

All about smoking

A cigarette is the only consumer product which, when consumed as intended, kills half of its regular consumers. This information sheet explains the physical and biological aspects of tobacco smoking. In particular it focuses on: what's in a cigarette, the role of addiction in smoking and the physical effects of just one cigarette.

What's in a cigarette?

"Thus a tobacco product is, in essence, a vehicle for delivery of nicotine, designed to deliver the nicotine in a generally acceptable and attractive form . . . Our industry is then based upon design, manufacture and sale of attractive dosage forms of nicotine."

1972 memo, "The nature of the tobacco business and the crucial role of nicotine therein," by R.J. Reynolds Tobacco Co. scientist Claude E. Teague

Tobacco is the main ingredient in cigarettes. A manufactured cigarette is made up of two main types.

- Cured types - flue cured, light and dark air cured, sun cured
- Reconstituted (stems, ribs etc) and expanded tobacco. Both of these lead to cheaper cigarettes by using less tobacco.

Cigarette additives

Cigarette manufacturers have spent many years manipulating what goes into cigarettes by using additives.

Additive types include

- **Humectants** - up to 5% of the weight of a cigarette. These preserve moisture, as dry tobacco has harsh taste. Glycerol and propylene glycol are most commonly used.
- **Flavour** - added to counteract reductions in flavour due to filters and the use of reconstituted tobacco. Natural and synthetic flavour enhancers are used to give woody, spicy, minty, fruity, sweet and flowery

flavours. Flavours also mask the 'harshness' of smoking, and may help young smokers begin and continue smoking.

Others, such as menthol, numb a smoker's throat. **Ammonia** raises smoke pH, enabling more nicotine to be absorbed.

"The secret of Marlboro is ammonia."

Scientist in 1989 Brown & Williamson Tobacco report

The Australian government has requested disclosure of ingredients and emissions for all brands of cigarette sold in Australia.

www.health.gov.au/tobacco

There is no legal requirement for ingredient disclosure for tobacco products as exists for food manufacturers.

Nicotine, a poisonous substance

"The cigarette was viewed as an engineered device for the specific purpose of delivering nicotine into the human body."

Stanford University Biochemical Engineering Professor Channing Robertson at the Minnesota Tobacco Trial

Nicotine is the drug in tobacco, which causes addiction among smokers. It is a highly toxic chemical, and is often used in industrial pesticides. It is regulated in all circumstances apart from in cigarettes.

Smokers inhale a very small dose of nicotine, and are not at risk of nicotine poisoning. However, children who eat or swallow cigarettes or butts should receive medical attention immediately.

Nicotine has a number of direct effects on the body. It stimulates the sympathetic nervous system, increases the heart rate and blood pressure, and causes constriction of the small blood vessels under the skin.

Carbon monoxide (CO)

Carbon monoxide (CO) is an odourless, tasteless gas, giving no warning of its presence in most circumstances. In large amounts it is rapidly fatal. CO is strongly linked with the development of coronary heart disease. CO is formed when a cigarette is lit.

Tar

This is the term used to describe the mixture that is formed from the tiny particles in cigarette smoke. All cigarettes contain tar, even 'light' or mild cigarettes.

Tar is made up of lots of chemicals - mainly nitrogen, oxygen, hydrogen, carbon dioxide, and carbon monoxide as well as numerous organic chemical compounds. Also found in tar are **carcinogenic compounds** - chemicals that may trigger cancer - such as nitrosamines and polycyclic aromatic hydrocarbons.

Other chemicals

Tobacco smoke contains many chemicals, some of which are poisonous and others that cause cancer.

Many of the chemicals in tobacco smoke cause cancer when painted on the skin of laboratory animals such as rats and mice. In smokers, chemicals in tobacco smoke may damage genetic material in cells. Smokers absorb these carcinogenic chemicals through their lungs, contributing to cancer in lungs and other parts of the body such as the bladder, kidney and pancreas.

Tobacco smoke contains chemicals such as hydrogen cyanide, ammonia, nitrogen dioxide, acrolein, and formaldehyde. These chemicals paralyse the cilia (tiny hair-like processors on the cells lining the airways), which clear mucus and anything that deposits on them. Smokers' lungs are more sensitive to cancer-causing chemicals because their cilia do not clear the airways effectively.

The Ninth Report on Carcinogens from the US National Environmental Health Service, declared both active and passive tobacco smoke Group A or 'known human carcinogens'. This means that there is an observed causal relationship between both types of tobacco smoke and cancer. <http://ehis.niehs.nih.gov/roc/toc9.htm>

The chemicals listed below can be inhaled in cigarette smoke. Those with an asterisk* are carcinogens (chemicals that cause cancer). All of them cause adverse health effects.

carbon monoxide	cresols
tar	hydrogen cyanide
nicotine	styrene
aldehydes*	acrylonitrile*
nitric oxide	quinoline*
isoprene	resorcinol
acetone	benzo[a]pyrene*
toluene	cadmium*
formaldehyde*	1- & 2-aminonaphthalene
phenol	lead*
acrolein	nickel*
benzene*	3- & 4-aminobiphenyl
pyridine	catechol
1, 3-butadiene*	chromium*
hydroquinone	methyl ethyl ketone

For a detailed explanation of the effects and uses of these chemicals, see Physicians for a Smoke-free Canada site www.smoke-free.ca >What am I inhaling?

Tobacco and addiction

Most smokers have been aware that tobacco smoking is addictive for a long time. The US Surgeon General's 1988 report reached three key conclusions about dependence and tobacco.

- Cigarettes and other forms of tobacco are addictive.
- Nicotine is the drug in tobacco that causes addiction.
- The pharmacological and behavioural processes that lead to tobacco addiction are similar to those leading to addiction to other drugs, such as heroin and cocaine.

We now know that since the 1960s, tobacco companies knew that people continue to smoke because they are addicted to nicotine.

As a lawyer acting for Brown & Williamson said: *Nicotine is addictive. We are, then, in the business of selling nicotine, an addictive drug.*

But in public discussion, tobacco companies continued to deny that nicotine was addictive. In the last few years, some tobacco companies have agreed that smoking is addictive. But to try and confuse people, some have compared smoking's addictiveness to being addicted to shopping or eating chocolate.

Almost all smokers are addicted to nicotine. Very few do not smoke daily. We only have a limited understanding of the underlying factors that contribute to nicotine addiction, but it is likely that genetic, as well as environmental factors play a part.

It is estimated that in most people, addiction emerges by the time they have smoked 100 cigarettes. Trying to quit leads to a number of physical withdrawal symptoms, such as mood and performance changes, craving, irritability, tension, difficulty concentrating, insomnia and weight gain.

What happens when you smoke?

Even one cigarette quickly causes noticeable physical effects on a smoker's body. When a smoker inhales, the nicotine contained in the inhaled smoke reaches the brain via the bloodstream in a matter of seconds. It also quickly reaches muscle tissue. Nicotine receptors (clusters of cells that react specifically to nicotine) in the brain and muscles quickly recognise its presence and a range of physical reactions take place, including the following:

- An increase in the heart rate (measured by your pulse rate)
- An increase in blood pressure, causing small blood vessels to narrow, and slowing of circulation, which is particularly noticeable in the hands and feet. Because of these things, skin temperature is also lowered.
- An increase in tension in some muscles. This can be measured by testing hand tremors with a tremor-testing machine before and after a cigarette. Strangely, nicotine can also relax some skeletal muscles at the same time.
- An increase in stomach secretions and changes brain activity.
- The nicotine 'hits' the brain cell receptors and stimulates the release of many different neurotransmitters - the brain's chemical messengers. Some of the more important messengers involved in nicotine's actions on the brain are dopamine, acetylcholine and serotonin. The release of these messengers affect how people pay attention, think, eat, deal with stress and feel pleasure.

New smokers generally feel the unpleasant side effects of nicotine, such as headaches or dizziness. But after a while their bodies get used to it, and these effects are no longer felt. Once you have been smoking for a while, your body becomes used to a certain level of nicotine, and without it, you no longer feel quite 'right'. As the effects of the nicotine wear off, you start to feel uncomfortable, uneasy and 'needing a cigarette' - these are the beginnings of **withdrawal symptoms** as your level of nicotine drops. To keep up your nicotine levels, you need to continually dose yourself by smoking.

Smokers go through a continual cycle of nicotine hit, followed by withdrawal, which prompts another hit - and this happens many times a day. They also develop a tolerance to nicotine over time, which means that they need to smoke more to get the same effect.

The chemicals in inhaled cigarette smoke are also absorbed into the bloodstream. These chemicals are also absorbed when passive smoking, and by the unborn children of pregnant women.

Carbon monoxide (CO)

CO is formed when a cigarette is lit. It has a number of toxic effects on the body, the most important of which is that it reduces the amount of oxygen that is carried in the bloodstream of smokers. CO binds with the haemoglobin in the blood instead of oxygen, meaning that less oxygen is available to body organs and tissue. The heart has to pump harder to make sure that enough oxygen can get to all organs.

In pregnant women, the unborn baby also has less oxygen available to it through the umbilical cord. Lack of oxygen also affects muscle performance.

Generally speaking, smokers of all ages become short of breath and exhausted more quickly than non-smokers of similar age and fitness.

Tar

Every time cigarette smoke is inhaled, tar goes into the lungs. Some is breathed out, but much condenses deep inside the airways of the lungs. Coughing is the body's way of trying to get rid of this tar, but chemicals in tobacco smoke paralyse the cilia (tiny hairs whose job it is to sweep foreign material out of the airways).

Tar is a sticky brown substance, the same one that causes smokers' fingers to go brown, and teeth to stain yellow. It also causes throat and lung cancer.

'Light' and 'Mild'

Many cigarette brands use the words 'light' and 'mild' as part of their name. These cigarettes may have lower tar and nicotine readings displayed on the pack, but the tar and nicotine yield of these brands when smoked is actually much higher.

These same words may also relate to taste in a smoker's mind. 'Mild' tasting cigarettes have often had flavourings and other chemicals added to the cigarette to mask the taste. It is of concern that these cigarettes may be more appealing to children and young people, because of additives such as sugar, honey, cocoa etc.

What is clear from research is that 'light' and 'mild' cigarettes are no better for you than any other brand. The switch, particularly by women, to 'light' and 'mild' cigarettes may go some way to explaining and increase in the type of lung cancer that is found deeper in the lungs.

Marketing of 'light' and 'mild'

For decades, Cigarette companies have marketed 'light' and 'mild' cigarettes as a less harmful, less addictive product. These cigarettes are designed to deliver less tar and nicotine, even though they contain the same tobacco as is used in full-strength cigarettes. Cigarette manufacturers

manipulate nicotine and tar yield in their cigarettes mainly by inserting **ventilation holes** in the filter.

- The tar, nicotine and carbon monoxide (CO) levels of Australian cigarette brands is monitored by machine testing in a laboratory - giving rise to the numbers on the packet. These 'smoking machines' take puffs of cigarettes and measure nicotine intake and tar and CO output.
- When the machine smokes these cigarettes, all the holes are clear, and air is drawn in as the cigarette is smoked, which affects the readings given by the machine.
- When smokers smoke these same cigarettes, they usually cover up the holes with their fingers - they usually don't know they're there, or what they do. When these holes are blocked, the tar and nicotine yields from these 'low tar' cigarettes increases. Smokers will also inhale more deeply and more frequently in order to compensate and ensure they inhale enough smoke to achieve satisfactory nicotine 'hits'.

What the tobacco companies knew...

The tobacco industry has known since the 1970's that machines smoke differently than people. Litigation in Canada and the USA has made available thousands of previously secret tobacco industry documents that show the depth of the tobacco industry's deception.

1. The tobacco companies knew about the role of nicotine in making smokers 'compensate' in order to get the same dose

"The smoker ... who smokes to maintain a constant blood level of nicotine is most likely trying to avoid the unpleasant sensations that he feels when he is not smoking. Without a cigarette he will become nervous, irritable and likely to make mistakes in his work. Such a smoker is likely to compensate for changed delivery if given a cigarette brand with different standard machine smoked deliveries to his usual brand so that as far as possible he maintains a constant blood level of nicotine." (BAT Co., 1978) David Creighton BAT Co. *Compensation for Changed Delivery*, 27th June, 1978. Source: Minnesota Trial Exhibit 11,089

2. The tobacco companies deliberately marketed low tar cigarettes as a safer alternative. The tobacco companies knew that marketing 'light' and 'mild' cigarettes to customers would give them a false sense of smoking a 'safer' cigarette, resulting in many smokers switching over instead of quitting

"All work in this area should be directed towards providing consumer reassurance about cigarettes and the smoking habit. This can be provided in different ways, e.g. by claiming low deliveries, by the perception of low deliveries and by the perception of "mildness". Furthermore, advertising

for low delivery or traditional brands should be constructed in ways so as not to provoke anxiety about health, but to alleviate it, and enable the smoker to feel assured about the habit and confident in maintaining it over time."

PL Short, BAT Co. Smoking and Health Item 7: the Effect on Marketing. 14th April 1977. Minnesota Trial Exhibit 10,585.

3. The tobacco companies failed to disclose this information to the public, and in fact intentionally withheld it.

"It is felt that the time is close when government agencies world-wide will take more notice of compensation — and of the scale of the differences, for a given commercial product, between smoking machine numbers and the dose of smoke actually obtained by smokers."

British American Tobacco, "Research Conference, Pichlarn, Austria, 24-28 August 1981" (minutes), document classified as "restricted,"

<http://www.hlth.gov.bc.ca/quildford/pdf/083/00008383.pdf>

References

The health consequences of smoking: Nicotine addiction: a report of the Surgeon General. US Department of Health and Human Services, Public Health Service Centers for Disease Control, Office on Smoking and Health: Rockville, Maryland, 1988. www.cdc.gov/tobacco/sgr/sgr_1988

Yeaman, A. Brown and Williamson memo 108.205, 17/7/63. <http://legacy.library.ucsf.edu/tid/xrc72d00>

Proctor, C. BAT Industries - Smoking gun? The Observer, 1/3/98

National Tobacco Campaign Background Research www.quitnow.info.au

Tobacco in Australia: Facts and Issues www.quit.org.au/quit/FandI/welcome.htm

What one cigarette does Background Brief. www.quit.org.au/quit/pdf/06One.pdf

Commonwealth Dept of Health and Ageing - tobacco site www.health.gov.au/tobacco

Nicotine addiction in Britain - a publication of the Royal College of Physicians: London, 2000 www.rcplondon.ac.uk/pubs/books/nicotine

Factsheets on 'Nicotine and Addiction' and 'What's in a Cigarette' from the ASH UK site www.ash.org.uk

Tobaccopedia - Addiction, pharmacology, chemistry www.tobaccopedia.org

Physicians for a Smoke-free Canada www.smoke-free.ca

NOVA - Search for a safe cigarette www.pbs.org/wqbh/nova/cigarette

Risks associated with smoking cigarettes with low machine-measured yields of tar and nicotine. cancercontrol.cancer.gov/tcrb/monographs/13

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