



PHYSICIANS FOR A SMOKE-FREE CANADA
MÉDECINS POUR UN CANADA SANS FUMÉE

P.O. Box 4849 • Station E • Ottawa • Ontario • K1S 5J1
www.smoke-free.ca

Background

The Engineering of Canadian Cigarettes

Canadian cigarettes are very different from those sold in the United States and in many other countries. The U.S. cigarette is made of a combination of different types of tobaccos (burley, oriental and Virginia), which are blended with flavourings and casings. Virtually all Canadian cigarettes are manufactured from the same variety of Virginia tobacco, grown in the same five Ontario counties. The use of additives appears to be restricted to papers and filters (and not the tobacco). The differences between Canadian brands are minor (sometimes the same cigarette is sold under different brand names, i.e. du Maurier light and Matinee).¹

Although the Canadian tobacco market is homogenous, it is not constant. Each recent decade has seen changes in cigarette design.

In the beginning: The "plain" cigarette

Before the 1960s, cigarettes were much simpler than they are today. The tobacco blend was the important ingredient in these cigarettes, which had, according to industry documents:

- low permeability paper
- high deliveries of tar and nicotine
- good taste and flavour.²

1950s and 1960s

The filter: a more convenient cigarette

In the late 1950s and early 1960s, cigarettes were changed as filters were added to save smokers from having to pick bits of tobacco out of their teeth. Filters also reduced the cost of cigarettes (filter material was cheaper than tobacco). These early filters were not designed to reduce 'tar' or change the flavour of the cigarette.

Filter cigarettes caught on equally quickly in Canada. Industry documents show that by 1971, over 80% of cigarettes were filtered. By the end of that decade it would be close to 100%.

The 1960s and 1970s.

Responding to the health concerns of smokers and governments.

With the publication of the major reports on smoking and health in 1962 in the United Kingdom and 1964 in the United States, both governments and manufacturers were under pressure to do something to respond to the health scare. BAT and Imperial Tobacco responded with two research strategies:

- Look for ways to make cigarettes that were safer
- Look for ways to make cigarettes that appeared safer.

Attempts to develop a genuinely safe cigarette at BAT failed and were eventually abandoned (although RJR-Reynolds continues to explore this market). Most of BAT's design activities focused on the development of cigarettes that appeared safer. There is evidence that some research into making cigarettes less harmful continued in Canada past 1994.

- ***The push for 'Light' cigarettes***

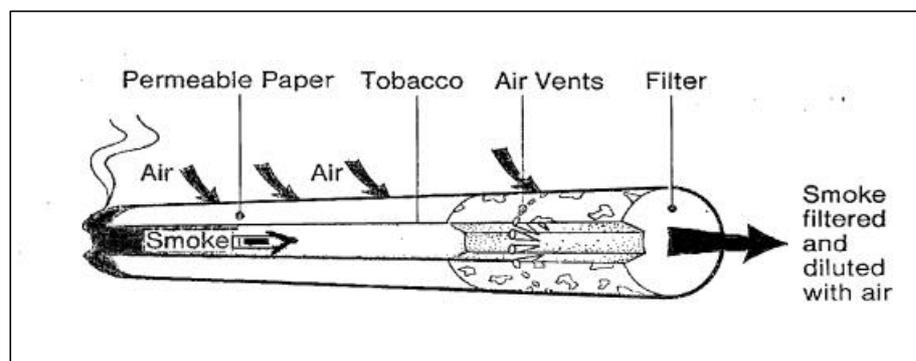
In the 1970s, governments, health officials and the public were convinced that reducing the tar levels in cigarette smoke would make cigarettes at least somewhat safer. A standard test was developed to measure the tar and nicotine content, and the results of these tests began to appear in printed tables and on the side of cigarette packages.

Smokers may have chosen 'light' cigarettes because they thought they represented a health advance, and governments may have been persuaded that this was the case. History (and industry documents) show otherwise. BAT scientists questioned whether there was any health benefit to these cigarettes, especially as their studies showed that smokers were likely getting as much tar and nicotine as they did from more conventional cigarettes.

The introduction of light cigarettes can be seen to have made the cigarette market larger than it otherwise would have been in three ways:

- by inducing more people to smoke,
- by inducing fewer people to quit
- by inducing more people to restart.

From the documents, it is clear that Imperial Tobacco paid attention to all three, and succeeded to some extent in encouraging more people to start or restart smoking and in reducing or delaying quitting.^{3,4}



- **The design of 'Light' cigarettes**

To make their cigarettes give lower readings on the smoking machine tests, Imperial Tobacco modified its cigarettes by:

- Increasing the 'pressure drop' of the filters (making it harder to inhale)
- Increasing the porosity of cigarette paper
- Putting Ventilation holes in the filters
- Reducing the amount of tobacco in a cigarette (by expanding the tobacco and packing it differently)

Light cigarettes (1970s)

- engineered to satisfy 'tar' ratings
- smokers compensated to overcome engineering

Brighter lights (1980s & 1990s)

- engineered to satisfy smokers
- engineers compensate to overcome smokers' behaviour and attitudes

Especially important in reducing tar levels was 'ventilating' the cigarette with holes so that smoke was diluted with air. Early ventilation techniques were unsophisticated, using pins to punch holes in the filter during the manufacturing process. Soon Imperial Tobacco moved to laser perforation, and the ventilation holes on many cigarettes are now invisible. In 1973, there were no ventilated cigarettes for sale in Canada. By 1983, over 50% of Imperial Tobacco's cigarettes were ventilated.⁵

The 1980s and 1990s:

Responding to smokers dissatisfaction with 'lights'.

By the mid 1980s, the market for lights had reached a plateau, and Imperial became concerned. Its market research revealed that they had not yet succeeded in meeting the needs of smokers. This was not surprising: they found that smokers held diametrically opposite views simultaneously. Smokers knowledge of health consequences made them want to quit smoking, but their addiction made them want to keep smoking. Although 'lights' had been a successful way of keeping them in the game in the 1970s,⁶ Imperial Tobacco realized that many were still unhappy with smoking.

From an engineering standpoint, the big problem with the first generation of light cigarettes was that smokers noticed that they couldn't get enough nicotine from them to satisfy their craving, unless they changed the way they smoked. "Sucking air" was how many described the experience of smoking Imperial's Medallion brand.

- **Brighter Lights**

The new challenge was to give smokers what they wanted (pleasure and satisfaction at minimum smoking effort) in a cigarette that had a low machine-test rating. ITL head of research, Dr. Patrick Dunn, suggested 18 ways of achieving this, and listed them under the title, "Making the smoke work harder"⁷. Included in his list were suggestions to:

- improve the nicotine hit (accelerate the magnitude of impact),
- allow nicotine to be absorbed through the nose,
- reduce dry mouth (which discourages inhalation),
- change the amount of 'free' nicotine

- **The Elastic Cigarette**

Of the ways identified by Imperial Tobacco's chief scientist, Pat Dunn, to make the smoke work harder, two merit special attention – elasticity and nicotine. Elasticity was the ability to give the smoker more than the league table value promised. The technical definition of elasticity, given in a 1993 ITL research report, follows:

*If the tar delivery increases in direct proportion to the increase in puff volume, the product is inelastic (i.e. elasticity = 1), while if the tar delivery increases faster than puff volume, elasticity > 1.*⁸

The effect of elasticity would be to make it even easier for smokers to get higher yields of nicotine and other constituents than shown on the packages without having to change how they smoked.

MAKING THE SMOKE WORK HARDER

A number of suggestions on this topic were raised and are listed in point form below.

1. Sensory effect
 - immediate, acute sensory response
 - longer term physiological response
2. Impact and taste
 - to accelerate the magnitude
3. The pH in smoke
4. Free and bound nicotine ratios
 - the best form of nicotine
 - free, base, or others
5. Interaction of nicotine and other impactors
 - oral cavity satisfaction
 - lung and body satisfaction
6. Assimilation of nicotine through the nose
 - i.e., vapour stage nicotine
7. Use of humectants in changing the particle size of smoke, or the concentration of nicotine in the vapour phase
8. Taste enhancers related to particle size
9. Irritation reduction related fatty acids
10. Surface tension agents
11. Changing the conventional aerosols
12. What factors control human ability to change T/N ratios?
13. Addition of pyrazine salts
14. Dispersion of the smoke in the mouth, and lung ciliastasis, mouth absorption
15. Aging of smoke
16. Selective filtration
 - i.e., Teflon, Duolite
17. Salivating agents
 - the use of hydrocarbon interferers re mouthful sensation
18. Policy on elasticity and/or human perception of mouthful of smoke relative to standard machine delivery.

P. Dunn

FD/svp
1626a

62082

- **The not-so-secret ingredient: Nicotine**

BAT discovered that increasing elasticity was one way that they could increase the nicotine kick by increasing the amount of 'free nicotine' through⁹:

- Higher ventilation
- Higher filter pressure drop
- Increased velocity of smoke

These cigarettes would be light in name only. Only the smoking machine would get low tar and nicotine yields from such cigarettes. Most smokers would get more tar and more nicotine than listed on the package. The companies had learned from earlier mistakes. This time smokers would not have to change the way they smoked. Unlike their experiences with early low-tar cigarettes, smokers would not have to perceptibly suck harder on their cigarettes or alter their behaviour in other ways to get the satisfaction they wanted.

Endnotes

¹ www.aalatg.com, document ID 965328

² <http://www.tobaccopapers.org/documents/psc76.pdf>, Document: pp. 102393928-946.
Citation: p. 10293942.

³ Response of the market and of Imperial Tobacco to the smoking and health environment. Imperial Tobacco Ltd., p. 2 (15102). Montreal Court of Appeal, Case Numbers 500-09-001296-912 and 500-090001297-910. 1991. Joint Record, Exhibit Number AG-41. Volume 76, pp. 15101-15110.

⁴ <http://www.tobaccopapers.org/documents/psc69.pdf>, Document: pp. 109869352-369.
Citation: p. 109869362.

⁵ <http://www.tobaccopapers.org/documents/psc93.pdf>, Document: pp. 102686857-870.
Citation: p. 102686861.

⁶ <http://www.tobaccopapers.org/documents/psc60.pdf>, Document: pp. 100501581-783.
Citation: p. 100501583-584.

⁷ <http://www.bw.aalatg.com>, Document: pp. 512107064. Citation: pp. 512107064.

⁸ <http://www.tobaccopapers.org/documents/psc8.pdf>, Document: pp. 402415168-217.
Citation: p. 402415194.

⁹ <http://www.tobaccopapers.org/documents/psc138.pdf>, Document: pp. 100535033-207.
Citation: p. 1005351346.