabolites in relation to lung cancer development in two prospective cohorts of cigarette smokers," *Cancer Research* 69(7):2990-5, 2009.

⁹¹ HHS, *The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General*, 2014.

⁹² Devesa, SS, et al., "International lung cancer trends by histologic type: male:female differences diminishing and adenocarcinoma rates rising," *International Journal of Cancer* 117(2):294-9, 2005.

⁹³ NIH, NCI, *Risks Associated with Smoking Cigarettes with Low Machine-Yields of Tar and Nicotine*; Report of the NCI Expert Committee, *Smoking and Tobacco Control Monograph* 13, October 2001.

⁹⁴ NIH, NCI, *Risks Associated with Smoking Cigarettes with Low Machine-Yields of Tar and Nicotine*; Report of the NCI Expert Committee, *Smoking and Tobacco Control Monograph* 13, October 2001; HHS, *The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General*, 2014.

⁹⁵ NIH, NCI, *Risks Associated with Smoking Cigarettes with Low Machine-Yields of Tar and Nicotine*; Report of the NCI Expert Committee, *Smoking and Tobacco Control Monograph* 13, October 2001.

⁹⁶ NIH, NCI, *Risks Associated with Smoking Cigarettes with Low Machine-Yields of Tar and Nicotine*; Report of the NCI Expert Committee, *Smoking and Tobacco Control Monograph* 13, October 2001; Kozlowski, LT, et al., "Smokers' Misperceptions of Light and Ultra-Light Cigarettes May Keep Them Smoking," *American Journal of Preventive Medicine* 15(1):9-16, July 1998.

⁹⁷ WHO, *TobReg, The Scientific Basis of Tobacco Product Regulation: Report of a WHO Study Group*. WHO Technical Report Series 951, 2008; WHO, *TobReg, The Scientific Basis of Tobacco Product Regulation: Report of a WHO Study Group*. WHO Technical Report Series 945, 2007.

⁹⁸ HHS, *The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General*, 2014.

⁹⁹ See, e.g., *U.S. v. Philip Morris USA, Inc.*, 449 F. Supp.2d 1, 461 (D.D.C. 2006).

¹⁰⁰ Laurene, AH & Piehl, DH, *Philip Morris Smoking Behavior Study Labelled SEX-1*, March 17, 1971, Bates No. 504208317-8360 at 8319.

¹⁰¹ Philip Morris, *Some Unexpected Observations on Tar and Nicotine and Smoker Behavior*, March 1, 1974, Bates No. 1000260363-80.

¹⁰² Philip Morris Cos., Inc. "Human Smoking Behavior". 1983. Bates No: 2500126796-2500126862.

¹⁰³ National Center for Health Statistics, *National Health Interview Survey Cancer Control Supplement, Public use data tape*, 1987, in *The FTC Cigarette Test Method for Determining Tar, Nicotine, and Carbon Monoxide Yields of U.S. Cigarettes*; Report of the NCI Expert Committee, NIH, NCI, *Smoking and Tobacco Control Monograph* 7, 1996.

¹⁰⁴ NIH, NCI, *Risks Associated with Smoking Cigarettes with Low Machine-Yields of Tar and Nicotine*; Report of the NCI Expert Committee, *Smoking and Tobacco Control Monograph* 13, October 2001.

¹⁰⁵ Shiffman, S, et al., "Smokers beliefs about light and ultralight cigarettes," *Tobacco Control* 10(Suppl I):i17-i23, 2001.

¹⁰⁶ USDHHS, *The Health Consequences of Smoking. A Report of the Surgeon General*, USDHHS, CDC, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2004, <http://www.surgeon-general.gov/library/smokingconsequences/>.

¹⁰⁷ USDHHS, *How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General*, 2010.

¹⁰⁸ *U.S. v. Philip Morris USA, Inc.*, 449 F. S Supp. 1 at 560-561 (D.D.C. 2006).

¹⁰⁹ *U.S. v. Philip Morris USA, Inc.*, 449 F. Supp. 1 at 560-561 (D.D.C. 2006).

¹¹⁰ Connolly, Gregory N. and Alpert, Hillel A., "Has the tobacco industry evaded the FDA's ban on 'Light' cigarette descriptors?" *Tobacco Control* (23), 140-145, 2014.