MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

CHANGE IN NICOTINE YIELDS 1998 - 2004

DATA SUBMITTED IN ACCORDANCE WITH MASSACHUSETTS GENERAL LAWS

CHAPTER 94: Section 307B, 105 CMR 660.000

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SUMMARY

Since 1997, cigarette manufacturers have delivered nicotine reporting information using testing methods established by the Massachusetts Department of Public Health (MDPH). Massachusetts General Law chapter 94 section 307B and Department of Public Health Regulations 105 CMR 660.000 mandate that cigarette companies report each year to the Department the nicotine yield ratings for all cigarette brands with a U.S. market share of greater than 1.5%.

Nicotine Yield Testing

- For all brands tested in both 1998 and 2004 (N = 116), the total amount of nicotine delivered to the smoker has increased significantly: 1.72 mg in 1998 compared to 1.89 mg in 2004. These data were also evaluated by manufacturer. For each of the major manufacturers (i.e., Brown & Williamson, Lorillard, Phillip Morris, and RJ Reynolds), the increases in nicotine delivered were significant.

- Each manufacturer markets many brands of cigarettes and this data was analyzed by brand. Once again, the increases in nicotine delivered were significant. With the exception of Winston cigarettes, all brands that were tested in both 1998 and 2004 had significant increases in nicotine delivered to the smoker. This includes Basic, Camel, Doral, Kool, Marlboro, and Newport cigarettes.

- Cigarette brand families (e.g. Marlboro) with a U.S. market share of greater than 1.5% were required to submit nicotine yield information. In 2004, a total of 179 brands were tested from the four major cigarette manufacturers – Brown & Williamson (now owned by RJ Reynolds), Lorillard, Philip Morris, and RJ Reynolds.

- For over 30 years, nicotine yields have been reported from tests using smoking machines. The operation of the machine was an attempt to mimic the smoking behavior of a typical smoker. However, these historical methods have been found to be inadequate[1,2] because the machine's puff duration is too short, too little smoke is inhaled, and none of the filter ventilation holes is covered. The MDPH testing method better simulates the smoking behavior of the typical smoker under typical smoking conditions. Using the Massachusetts' method, the amount of smoke inhaled with each puff is increased and the amount of time between puffs is reduced. In addition, 50% of the cigarette filter is covered.

- Testing for nicotine yield using the MDPH method revealed levels that are more than twice as high as those found by the historical method. For the typical smoker, 'low yield' cigarettes in almost every case deliver moderate to high doses of nicotine. These levels are sufficient to cause and maintain heavy dependence. For all brands tested in both 1998 and 2004 (N = 116), the average from using the historical method was 0.90mg/cigarette while the average from the Massachusetts method was 1.89mg/cigarette.

Nicotine Ranges

- Massachusetts has rated different brands of cigarettes based on the nicotine that a cigarette delivers under typical smoking conditions. The nicotine ratings range from high, moderate, low, or nicotine free. These ranges were created in order to allow smokers to compare nicotine levels among brands of cigarettes.

- Ninety-three percent of the cigarettes tested in 2004 fell into the highest nicotine range. This compares to 84% in 1998. Of 179 cigarette brands tested in 2004, 166 were rated as *high nicotine*. This includes 59 brands that the manufacturers label as 'light' cigarettes, 12 brands labeled as 'mild' or 'medium', and 14 labeled as 'ultra-light'. All remaining brands fell into the moderate range. Cigarettes with moderate and high yields can cause heavy dependence on nicotine.

Nicotine Content of Whole Tobacco

- For all brands tested in both 1998 and 2004, there were no significant differences in the total nicotine content between 'full flavor,' 'medium,' 'mild,' 'light,' or 'ultra-light' cigarettes.

- Whether a cigarette is classified by the manufacturer as being 'full flavor,' 'medium,' 'mild,' 'light,' or 'ultra-light,' it is likely to contain similar amounts of nicotine in the unsmoked tobacco. Smokers who switch to 'lower yield' cigarettes to reduce their intake of nicotine are faced with similar levels of nicotine content.

Percent Filter Ventilation

- For all brands tested in 2004, cigarettes ranged from 0% to 83% filter ventilation, emphasizing the extreme differences in cigarette design.

- When smokers place their lips and fingers over the vents, they keep outside air from diluting the smoke. As a result, they take in higher levels of tar and nicotine.

- Based on information provided by the manufacturers, there is a strong correlation between the percent of filter ventilation and total nicotine content for *ultra-light* cigarettes. When the nicotine content is low, there is relatively little filter ventilation. When it is high, there tends to be much more ventilation. Under typical smoking conditions, the amount of filter ventilation reduces the amount of nicotine delivered to the smoker. Despite lower nicotine content for some ultra-light cigarettes, these same cigarettes tend to have correspondingly low levels of filter ventilation. This means that a much higher proportion of the nicotine in the cigarette enters a smoker's lungs.

BACKGROUND

M.G.L. Chapter 94, Section 307B requires tobacco manufacturers to file an annual report concerning nicotine yields with the Massachusetts Department of Public Health (MDPH) for each brand of tobacco product sold in the Commonwealth. This annual report provides nicotine yield ratings which accurately predict nicotine intake for typical consumers, based on standards established by MDPH.

The national standard for testing tar and nicotine in mainstream smoke by use of a smoking machine was developed over thirty years ago.[3] The nicotine yield ratings produced by this historical method were meant to serve as a relative measure of nicotine yield between cigarette brands.[4] They are not reliable measures of how much nicotine a smoker actually takes into their body under normal smoking conditions.

Cigarette design has undergone significant changes over the last 30 years. Technology has altered the manner in which tar and nicotine are delivered to the smoker, and the smoking practices of consumers have shifted accordingly. Since the introduction of 'low yield' cigarettes (i.e. light and ultra-light cigarettes) in the late 1970's, smokers have been found to compensate for lower levels of nicotine yield by smoking more frequently, by smoking more cigarettes, smoking more deeply, and increasing puff volume.[5] These changes in smoking behavior result in much higher relative nicotine levels being delivered to the body from lower yield cigarettes than what is calculated using the historical testing method.[6]

A recent report of the National Cancer Institute's Ad Hoc Committee of the President's Cancer Panel on the historical test method concluded that current ratings from this method provide little information for consumers who wish to know how much nicotine they actually take into their body when smoking.[7] MDPH testing standards, developed in 1997, draw heavily on that report and reflect current scientific knowledge about compensatory smoking behaviors and nicotine intake.

This report features the following information reported to Massachusetts for cigarette brands:

- total nicotine content (mg) of tobacco contained in the cigarette rod
- percent filter ventilation (the amount of air allowed to dilute the smoke)
- nicotine yield based on MDPH developed test
- nicotine classification based on MDPH developed classification
- pH levels for a selected subset of cigarette brands

NICOTINE YIELD TESTING

What Is Nicotine Yield?

- A cigarette does not deliver fixed amounts of tar and nicotine in the manner that a capsule delivers a fixed dose of medicine. In part, it is how a person smokes that determines the amount of tar and nicotine that is delivered from the cigarette into the body.

- Nicotine yield is a measure of the amount of nicotine in the smoke that a smoker inhales. It does not measure the amount of nicotine in a cigarette.

- The amount of nicotine which smokers inhale is based on how long and how deeply they breathe in with each puff (puff volume), the amount of time between puffs (puff interval), and the percent filter ventilation of the smoke they breathe (the amount of pure air which is drawn in through vent holes in the filter tip during smoking and allowed to mix with the smoke, lessening its concentration).

When compared to the historical method of testing cigarettes, the Massachusetts method better simulates the smoking behavior of the typical smoker under normal smoking conditions. The Massachusetts method increases the amount of smoke inhaled with each puff by the smoking machine, reduces the amount of time taken between puffs, and requires that 50% of the cigarette filter be covered.

What Do Nicotine Yield Ratings Reflect?

- The historical method of measuring nicotine yield uses a smoking machine to simulate the way in which a smoker smokes. Nicotine yields and tar levels using the historical method are determined on the basis of the amount of smoke which is inhaled by the machine.

- Because nicotine yield is based on the way in which an individual smokes, ratings based on the historical method reflect what you take into your body only if you smoke a cigarette in exactly the same way as the testing machine.

- Ratings based on the historical method cannot accurately reflect the effects of vent blocking -- blocking ventilation holes in the filter. A typical smoker is likely to cover the vents placed around the filter, raising the levels of tar and nicotine which they inhale. The filter vents are left open when nicotine yields are measured using the historical method.

- The Massachusetts testing method was developed to reflect compensation techniques-- such as vent blocking, puffing more frequently, and inhaling more deeply. If smokers employ these compensation behaviors, they will inhale increased amounts of nicotine.

What Were the Results of Massachusetts Nicotine Yield Testing?

- By adjusting parameters to more accurately reflect typical smoking conditions, 2004 Massachusetts testing for nicotine yield produced numbers that were about twice as high as those found using the historical method. The typical smoker receives much greater levels of nicotine than is suggested by historical methods ratings.

Table 1: Nicotine yield from Massachusetts method compared to historical method

Cigarette Type[1]	MA Method Nicotine Yield (mg/cigarette)[2]	Historical Method Nicotine Yield (mg/cigarette)[2]	% Difference[3]
Full (Regular)	2.16	1.09	98%
Medium / Mild	2.01	0.93	116%
Light	1.71	0.80	114%
Ultra-light	1.21	0.43	181%

Note: All data in Table 1 was supplied to the Massachusetts Department of Public Health (MDPH) by the cigarette manufacturers in compliance with M.G.L. Chapter 94, Section 307B. Tobacco manufacturers are required to file an annual report concerning nicotine yields with the MDPH for each brand of tobacco product sold in the Commonwealth. 1) In reporting information to MDPH, cigarette manufacturers classify cigarettes as Full Flavor, Medium or Mild, Light, or Ultra-Light. 2) Each year, manufacturers report nicotine yield in milligrams per cigarette from studies using both the Massachusetts and historical methods. 3) MA method yield divided by historical method yield.

- Compensation techniques used by smokers alter levels of nicotine received from 'light' or 'ultra-light' cigarettes to a much greater degree than with regular cigarettes. All cigarettes ('light', 'ultra-light', etc.) are based on nicotine yield ratings using the historical method, but 'low yield' cigarettes depend more heavily on design factors such as filter ventilation which are not accounted for by the historical testing method.

- For the typical smoker, 'low yield' cigarettes deliver moderate to high doses of nicotine. These levels are sufficient to cause and maintain heavy dependence. No brand tested produced nicotine yields of less than 0.5 mg per cigarette when smoked under typical smoking conditions.

NICOTINE CONTENT OF WHOLE TOBACCO

What Is Nicotine Content?

- The nicotine content of a cigarette is an important element in its design. Nicotine content is the amount of nicotine contained in the tobacco before it is burned and inhaled. A smoker extracts the nicotine contained within the tobacco by inhaling nicotine which is released into the smoke when the tobacco is burned.

- A cigarette with a higher nicotine content has a greater amount of nicotine, which may potentially be extracted by the smoker and inhaled during smoking.

- Consumers may believe that 'light' and 'ultra-light' cigarettes contain less nicotine than full flavor cigarettes. However, such classifications do not reflect the amount of nicotine in the cigarette-- they are based solely on ratings of nicotine yield using the historical method.

Why Is Nicotine Content Important?

- Nicotine yield ratings from the historical method are based on the amount of nicotine 'inhaled' by a smoking machine. These data suggest that light cigarettes contain less nicotine than regular cigarettes. In reality, the difference in nicotine content across types is not statistically significant. Light and regular cigarettes offer similar amounts of nicotine to the smoker.

- Compensation techniques such as vent blocking or taking longer and deeper puffs on a cigarette are used by smokers as means of extracting a greater amount of nicotine. When a cigarette has a high level of nicotine content, the smoker may be able to extract high levels of nicotine even when smoking cigarettes labeled with lower nicotine yields.

- A cigarette classified as 'light' according to the amount of nicotine which a standard smoking machine will extract from it, will contain levels of nicotine similar to that of a regular cigarette.

- Smokers who switch to 'lower yield' cigarettes in order to reduce their intake of nicotine, can be faced with similar levels of nicotine content in the 'low yield' cigarettes. By simply smoking harder and longer on light and ultra-light cigarettes, smokers can achieve the same impact and the same level of nicotine as they did from 'higher' nicotine yield brands.

According to 2004 data, there were no statistically significant differences in the nicotine content of 'full flavor,' 'medium,' 'mild,' 'light,' or 'ultra-light' cigarettes.

Whether a cigarette is classified as 'full flavor,' 'medium,' 'mild,' 'light,' or 'ultra-light', it is likely to contain similar amounts of nicotine in the unsmoked tobacco.

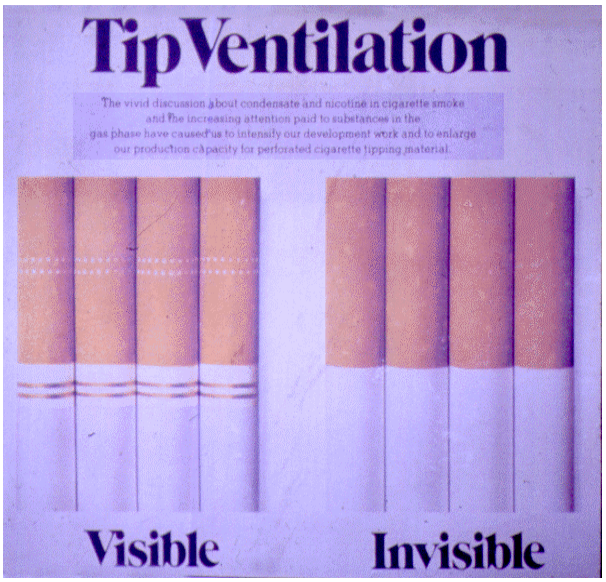
PERCENT FILTER VENTILATION

What Is Vent Blocking?

- Many cigarettes are made with tiny holes around the filter which allow air that has not been drawn through the end of the cigarette to mix with the tobacco smoke during smoking.
- When smokers place their mouth or fingers over the vents, they keep outside air from diluting the mixture and so take in higher levels of tar and nicotine.

How Can a Smoker Tell If They Are Vent Blocking?

- It is difficult for smokers to know if they are covering up the vents. Many brands have vents that are so tiny they are invisible to the naked eye. Often the placement of the holes makes it difficult if not impossible for a smoker to smoke a cigarette without blocking some or all of the vents.
- Cigarettes are designed in such a way that normal smoking behaviors results in covering some or all of the filter vents. Thus, normal smoking behaviors result in heavier amounts of tar and nicotine delivered to a smoker.



What Does Vent Blocking Mean for 'Light' and 'Ultra-light' Cigarettes?

- Filter vents are more often found in 'light' and 'ultra-light' cigarettes.
- The filter vents reduce the amount of nicotine and tar measured by the historical testing method, without reducing the amount of tar and nicotine in the cigarette.
- A smoker will likely block at least some of the filter vents on a 'light' or 'ultra-light' cigarette, breathing in more of the dangerous and addictive substances in the smoke.
- For cigarettes tested in 2004, filter ventilation ranged from 0% to 83%. This emphasizes the significant differences in cigarette design between brands of cigarettes.

NICOTINE YIELD RATINGS

Why Publish Nicotine Ranges?

- Because of the differences in individual smoking patterns, no number is truly representative of the amount of nicotine any smoker will receive from a cigarette. Therefore, Massachusetts has developed ranges which classify levels of nicotine relative to each other. These ranges are high (>1.2 mg), moderate (>0.2-1.2), low (.01-.2) or nicotine free (<.01).

Massachusetts is publishing the range of nicotine which a cigarette delivers under typical smoking conditions. All brands are classified as either *high*, *moderate*, *low*, or *nicotine free*. Since individual smoking behaviors vary, these ranges will allow smokers to compare nicotine levels among brands of cigarettes without suggesting specific amounts of nicotine delivered.

What Do the Classifications Show?

Of 179 cigarette brands tested, 166 were rated as *high*, including most of the 'light' cigarettes tested, and even some of the 'ultra-light' cigarettes tested.

- Of the remaining 13 brands (7% of cigarettes tested), all were rated moderate by MDPH standards. This suggests that virtually all cigarettes on the marketplace today deliver moderate to high doses of nicotine sufficient to cause and maintain heavy dependence.

- Eighty-five (85)—or more than half of the all brands rated as high were classified as 'ultra-light,' 'light,' or 'medium.'

- No brand tested fell into the 'low' classification.

The results tests performed in accordance with MDPH regulations demonstrates the highly addictive potential of nearly all brands of cigarettes-- whether full flavor, 'light,' or 'ultra-light.' Brands rated as low in nicotine according to the historical method are shown to deliver significantly greater levels of nicotine and to be potentially more addictive than the ratings would suggest.

Table 2-- Nicotine Yield Ratings

HIGH (>1.2 mg)

BRAND[1]	SUB-BRAND[2,3]	BRAND	SUB-BRAND
Basic	085 FI FF HP *	Camel	085 FI LT HP MEN (TURKISH JADE)
Basic	085 FI FF HP MEN *	Camel	085 FI LT SP *
Basic	085 FI FF SP *	Camel	085 FI LT SP (SPECIAL) *
Basic	085 FI FF SP MEN *	Camel	100 FI FF HP (99's) *
Basic	085 FI LT HP *	Camel	100 FI FF HP (TURKISH GOLD)
Basic	085 FI LT SP *	Camel	100 FI FF HP MEN (TURKISH JADE)
Basic	085 FI LT SP MEN *	Camel	100 FI FF SP *
Basic	100 FI FF HP *	Camel	100 FI LT HP (99's) *
Basic	100 FI FF SP *	Camel	100 FI LT HP (SPECIAL) *
Basic	100 FI FF SP MEN *	Camel	100 FI LT HP MEN (TURKISH JADE)
Basic	100 FI LT HP *	Camel	100 FI LT SP *
Basic	100 FI LT SP *	Camel	100 FI UL HP *
Basic	100 FI LT SP MEN *	Doral	085 FI FF HP *
Basic	100 FI UL SP *	Doral	085 FI FF HP MEN *
Benson & Hedges	100 FI FF SP MEN *	Doral	085 FI FF SP *
Benson & Hedges	100 FI LT HP MEN	Doral	085 FI FF SP MEN *
Benson & Hedges	100 FI LT SP MEN *	Doral	085 FI LT HP *
Benson & Hedges	100 FI UL HP *	Doral	085 FI LT SP *
Camel	070 NF FF SP *	Doral	085 NF FF SP *
Camel	085 FI FF HP (RED KAMEL) *	Doral	100 FI FF HP *
Camel	085 FI FF HP *	Doral	100 FI FF HP MEN
Camel	085 FI FF HP (TURKISH GOLD)	Doral	100 FI FF SP *
Camel	085 FI FF HP (TURKISH ROYAL)	Doral	100 FI FF SP MEN *
Camel	085 FI FF HP (WIDES) *	Doral	100 FI LT HP *
Camel	085 FI FF HP MEN (TURKISH JADE)	Doral	100 FI LT SP *
Camel	085 FI FF HP MEN *	Doral	100 FI LT SP MEN *
Camel	085 FI FF SP (AEGEAN SPICE)	Doral	100 FI UL HP
Camel	085 FI FF SP (BACK ALLEY)	Doral	100 FI UL SP *
Camel	085 FI FF SP (BAYOU BLAST)	Kool	085 FI FF HP MEN *
Camel	085 FI FF SP (BEACH BREEZER)	Kool	085 FI FF SP MEN *
Camel	085 FI FF SP (DARK MINT)	Kool	085 FI LT HP MEN *
Camel	085 FI FF SP *	Kool	085 FI LT SP MEN *
Camel	085 FI FF SP (KAUAI KOLADA)	Kool	085 FI MD HP MEN (CARIBBEAN CHILL)
Camel	085 FI FF SP (MANDALAY LIME)	Kool	085 FI MD HP MEN (MIDNIGHT BERRY)
Camel	085 FI FF SP (MIDNIGHT MADNESS)	Kool	085 FI MD HP MEN *
Camel	085 FI FF SP (TWISTA LIME)	Kool	085 FI MD HP MEN (MINTRIQUE)
Camel	085 FI FF SP (WINTER TOFFEE)	Kool	085 FI MD HP MEN (MOCHA TABOO)
Camel	085 FI FF SP (WINTER MOCHA MINT)	Kool	085 FI MD SP MEN *
Camel	085 FI FF SP MEN (MANDARIN MINT)	Kool	085 FI UL SP MEN *
Camel	085 FI FF SP MEN (RARE)	Kool	100 FI FF HP MEN
Camel	085 FI FF TN (BASMA)	Kool	100 FI FF SP MEN
Camel	085 FI FF TN (CREMA)	Kool	100 FI LT SP MEN *
Camel	085 FI FF TN (IZMIR STINGER)	Kool	100 FI MD HP MEN *
Camel	085 FI FF TN (SAMSUM)	Kool	100 FI MD SP MEN *
Camel	085 FI FF TN (TWIST)	Kool	100 FI UL SP MEN *
Camel	085 FI LT HP *	Marlboro	085 FI FF HP *
Camel	085 FI LT HP (SPECIAL) *	Marlboro	085 FI FF HP MEN *
Camel	085 FI LT HP (WIDES) *	Marlboro	085 FI FF SP *
Camel	085 FI LT HP (RED KAMEL) *	Marlboro	085 FI FF SP MEN *
Camel	085 FI LT HP MEN *	Marlboro	085 FI LT HP *

BRAND	SUB-BRAND	BRAND	SUB-BRAND
Marlboro	085 FI LT HP MEN *	Newport	100 FI LT HP MEN *
Marlboro	085 FI LT SP *	Newport	100 FI LT SP MEN *
Marlboro	085 FI LT SP MEN *	Newport	100 FI MD HP MEN
Marlboro	085 FI MD HP *	Newport	120 FI LT HP MEN *
Marlboro	085 FI MD SP *	Old Gold	085 FI FF SP
Marlboro	085 FI UL HP *	Old Gold	085 NF FF SP
Marlboro	100 FI FF HP *	Parliament	085 FI LT HP *
Marlboro	100 FI FF HP MEN *	Parliament	085 FI LT HP MEN
Marlboro	100 FI FF SP *	Parliament	100 FI LT HP
Marlboro	100 FI LT HP *	Salem	085 FI FF HP MEN
Marlboro	100 FI LT HP MEN *	Salem	085 FI FF SP MEN
Marlboro	100 FI LT SP *	Salem	085 FI LT HP MEN
Marlboro	100 FI LT SP MEN *	Salem	085 FI LT SP MEN
Marlboro	100 FI MD HP *	Salem	100 FI LT HP MEN
Marlboro	100 FI MD SP *	Salem	100 FI UL HP
Marlboro	100 FI UL HP *	Virginia Slims	100 FI FF HP MEN
Maverick	100 FI FF HP	Virginia Slims	100 FI LT HP *
Maverick	100 FI FF HP MEN	Virginia Slims	100 FI UL HP MEN
Maverick	100 FI LT HP MEN	Winston	085 FI FF HP *
Max	120 FI FF SP	Winston	085 FI FF HP (S2)
Merit	100 FI UL SP	Winston	085 FI FF HP (SELECT) *
More	120 FI FF SP MEN	Winston	085 FI FF SP *
Newport	085 FI FF HP MEN *	Winston	085 FI LT HP
Newport	085 FI FF SP MEN *	Winston	085 FI LT HP (SELECT) *
Newport	085 FI FF SP MEN *	Winston	085 FI LT SP *
Newport	085 FI LT HP MEN *	Winston	085 FI UL HP *
Newport	085 FI LT SP MEN *	Winston	100 FI FF HP
Newport	085 FI MD HP MEN	Winston	100 FI FF HP (S200's)
Newport	100 FI FF HP MEN *	Winston	100 FI FF SP *
Newport	100 FI FF SP MEN *	Winston	100 FI LT HP *
Newport	100 FI FF SP MEN *	Winston	100 FI LT HP (SELECT SLIM)
Newport	100 FI LT HP *	Winston	100 FI LT SP *
Newport	100 FI LT HP MEN *	Winston	100 FI UL HP *

Table 2 -- Nicotine Yield Ratings (cont.)

MODERATE (>.2-1.2)

BRAND	SUB-BRAND	BRAND	SUB-BRAND
Basic	085 FI UL SP *		
Camel	085 FI UL HP *		
Camel	085 FI UL SP *		
Doral	085 FI LT HP MEN		
Doral	085 FI LT SP MEN *		
Doral	085 FI UL HP		
Doral	085 FI UL SP *		
Eclipse	085 FI UL HP		
Eclipse	085 FI UL HP MEN		
Merit	085 FI UL SP		
Salem	085 FI UL HP		
Winston	085 FI UL SP *		
Winston	100 FI UL SP *		

Table 2 -- Nicotine Yield Ratings (cont.)

LOW (>0-0.2)

None	**None**

NICOTINE FREE (=0.0)

Note: All data Table 2 was supplied to Massachusetts Department of Public Health (MDPH) by the cigarette manufacturers in compliance with M.G.L. Chapter 94, Section 307B. Tobacco manufacturers are required to file an annual report concerning nicotine yields with the MDPH for each brand of tobacco product sold in the Commonwealth. 1) Brand information supplied by the manufacturer. 2) The sub-brand code includes information about the length of the cigarette in millimeters (070, 085, 100, or 120), whether the cigarette was filtered (FI) or unfiltered (NF), whether a cigarette was listed as full flavor (FF), light (LT), or ultra-light (UL), whether the cigarettes were sold in a hard pack (HP) or a soft pack (SP), whether the cigarettes were listed as mild or medium (MD), and whether the cigarettes contained menthol (MEN). In some cases, the above coding system was insufficient to distinguish brand/sub-brand combinations. In those cases, additional labeling information was added to the code in order to produce a unique list of brand/sub-brand combinations. 3) Sub-brands marked with asterisks (*) have nicotine delivery values from both 1998 and 2004.

[1] Kozlowski LT, O'Connor RJ. Official cigarette tar tests are misleading: use a two-stage, compensating test. *Lancet* 2000;355:2159–61.

[2] Kozlowski LT, O'Connor RJ. Cigarette filter ventilation is a defective design because of misleading taste, bigger puffs, and blocked vents. *Tobacco Control*, 2002:11, 40–50.

[3] Pillsbury, Harold C., Jr. "Review of the Federal Trade Commission Method for Determining Cigarette Tar and Nicotine Yield," *The FTC Cigarette Test for Determining Tar, Nicotine, and Carbon Monoxide Yields of U.S. Cigarettes (Monograph 7)*. Report of the NCI Expert Committee: U.S. Department of Health and Human Services, National Institutes of Health, 9.

[4] Peeler, C. Lee. "Cigarette Testing and the Federal Trade Commission: A Historical Overview," *The FTC Cigarette Test for Determining Tar, Nicotine, and Carbon Monoxide Yields of U.S. Cigarettes (Monograph 7)*. Report of the NCI Expert Committee: U.S. Department of Health and Human Services, National Institutes of Health, 2.

[5] Zacny, James P. and Maxine L. Stitzer. "Human Smoking Patterns," *The FTC Cigarette Test for Determining Tar, Nicotine, and Carbon Monoxide Yields of U.S. Cigarettes (Monograph 7)*. Report of the NCI Expert Committee: U.S. Department of Health and Human Services, National Institutes of Health, 154-55.

[6] Kozlowski, Lynn T. and Janine L. Pillitteri. "Compensation for Nicotine by Smokers of Lower Yield Cigarettes," *The FTC Cigarette Test for Determining Tar, Nicotine, and Carbon Monoxide Yields of U.S. Cigarettes (Monograph 7)*. Report of the NCI Expert Committee: U.S. Department of Health and Human Services, National Institutes of Health, 168.

[7] Freeman, Harold P. *The FTC Cigarette Test for Determining Tar, Nicotine, and Carbon Monoxide Yields of U.S. Cigarettes (Monograph 7)*. Report of the NCI Expert Committee: U.S. Department of Health and Human Services, National Institutes of Health, vi-viii.