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Impact Assessment of New York State's Cigarette Fire Safety Performance Standard

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Notice

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U.S. Department of Commerce
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Abstract

New York State is the first state in the nation to pass legislation aimed at reducing the cigarette fire problem by setting a standard requiring all cigarettes sold in the State to have a reduced risk of accidentally igniting household furnishings. The goal of this study is to develop a methodology to assess the impacts of cigarette fire safety standards and to present results for a base case and for alternative scenarios to shed light on possible impacts of the standard within the State. It estimates first-order impacts, defined as the direct human costs of residential fires caused by cigarettes, including number of deaths and injuries, and value of fire property damage. It also estimates second-order impacts, defined as State-wide economic effects of reduced fire losses, and State-wide economic effects that may result from price- or preference-driven shifts in cigarette purchases, including impacts on in-State businesses, and changes in State-wide expenditures, income, jobs, and excise tax revenues. The study uses a benefit-cost methodology as an organizing framework for the impact assessment and the Regional Economic Models, Inc. (REMI) forecasting model for NY State to estimate second-order economic impacts. The study projects residential fire losses due to cigarette-caused fires in NY State over a six-year period of analysis at approximately 180 deaths, 1,460 injuries, and $80 million in direct property losses. These are the projected losses the standard seeks to avoid. A complicating factor is that existing tax-related diversion of cigarettes to out-of-state channels may possibly lower the ability of the standard to reduce losses. However, if manufacturers produce cigarettes that comply with or exceed the standard's requirements, that are acceptable to smokers, and that are priced in line with non-complying cigarettes, the standard is positioned to generate net benefits. If producers increase prices of complying cigarettes or if smokers are dissatisfied, diversion of cigarettes to non-complying channels could increase, and these developments would be expected to reduce fire-loss avoidance and generate negative impacts on business sales and State excise tax. The study assumes that the standard will not change smoking health effects because compliant cigarettes are believed to have about the same smoking-related toxicity effects as non-compliant cigarettes, and it is assumed that any price- or preference-driven reductions in the consumption of compliant cigarettes will be offset by shifts to purchases of non-compliant cigarettes through channels not regulated by the State. Reflecting uncertainties, the study presents projected impact estimates for a number of alternative, hypothetical scenarios. The methodology may be useful to other states for use in assessing potential impacts of cigarette fire safety standards.

Keywords

cigarette fires, economic impacts, fire, fire-safe cigarettes, low-ignition cigarettes, NY State, residential fires

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Executive Summary

In August 2000, NY State passed the first law at the state level aimed at reducing accidental fires caused by cigarettes by establishing a cigarette-ignition performance standard. Entitled "Fire Safety Standards for Cigarettes," the legislation requires that the NY State Office of Fire Prevention and Control (OFPC) set a fire safety performance standard which will limit the risk that cigarettes will ignite upholstered furniture, mattresses, and other household furnishings. The legislation requires that only cigarettes that meet the standard can be legally sold throughout the State after a period of 180 days following adoption of the Rule implementing the legislation. The National Institute of Standards and Technology (NIST), which is providing technical expertise to the OFPC, arranged for this impact assessment of the standard. On June 28, 2004, the regulations implementing the standard took effect. This study was prepared without benefit of any data generated as a result of the adoption.

Study Methodology

The study uses a benefit-cost methodology as a general organizing framework for the impact assessment. The impact assessment estimates the reductions in direct human costs of cigarette fires in residences. Termed "first-order impacts," these are the intended effects of the standard—reductions in deaths, injuries, and fire property damage. The impact assessment also attempts to estimate unintended effects of the standard—impacts on NY State businesses, employment, and excise tax revenues that may result under certain conditions. These are termed "second-order impacts." Two tools are used to assess first- and second-order impacts. An EXCEL spreadsheet is used to assess first-order impacts, and the Regional Economic Models, Inc. (REMI) forecasting model for NY State is used to estimate second-order economic impacts.

Because the standard's impacts lie in the future, the study first develops projected baselines of cigarette consumption, sales, and fires and fire losses per number of cigarettes consumed as if there were no standard. It then estimates the standard's impacts as changes from the projected baselines.

The report presents results for a base-case scenario and for a range of alternative possibilities. To reflect uncertainty, the study models alternative scenarios that feature key assumptions of particular interest from a policy perspective and that stand to change the outcome.

Alternative Scenarios

The matrix below identifies five scenarios developed in the study. Scenario 2 is considered the "best-guess," base-case scenario. Scenarios 1, 3, 4, and 5 provide the results of sensitivity analysis. The scenarios differ with respect to the assumed effectiveness of complying cigarettes. They also differ with respect to the assumed rate of diversion of cigarettes purchased into channels supplying non-complying cigarettes. The diversion of cigarette purchases may occur via travel to bordering states, through mail order, telephone, and Internet channels, through purchases from Indian reservations, or through illegal channels. Diversion of cigarette purchases from regulated to less regulated channels is important to the analysis, because if it occurs it

decreases the standard's effectiveness.

Tax policy in the State drives an existing diversion of cigarettes away from regulated channels. If producers fail to produce compliant cigarettes that smokers like, or increase significantly the price of compliant cigarettes, this could trigger additional diversion of cigarettes. Although any additional diversion is expected to be much smaller than the existing diversion triggered by taxes, it is relevant to the impact of the standard and is treated in the sensitivity analysis.

Table E-1. Five Scenarios Modeled and Assessed for Impact

Scenario	Assumed Effectiveness of Modified Cigarettes	Upper-limit Benefits (No Diversion)	Existing Tax-driven Diversion = 32 %		
			Base-case (Existing Tax-driven Diversion Only)	+ Modification-induced, Price-increase-driven Diversion = 0.7 %	+ Modification-induced, Preference-driven Diversion = 10 %
1	100 %	X			
2	30 % to 80 %*		X		
3	60 %			X	
4	60 %				X
5	60 %			X	X

Note: "Modification" refers to changes in cigarettes in compliance with the standard to make them less likely to start fires.
* Scenario 2 includes sensitivity analysis for effectiveness values of modified cigarettes ranging from 30 % to 80 %, in 10 % steps.

Each scenario is analyzed for four alternative study periods. One variation in the study period concerns the timing of implementing the standard; that is, immediate implementation versus implementation in two years. The other variation concerns how long it is assumed the NY State standard will remain in effect before a similar national standard is adopted--six years or only three years. Pairing each of these possibilities yields four study periods.

A start time in two years is included as part of the sensitivity analysis because the issue of timing and related effects may be of interest to other states considering adoption of a similar standard.

Key Data and Assumptions

As indicated in the report, conservative estimates have been used in developing the projected baselines of cigarette consumption, fires, and fire losses. Projections of lower rates of decline in these baseline values would have yielded larger benefits estimates.

In addition to the cigarette data, population data, and fire incident data used to develop the baseline estimates, a number of additional key values and assumptions figure importantly in the analysis. Summarized in the table below, they are used to develop the scenarios and perform sensitivity testing.

Table E-2. Summary of Key Values and Assumptions Used in Base Case and Sensitivity Testing

Name of Variable	Value used in Base Case	Value used in Upper-limit Sensitivity Testing	Value used in Pessimistic Sensitivity Testing
Price change	$0.00 per pack	$0.00 per pack	$0.10 per pack
Price elasticity of demand	N.A.	N.A.	-0.4
Preference-driven diversion	0.0	0.0	10 %
Existing tax-driven diversion	32 %	0.0	32 %
Effectiveness level of conforming cigarettes	60 %	100 %	60 %

In addition to the scenario-specific assumptions, several important uniform assumptions underlie all of the scenarios. One of these underlying assumptions is that for any given year, total cigarette consumption within NY State may shift in composition between purchased cigarettes that comply with the standard to those that do not, but total cigarette consumption in the State in that year is not changed by the standard.

Another underlying assumption is that smoking related health effects are unaffected by the standard. This assumption rests on the above assumption that any price- or preference-driven reductions in purchases of complying cigarettes are offset by diversions to non-complying cigarettes. It also rests on the assumption that cigarettes complying with the standard have about the same smoking toxicity effects as non-conforming cigarettes. These two assumptions in combination allow the study to focus on fire-loss effects rather than smoking health effects.

Findings

Estimated results are presented as requested by the sponsors as sets of measures, reflective of the different kinds of impacts treated. Although reducing all impacts to a dollar value is possible and makes for easier comparisons, the results tend to be controversial, as one must assign a dollar value to death and injuries ranging from minor to the most serious imaginable. It remains for the reader to make the cross-unit comparisons, review the possible scenarios, and judge the standard's likely overall consequence.

Base-Case Impacts (Scenario 2)

Scenario 2 is considered the base-case because it takes into account the existing tax-driven diversion of cigarettes into channels that are assumed not to offer cigarettes that comply with the standard. Furthermore, it bases results on a conservative assumption about the effectiveness of conforming cigarettes in eliminating cigarette fires and associated losses in NY residences.
Key Assumptions:

- Cigarettes modified to comply with the standard eliminate 60 % of cigarette fires and associated losses in NY residences.
- Cigarette manufacturers supply the modified cigarettes without raising price; hence there are no price-driven diversions caused by the standard.
- Cigarette manufacturers supply the modified cigarettes in popular brands, and smokers are widely accepting of the modified cigarettes; hence there are no preference-driven diversions caused by the standard.
- Smokers continue to divert an estimated 32 % of purchases through channels not regulated by New York State due to existing cigarette tax differentials (not attributed to the standard).
- The standard is implemented immediately.
- A similar national standard is implemented in six years; hence, the study period is six years, extending from 2004 through 2009.
- A discount rate of 7 % is used to compute present value monetary benefits.

Summarized First-Order Impacts of Fire Losses Avoided, 2004-2009:

Number of fires prevented (to the nearest 10)	1,880
Number of deaths avoided (to the nearest five)	75
Number of injuries avoided (to the nearest 10)	600
Direct property damage avoided (present value, to the nearest million)	$32 million

Summarized Second-Order Economic Impacts, 2004-2009:

(From reduced out-of-pocket property loss)

Number of jobs gained (annual average, to the nearest 10)	20
Business sales gains (present value, to the nearest million)	$13 million

(From standard-induced price-and preference-driven diversions)

Jobs lost	0
Business sales loss	0
Cigarette excise tax revenue lost	0

The base-case scenario shows that if cigarette companies make cigarettes that smokers like and sell them at a price close to that of non-modified cigarettes, the standard is estimated to have significant positive effects and few negative effects. And, to the extent that cigarettes perform better than assumed in this scenario, the net benefits increase.

Sensitivity Analysis (Scenarios 1, 3, 4, and 5)

The two tables below summarize results for all the scenarios. The first table shows results based on adoption of a similar national standard in 2009, six years after implementation of the NY standard. The second table shows results based on adoption of a similar national standard in 2006, only three years after implementation of the NY standard. The tables facilitate comparing the more favorable results of Scenario 1, and less favorable results of Scenarios 3, 4, and 5, with the results for the Base-Case Scenario 2 shown in Column 3.

Column 4 shows the upper-limit benefits provided by Scenario 1, which defines the playing field in terms of the potential benefits from completely solving the cigarette fire problem in NY

residences. As compared with the base-case scenario, Scenario 1 shows the upper limits of benefits that would be possible if, hypothetically speaking, the existing tax-driven diversion of cigarettes were eliminated and if the effectiveness level of compliant cigarettes were 100 %. Estimates are that for the six-year study period, from 2004 through 2009, there are approximately 4,600 cigarette fires, 180 related deaths, 1,500 related injuries, and $80 million in present value related property damage to be avoided.

Column 5 shows results for Scenario 3, based on an assumed increase in the price of compliant cigarettes of $0.10/pack or 1.8 % of pack price. Small reductions in fire-avoidance benefits and

Table E-3. Summary of impacts for selected scenarios, 7 % discount rate, 2004 to 2009

			Sensitivity Tests			
Major Categories of Impacts	Types of Effects	Base-Case Scenario 2	Upper-Limit Benefits Scenario 1	Price Increase Scenario 3	Adverse Preference Reaction Scenario 4	Combined Price Increase and Adverse Preference Scenario 5
		Fire-Safety Effectivessness Level				
		60%	100%	60%	60%	60%
[1]	[2]	[3]	[4]	[5]	[6]	[7]
First-order Fire-avoidance Impacts	Fires Avoided	1,883	4,616	1,870	1,695	1,683
	Deaths Avoided	74	182	74	67	66
	Injuries Avoided	595	1,457	590	535	531
	Property Losses Avoided (mill PV$)	$32	$78	$32	$29	$28
Second-order Economic Impacts	Business Sales (mill PV$)	$13	$6,334	($702)	($1,722)	($2,397)
	Cigarette Excise Tax Revenue (mill PV$)	NA	$249.5	($5.3)	($75.9)	($81.1)
	Persistent Job Change	24	8,832	-1,191	-2,310	-3,470
	Job Change as a % of base line	0.00%	0.10%	-0.01%	-0.03%	-0.04%

Note: Losses are indicated by parentheses.

negative economic effects result from a price increase of the size estimated as reflective of

possible producer costs of manufacturing compliant cigarettes.

Column 6 shows results for Scenario 4, based on an assumed adverse preference reaction by smokers to compliant cigarettes, which drives a 10 % diversion to non-compliant cigarettes. The assumption of a 10 % preference-driven diversion is purely hypothetical; it is used only for the purpose of conducting sensitivity analysis. The results highlight that smoker acceptance of compliant cigarettes may be of greater concern to success of the standard than a potential price increase. The reason is that the possible magnitude of an adverse preference-driven change seems more uncertain at this time than the likely magnitude of a price-driven change.

Results of a more pessimistic scenario are given in Column 7 for Scenario 5. These results reflect the combination of both the price-driven and preference-driven diversion of cigarettes away from compliant channels. Fire-avoidance benefits are reduced and negative economic effects increased.

Table E-4. Summary of impacts for selected scenarios, 7 % discount rate, 2004 to 2006

Major Categories of Impacts	Types of Effects	Base-Case Scenario 2	Sensitivity Tests: Upper-Limit Benefits Scenario 1	Price Increase Scenario 3	Adverse Preference Reaction Scenario 4	Combined Price Increase and Adverse Preference Scenario 5
		Fire-Safety Effectivessness Level				
		60%	100%	60%	60%	60%
[1]	[2]	[3]	[4]	[5]	[6]	[7]
First-order Fire-avoidance Impacts	Fires Avoided	1,089	2,669	1,081	980	973
	Deaths Avoided	42	104	42	38	38
	Injuries Avoided	335	821	333	302	299
	Property Losses Avoided (mill PV$)	$19	$46	$19	$17	$17
Second-order Economic Impacts	Business Sales (mill PV$)	$8	$3,927	($432)	($1,075)	($1,485)
	Cigarette Excise Tax Revenue (mill PV$)	NA	$147.3	($3.1)	($44.8)	($47.9)
	Persistent Job Change	26	10,603	-1,371	-2,803	-4,143
	Job Change as a % of base line	0.00%	0.12%	-0.02%	-0.03%	-0.05%

Note: Losses are indicated by parentheses.

Effects not Captured

While the study covered five scenarios for four study periods, it clearly has not covered all possible scenarios or quantified all possible impacts that may result from implementation of the standard. One type of benefit not captured is avoidance of the consequences of residential fire losses, namely, medical costs of treatment, particularly for serious burn cases; the attendant pain and suffering associated with injury and death, which have been estimated to be at least an order of magnitude higher than the direct economic costs of injuries; the pain and suffering of family and friends; the loss of one's personal possessions, including irreplaceable family heirlooms; burial costs; lost wages of those dead and injured; costs of temporary housing; loss of pets; lower insurance premiums; and other tangible and intangible costs of fire losses. The severity of many of the burn injuries suffered by victims of cigarette-caused residential fires makes the pain and suffering costs of particular concern.

The study has limited its coverage to residential cigarette fires, because that is what the standard targets. However, to the extent that conforming cigarettes also have a lower probability of starting other kinds of accidental fires, such as forest fires, the benefits of the standard are understated.

Another potential benefit of the standard, not assessed in detail because it lies beyond the perspective taken by the study, is the potential for NY State's early adoption of the standard to accelerate adoption of a similar standard by other states, the nation at large, or other countries.[1] Should this acceleration occur, the NY State standard may take credit for the avoidance of additional deaths, injuries, and property losses for the estimated period of acceleration. In 1999, for example, there were reported 22,700 cigarette-caused fires in U.S. residential structures. Reported deaths, injuries, and property loss included 685 civilians (excluding firefighters) killed, 1,738 civilians injured, and $320.3 million in direct property damage. (These statistics do not reflect unreported losses.) Accelerating an end to a large portion of national cigarette-caused losses would yield a sizable benefit from the standard from a national perspective. At the same time, adoption of a national standard would eventually eliminate some or all of the in-State effects specifically attributed to the existence of a State standard.

The following is a summary listing of additional loss-avoidance benefits of reducing cigarette fires not captured in the quantitative results provided in the tables above:

- Medical costs of treatment
- Pain and suffering of victims of death and injury
- Pain and suffering of family and friends
- Loss of personal possessions, often not replaceable
- Burial costs
- Lost wages of the dead and injured
- Costs of temporary housing
- Loss of pets

1. This study could be used to assess the effects of a cigarette fire safety standard in any state which is considering adoption of such a standard, provided assumptions and data specific to those states are used.

- Lower insurance premiums
- Other tangible and intangible costs
- Forest fire losses and losses from other cigarette-caused non-residential fires
- Accelerated loss avoidance in other states, the nation at large, or the rest of the world attributable to NY's earlier action.

There are also costs that are omitted from this State impact assessment. These include the short-term costs incurred by distributors and sellers of cigarettes in the State of changing over from non-complying to complying cigarettes. Also omitted are the additional costs of double inventory management, additional storage fees, and extra stocking costs of those businesses in the State that supply cigarettes both inside and outside the State and maintain dual supplies of complying and non-complying cigarettes.

Current Status

The standard has been implemented in NY State. Moreover, as of October 2004, the NY Department of State reported that cigarette brands comprising 97 % of the national market share have been certified as compliant. Thus far there appears to be no significant supply problem or price increase. NY's "Fire Safety Standards for Cigarettes" appears positioned to be cost effective from the standpoint of the first- and second-order impacts considered in this study.

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The Problem: Cigarette Fires in Soft Furnishings Kill and Injure People and Destroy Property

Most people are aware of the health threat posed by smoking cigarettes; fewer are aware of the related fire hazard. According to a recent report, lighted tobacco products are the major cause of deaths from unintentional fires in the United States and in every other country where fire deaths can be analyzed by cause.[1] Of fires started by lighted tobacco products in the United States, approximately three-fourths are "outdoor and other" fires, approximately 4 % are vehicle fires, and a little more than a fifth are structure fires. Structure fires—and specifically residential structure fires started by lighted tobacco products—though not the dominant type of unintentional fire, are the leading cause of death, injury, and property loss from these fires. And, cigarettes are by far the leading type of lighted tobacco product starting fires in residential structures. In contrast, cigars and pipes accounted for very few residential structure fires.[2] Most commonly, mattresses and bedding, upholstered furniture, and trash are the items ignited by cigarettes in structures.[3]

In 1999, cigarettes were reported to have caused 22,700 fires, 685 civilian deaths, 1,738 civilian injuries, and $320.3 million in direct property damage in residential structures in the U.S.[4] According to the U.S. Consumer Product Safety Commission, not having a national standard to require low-ignition cigarettes is costing the country approximately $4.6 billion per year in loss of human life and personal property.[5] Cigarette fire injuries tend to be unusually lethal and cigarette fire mortality shows a steadily rising rate with increasing age.[6] Cigarette-initiated fires are the single largest cause of fire deaths in the U.S.[7]

In New York State, like the rest of the nation, smoking-caused fires killed more people in residences than any other single cause of fires. In 2001, smoking-caused fires in residences

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1. John R. Hall, Jr., *The Smoking-Material Fire Problem*, National Fire Prevention Administration, Quincy, MA, May 2003, p. *i*.
2. Based on national estimates developed from survey data regarding the form of heat for residential structure fires in 1999. The data showed 87.7 % of residential structure fires started by cigarettes, 1.6 % started by cigars and pipes fires, and 10.7 % started by an unclassified or unknown type of smoking material. Ibid, p. 18.
3. Ibid, p. *i*.
4. Ibid, p. 18.
5. Michael Appleman, "The Joseph Moakley Memorial Fire Safe Cigarette Act of 2002," describes findings of the Consumer Product Safety Commission. Article available at the website of Burn Survivors throughout the World, Inc., www.burnsurvivorsttw.org/articles/hr4607.html.
6. Burn Foundation, "The Fire-Safe Cigarette: The Search for a Standard," excepted from "Progress Towards a Fire-Safe Cigarette," Journal of Public Health Policy, Volume 16, 1995, Number 4; available on-line at www.burnfoundation.org/firesafecig.html.
7. Building and Fire Research Laboratory, "Questions and Answers on NIST Reduced Ignition Propensity Cigarette Testing," National Institute of Standards and Technology, February 20, 2001. Available on-line at www.bfrl.nist.gov/info/fire_safe_cig/questions_and_answers.htm.

killed an estimated 33 people in NY State.[8]

Alternative Approaches to Reducing the Cigarette-Fire Problem

Given the extent of the problem, it is not surprising that attention has been given to potential solutions. Multiple approaches have been envisioned for reducing smoking-caused fires in residential buildings. These can be grouped by approach into five categories: (1) behavior modification approaches, (2) economic approaches, (3) regulatory approaches, (4) public service approaches, and (5) technological approaches.

Behavior modification approaches include efforts to reduce smoking, such as by anti-smoking campaigns, restricting smoking to less convenient locations, and using medically-based supports and treatments to help people stop smoking. They also include efforts to reduce the carelessness of smokers, such as fire-safety education. Economic approaches include actions that increase the cost of smoking and thereby discourage it. Examples are imposing special taxes on cigarettes, and increasing insurance or rental rates for smokers. Regulatory approaches include building fire codes that call for the use of construction techniques and building materials that reduce the incidence and spread of fires in structures, as well as public ordinances that restrict smoking to designated areas. Public service approaches include the location, staffing, and response times of fire departments.

Technological approaches to mitigate the cigarette-fire problem include the application of fire retardants to residential furnishings to make them less flammable when lighted cigarettes are dropped on them.[9] This approach has become more effective over time as older furnishings have been replaced with sofas, easy chairs and mattresses treated with fire retardants. Technological approaches also include the use of fire alarm and suppression technologies. Photoelectric smoke alarms, designed to detect smoldering fires, are particularly important to alerting building occupants to smoking-caused fires. Another technological approach aimed at reducing the problem of residential fires started by cigarettes is to reduce the ignition strength of cigarettes, making them less likely to start a fire if dropped on household furnishings and other materials. Several ways have been found to reduce the ignition strength of cigarettes, including modifying the paper wrapper.

Of particular interest to this study is a technological approach--reducing the ignition strength of cigarettes--implemented by legislation and regulation.

8. NY State Department of State, Office of Fire Prevention and Control, provided data in EXCEL Table H-43.
9. See J.F. Krasny, *Cigarette Ignition of Soft Furnishings—A Literature Review with Commentary*, Report No. 2, Technical Study Group on Cigarette and Little Cigar Fire Safety, Cigarette Safety Act of 1984, and NBSIR 87-3509, U.S. National Bureau of Standards (now the National Institute of Standards and Technology), Gaithersburg, MD, 1987.

Reducing Cigarette Ignition Propensity: Legislative Background

It is important to define terms. The term "fire-safe" has often been used in legislation and discussions concerning modification of cigarettes. This term is apparently troubling both to the research community and to the fire-service industry. According to the Building and Fire Research Laboratory (BFRL) of the National Institute of Standards and Technology (NIST), which has played a central research role in the investigation of cigarette ignition, "A reduced ignition propensity (more commonly, but incorrectly known as 'fire-safe') cigarette is one that has been designed to be less likely than a conventional cigarette to ignite soft furnishings such as a couch or mattress."[10] Others have made the point that any lit cigarette will retain a potential to start a fire. Reportedly, a spokesperson for cigarette manufacturer Philip Morris stated, "the industry supports the development of cigarettes with reduced 'ignition propensity,' but takes issue with 'fire-safe.'"[11] A Philip Morris press release noted, "Reduced IP [ignition propensity] cigarettes are not 'fire safe' – any product that burns can cause a fire if it is handled carelessly."[12] This present report is about reducing cigarette ignition propensity. As used in the current context, "fire-safe" is taken to be synonymous with "reduced-ignition propensity," "reduced-ignition strength," and "less fire-prone," all meaning cigarettes less likely to start fires.

Public attention to this problem is not new. Congress first directed that research be conducted to make "fire-safe" cigarettes in 1929. The National Bureau of Standards (now NIST) was directed to conduct the research.[13]

In 1974, after a long period with little activity, legislation mandating fire-safe cigarettes was introduced in the Senate and passed. It, however, failed in the House of Representatives.

In 1984, Congress passed the "Cigarette Safety Act of 1984,"[14] creating the Technical Study Group (TSG) on Cigarette and Little Cigar Fire Safety. The TSG was directed to investigate the technical and commercial feasibility, economic impact, and other consequences of requiring that cigarettes and little cigars have "minimum propensity" to ignite upholstered furniture and mattresses. That research effort produced a collection of reports on the feasibility and estimated effects of cigarettes with reduced ignition propensity.[15] The effort also resulted in a report of the TSG to Congress concluding that it is technically and likely commercially feasible to produce

10. BFRL/NIST, "Less Fire-Prone Cigarettes: Questions and Answers on NIST Reduced Ignition Propensity Cigarette Testing," available at the BFRL/NIST web site, http://www.bfrl.nist.gov/info/fire_safe_cig/questions_and_answers.htm.
11. Meg Haskell, "Fire-Safe Cigarettes may come to Maine," *Bangor Daily News*, December 30, 2003, www.bangornews.com.
12. Philip Morris, Press Release, "Philip Morris USA Submits Comments to Help Reduce Ignition Propensity of Cigarettes in New York State," dated April 15, 2003, and revised April 30, 2003.
13. "Fire Safe Cigarette Legislative Update," American Burn Association, www.ameriburn.org/adocacy/fireSafeCig.htm.
14. Public Law 98-567; Stat. 2925, October 30, 1984.
15. Called out in the contract for the current study as an "applicable document" is the following report from the TSG-commissioned set: R.T. Ruegg, S.F. Weber, B.C. Lippiatt, and S.K. Fuller, *Improving the Fire Safety of Cigarettes: An Economic Impact Analysis*, NBS Technical Note 1242, National Institute of Standards and Technology, Gaithersburg, MD 1988. This and the other reports from the TSG-commissioned set are available at www.bfrl.nist.gov by clicking on "Highlights," and then selecting "Less Fire Prone Cigarettes."

cigarettes less likely to start fires in soft furnishings.

In 1990, Congress passed the "Fire Safe Cigarette Act of 1990,"[16] which directed the Consumer Product Safety Commission to develop a reliable test to accurately and consistently determine the effects of dropping lighted cigarettes on furnishings. The Commission requested that NIST develop the test for assessing cigarette ignition propensity. NIST research subsequently provided the scientific basis leading to the establishment of ASTM E2187-02b, Standard Test Method for Measuring the Ignition Strength of Cigarettes.[17] Under the 1990 Act, the Commission also requested that NIST test a sample of commercially available cigarettes for their ignition performance.[18] The NIST testing found that 14 best sellers had comparatively higher ignition propensities and that six other brands then on the market had much lower ignition propensities. Testing further revealed that "both sets of cigarettes produced similar amounts of tar, nicotine and carbon monoxide."[19] These test results support the following two assumptions used in this current study: (1) It is possible now to produce cigarettes with lower ignition propensities and to sell them competitively against cigarettes with higher ignition propensities. (2) The toxicity of smoke is not necessarily affected by the ignition propensity of cigarettes.

In 1999, Congressman Moakley introduced the "Fire Safe Cigarette Act of 1999" as H.R. 1130. The proposed legislation would require the establishment of a cigarette safety standard to be implemented in the U.S. within 18 months of the date of passage. This bill was not passed, but was re-introduced in 2002, as noted below as the "Moakley Act."[20]

In 2002, the "Joseph Moakley Memorial Fire Safe Cigarette Act of 2002" was introduced in the House as H.R. 4607, and in the Senate as S. 2317, with support from the National Fire Protection Association (NFPA). This proposed legislation would direct the Consumer Product Safety Commission (CPSC) to establish a standard, specified in the act, by which cigarettes could be regulated with respect to their propensity to start fires. The bill also would prohibit advanced stockpiling of non-complying cigarettes and allow states to pass fire-safety standards for cigarettes more stringent than the proposed national standard.[21] This legislation was re-introduced in 2004.

Efforts to legislate cigarettes with lower fire propensity at the national level were paralleled by efforts at the state level. In 2000, NY State passed the first state law requiring fire-safe cigarettes. The law contained the provision that it was "to take effect by July 1, 2003, unless federal legislation is enacted which supersedes it." Reportedly, eleven other states, including Maine and Massachusetts, are considering similar laws. These other states are said to be

16. Public Law 101-352.
17. NIST staff were awarded ASTM's Simon H. Ingberg Award for "the original and comprehensive work in research, testing and analysis they performed to create the sound scientific basis for ASTM Standard E2187…."
18. Gann, R.G., Steckler, K.D., Ruitberg, S., Guthrie, W.F., and Levenson, M.S., "Relative Ignition Propensity of Test Market Cigarettes," NIST Technical Note 1436, National Institute of Standards and Technology, Gaithersburg, MD, 2001.
19. Building and Fire Research Laboratory, "Questions and Answers on NIST Reduced Ignition Propensity Cigarette Testing," op. cit., see #4.
20. American Burn Association, "Fact Sheet on Fire-Safe Cigarettes," www.ameriburn.org/advocacy/fireSafeCig.htm.
21. National Volunteer Fire Council, www.nvfc.org/leg/firesafecig.html.

watching closely developments in NY State and taking advantage of NY State's investment in pursuing its standard.[22]

Table 1-1 summarizes the legislative history in the U.S. of attempts to reduce cigarette fires by lowering their ignition propensity. From 1929 to 1997, all of the entries except one for NY State refer to federal legislation. Beginning in 1997, the entries pertain variously to federal and state legislation.

Table 1-1. History of U.S. National and State Legislative Action to Lower Cigarette Ignition Strength, 1929-2003

Year	Legislative Action
1929	Congress directs National Bureau of Standards to conduct "fire-safe" cigarette research
1974	Senate passes legislation requiring "fire-safe" cigarettes; legislation fails in House
1983	First "fire-safe" cigarette legislation is introduced in New York State
1984	Congress passes Federal Cigarette Safety Act of 1984, mandating formation of a Technical Study Group to determine the technical and economic feasibility of making a "fire-safe" cigarette
1987	The Technical Study Group reports to Congress that it is technically and economically feasible to produce cigarettes that are more fire safe
1990	Congress passes Federal Fire Safe Cigarette Act of 1990, mandating formation of a Technical Advisory Group to develop a fire-safe test method for cigarettes
1993	The Technical Advisory Group reports to Congress that a fire safety test method had been developed in support of promulgating a fire safety standard for cigarettes
1997	A fire safe cigarette bill is introduced in Oregon, but does not pass
1998	Legislation is introduced in Vermont concerning fire safety and cigarettes, but does not pass
1999	The Fire Cigarette Act of 1999 is introduced in the House as H.R. 1130, to require the establishment of a cigarette safety standard and to direct the CPSC to implement it nationwide, but is not voted on
2000	New York State passes the first state law requiring fire-safe cigarettes to take effect July 2003 unless superseded by federal law
2001	Massachusetts passes through the State Senate a bill requiring fire-safe cigarettes, but the bill stalls in the House

22 Haskell, "Fire-safe cigarettes may come to Maine," op. cit.

Year	Legislative Action
2001	Minnesota introduces a bill in the State Senate requiring the State fire marshal to adopt rules for fire retardant standards for cigarettes, but the bill does not become law
2002	The Joseph Moakley Memorial Fire Safe Cigarette Act of 2002 is introduced in the U.S. House as H.R. 4607 and in the Senate as S. 2317, to direct the CPSC to establish a standard for regulating cigarette propensity to start fires, to prohibit advanced stockpiling of non-complying cigarettes, and to allow states to pass more stringent fire-safety standards for cigarettes; it died in committee
2003	In Maine "An Act to Require Fire-Safe Cigarettes in the State," LD1127, calling for all cigarettes sold in Maine to be fire-safe, is introduced but held over without action
2003	Effective date of NY State legislation is established as June 2004

Source: Derived in part from the American Burn Association's "Fact Sheet on Fire-Safe Cigarettes," op cit.

Currently, similar legislative efforts are also underway in other countries around the world. For example, Canada passed legislation in the spring of 2004 to require manufacturers to sell only self-extinguishing cigarettes.[23] New Zealand, and South Africa[24] are among those nations that appear to be moving toward legislation to require less fire-prone cigarettes.

New York State's Cigarette-Ignition Performance Standard

Legislation enacted in NY State in 2000 made it the first state in the nation, and, indeed, the first in the world to tackle the cigarette fire problem by setting a cigarette-ignition performance standard. Entitled "Fire Safety Standards for Cigarettes,[25] the legislation requires that the NY State Office of Fire Prevention and Control (OFPC) set a fire safety performance standard which will limit the risk that cigarettes will ignite upholstered furniture, mattresses, and other household furnishings. The legislation requires that only cigarettes that meet the standards can be legally sold throughout the State after a period of 180 days following adoption of the Rule implementing the legislation. A detailed timeline for NY State's legislation is presented in Table 1-2.

23. CBC News, "Fire-safe cigarette finally on the way," April 2, 2004.
24. The National Council of South Africa called for legislation to make cigarettes (or, as they are popularly called, "stompies") fire-safe in 2003. Found at "Call for fire-safe cigs," www.news24.com/News24/South_Africa/News?0,,2-7-1442_1427278,00.html.
25. See Chapter 284 of the New York Laws of 2000.

Table 1-2. Timeline for Establishment of NY Fire Safety Standard for Cigarettes

Date	Event
August 17, 2000	NY "fire-safe" cigarette bill is signed into law (Laws of 2000, Chapter 284)
December 31, 2002	Notice of Proposed Rule Making is published in the State Register
April 2003	Public Comment Period on the Proposed Rule ends
September 3, 2003	Assessment of Public Comments and Notice of Revised Rule Making is published in the State register
November 3, 2003	Comment Period on Revised Rule ends
December 31, 2003	Rule is adopted (Title 19, Part 429, New York Codes, Rules and Regulations)
June 28, 2004	Rule took effect

According to the OFPC, the public submitted approximately 7500 pages of comments during the period of public comment following publication of the Notice of Proposed Rule Making. This study draws on the record of public comment. In its "Assessment of Public Comment," the OFPC stated:

> "The overwhelming majority of these comments supported the rule, made no suggests that it be modified, and urged its speedy adoption. An extremely small proportion of these comments were opposed to the rule for various reasons. None of these comments opposing the rule suggested any significant alternative to the rule other than that the rule not be adopted. This alternative is not authorized by Executive Law section 156-c, the statute which requires the promulgation of the rule."
>
> (OFPC, Assessment of Public Comment, p. 1.)

As a result of technical comments received, the OFPC made revisions to the proposed Rule. The date cigarettes sold in the State must conform to the Rule is June 28, 2004.[26]

The State's legislation is expected to have a direct beneficial impact in terms of cigarette fire losses, but the potential impact within NY State extends beyond these intended benefits to include other, unintended effects. Changes in cigarettes to meet the new performance standard may adversely affect cigarette price and smoker preferences, affecting spending patterns within the State. Price increases or adverse preference reactions may affect cigarette manufacturers, suppliers of inputs to cigarette manufacturers, agents, wholesalers and retailers of cigarettes,; as

26. Associated Press Wire Release, "Pataki calls for Marketing 'Fire-Safe' Cigarette," January 2, 2004. Implementation of the legislation has since occurred.

well as on State employment, output, and excise revenue. There may be related effects on households in their expenditures for cigarettes and other items. In addition, the effect of NY State's legislation may extend beyond the borders of the State to influence other states and other countries to adopt similar legislation.

The National Institute of Standards and Technology (NIST) is providing technical expertise to the NY State Office of Fire Prevention and Control (OFPC) in support of the cigarette fire safety legislation. In its capacity, NIST has arranged for this study to develop a methodology to assess the effects of cigarette fire safety standards and to apply it under alternative hypothetical scenarios.

Study Overview

This study was developed at a time when real world data concerning the effect of New York's first-of-its-kind cigarette fire safety standard were not yet available. The application of the assessment methodology was therefore conducted for a series of hypothetical scenarios. As empirical data become available, it may be possible to determine the actual effects of the standard.

The study's objective is to estimate the impacts of NY State's new cigarette fire safety standard, including first-order fire-reduction impacts, and second-order economic impacts. The impact scope of the study is limited to effects attributable to the standard. The geographical scope of the analysis is NY State. The study uses a general benefit-cost methodology as an organizing framework for the impact assessment of five case scenarios. It uses two principal analysis tools to estimate the benefits and costs of the new cigarette fire safety standard: (1) The EXCEL spreadsheet tool, and (2) The Regional Economic Models, Inc. (REMI) forecasting model.

Methodology Development

Chapter 2 sets forth the methodology used to assess the impact of a cigarette fire safety standard. The focus is on the framework, models and tools of analysis, development of scenarios for analysis, and areas of uncertainty. Approaches taken to the assessment are explained. It is left to Chapters 3 and 4 to populate the framework with data. First, the model approaches and methodologies are stated; then development of each of the input parameters necessary for implementation is described in turn. Any state which intends to use the methodologies described in this study must develop information for the relevant input values. Uncertainties in the input values chosen for this study are described, and may serve to illustrate the uncertainties that may arise in similar assessments by other states.

Benefit-Cost Framework

A benefit-cost model provides a useful organizing framework for categorizing effects from an action or event as either benefits or costs occurring within a well-defined timeframe. A benefit-cost framework facilitates comparisons. Where feasible, the benefits and costs are expressed in dollar terms, and adjusted for their varying times of occurrence, to make the comparison easier. To attribute benefits and costs to the standard, estimated impacts are expressed in terms of changes to a set of baseline projections that forecast what would have been expected to occur in the absence of the standard.

This analysis uses multiple units of valuation to better reflect the mixture of different types of benefits and costs, and the particular interests of stakeholders. The units of measure employed in the study include the following: (1) number of deaths averted, (2) number of injuries avoided, (3) dollar value of property damage avoided, (4) number of jobs lost or gained, (5) dollar changes in personal income, (6) dollar changes in business sales, (7) dollar changes in state excise tax revenue collected, and (8) dollar changes in gross state product. Because some of the economic effects are overlapping, it is necessary to avoid "double-counting."

First-order Impacts

First-order impacts from the new standard are defined as reductions in deaths, injuries, and property damage from having fewer cigarette-ignited residential fires. These are termed "first-order impacts" because they are the effects deliberately intended by the legislation creating the standard. Measures used are the number of fires prevented, the number of deaths and the number of injuries avoided, and the dollar value of property damage avoided. Property damage avoided is projected year-by-year in 2003 dollars and also is stated in present value dollars over the designated study period. These are the principal benefits of the standard that this study seeks to quantify.

In addition to reducing cigarette-ignited residential fires, the standard may reduce cigarette-ignited fires in non-residential settings. A large potential exists in reducing the number of forest fires and their attendant losses. While substantial benefits will likely accrue from avoiding non-

residential incidences of cigarette-caused fires, this study focuses only on those in residential structures.

Second-order Impacts

Other impacts of the standard are essentially unintended, though not necessarily unforeseen. In this study, these effects, which include mainly costs but also benefits, are termed "second-order impacts."

All cost effects are in the category of second-order impacts because they are all unintended; they are effects that may be incurred in the process of achieving the benefits if certain conditions attain. The unintended costs will arise if producers raise prices or supply conforming cigarettes smokers reject, causing diversion of cigarette purchases to channels less advantageous to the State and its businesses. If such diversions of cigarette purchases occur, they would be expected to affect any firms located in the State that are engaged in cigarette manufacture, distribution, storage, and wholesale and retail sales. Any decreases in within-State sales would also be expected to affect State-wide employment and income, as well as excise tax revenue collected within the State.

Second order impacts also include positive effects resulting from reductions in out-of-pocket property losses. These impacts are given in terms of gains in business sales and jobs.

It should be noted that since the study was generated at a time when no real world data concerning the economic effect of New York's cigarette fire safety standard were available, the conclusions of the study concerning second-order impacts are based on hypothetical scenarios and simplifying assumptions.

Study's Scope and Perspective

For the purpose of this analysis, NY State is treated as an island with cigarettes modified to comply with the standard, surrounded by a sea of states with unmodified cigarettes, and with channels within the State through which unmodified cigarettes may be obtained. The benefits and costs estimated for alternative scenarios all occur within NY State.

Actions of the rest of the nation, however, do enter the study in two ways: 1) in influencing the timeframe for the analysis, and 2) in possibly generating acceleration benefits of the NY State standard (not included in this study's quantified impact estimates).

The timeframe for analysis is affected by actions of the rest of the nation, because adoption of a national standard will eliminate the uniqueness of the NY market and reduce the ability of consumers in NY State to shift their cigarette purchases to unmodified cigarettes. More to the point, a national standard will eliminate the need for a standard at the state level to achieve the same results.

At the same time, there is reason to think the NY State standard—the first in the nation—may accelerate the adoption of a similar standard by the rest of the nation. From a national perspective, this effect may be included among the impacts of the NY Standard.27 However, because the focus of this study is on within-State impacts only, the quantitative analysis does not include the effects of a potential acceleration effect.

The study does not provide estimates of changes in smoking-related health costs for the population of NY State. Neither does it ignore these costs. Rather, changes in smoking-related health costs resulting from the cigarette fire safety standard are zero because the study assumes that smoking behavior and health effects are unaffected by the standard. This assumption is based on two underlying suppositions. (1) Cigarettes modified to conform to the new fire safety standard are assumed to have the same toxicity characteristics as unmodified cigarettes. (2) The total consumption of cigarettes within NY State for any given year is assumed to comprise varying combinations of conforming and non-conforming cigarettes but the total consumption for the year is assumed fixed. Consumer preference and price reactions are assumed to manifest in shifts in cigarette purchases away from conforming channels to non-conforming channels, rather than in decreases in overall cigarette consumption within the State.

Estimating Baseline Projections

Assessing the impact of the new standard requires for comparison a set of projected baselines of what is expected to happen in the absence of the standard. Impacts of the standard are then estimated as changes in the baselines.

For estimating cigarette fires and associated losses, the projected baselines are modeled as having three components: (1) a projection of annual cigarette consumption in NY State from 2004 through 2011, (2) a projection of annual taxed cigarette purchases in NY State from 2004 through 2011, and (3) projections of the various kinds of fire losses per unit quantity of cigarettes consumed in NY State from 2004 through 2011. Annual cigarette consumption in the State—as contrasted with annual taxed purchases—is projected because it is the within-State consumption that drives cigarette fires in the State. Annual taxed cigarette purchases in the State are projected because the standard is most likely to affect cigarettes purchased through channels that are subject to State regulation, oversight, and enforcement. The quantity of cigarettes consumed within the State that are purchased outside State-regulated channels dilutes the effectiveness of the standard to affect the cigarette-caused fire problem. Separating the baselines for in-State cigarette consumption, taxed cigarette purchases, and fire losses per quantity of cigarettes consumed facilitates the prediction of these different effects in the analysis. (The baselines are projected out to 2011 to accommodate one of four alternate study periods used in the analysis--a six-year study period with a starting time of 2006).

It should be noted that the data in the baseline projections are projected data; there were no empirical data for the baseline periods at the time the baselines were estimated.

27 It would also be possible to take a worldwide perspective of potential acceleration effects. Canada, the first country in the world to adopt a cigarette ignition performance standard, for example, reportedly was influenced by NY State's adoption of its standard. A worldwide perspective is also beyond the scope of this study.

Baseline Projection of Cigarette Consumption in NY State: Total cigarette consumption in the State is projected by applying a linear trend line to past consumption. This may seem like an oversimplification, given that past and future smoking rates are a complex function of such factors as age, gender, educational level, income and employment status, and other demographic characteristics; prices of cigarettes; anti-smoking campaigns; medical information; and anti-smoking medications and other aids. Moreover, future smoking rates are a function of past smoking rates, given the additive nature of smoking. However, an inspection of per capital cigarette consumption over the previous 17 years for which data were available, revealed a relatively steady downward trend with little nonlinearity. Based on the past trend in consumption rates, together with expectations of a continued decline in smoking, it was decided that fitting a simple, linear trend line to the historical data, and projecting the resulting trend line over the study period would likely better represent future consumption rates than would attempting a much more complicated analysis of underlying causal factors.

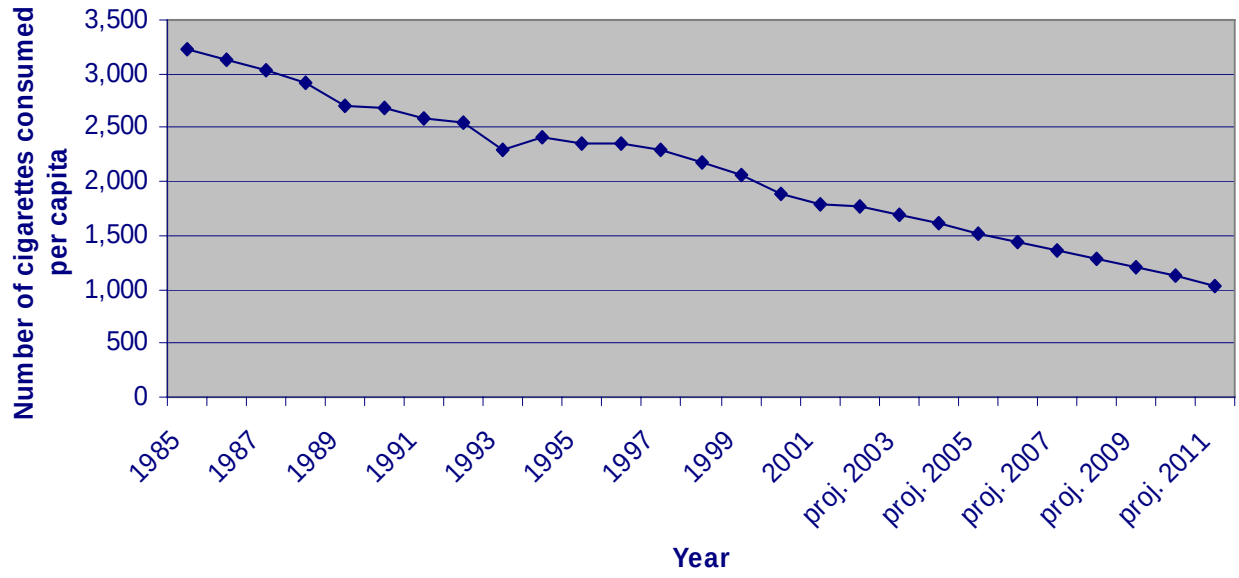
National annual per capita domestic cigarette sales from 1985 through 2001, reported by the U.S. Federal Trade Commission, provide the starting point. The national per capita rates are adjusted to account for deviation of New York smoking rates from the national average. As explained earlier, deriving NY State consumption in this way avoids the problem that would result from using actual NY State reported cigarette sales, because the latter excludes consumption that comes from cigarette purchases through unreported channels.

The method of ordinary least squares is used to fit a regression equation to the set of historical per capita sales data, adjusted for NY smoking rates in comparison with national rates. Per capita domestic sales are assumed equal to per capita domestic consumption. The resulting regression equation has a coefficient *a*, the y-intercept, which gives the estimated value of y when the value of x is zero. The equation has a value *b* that represents the slope of the trend line, indicating the change in the estimated value of y for a one unit change in x. The regression equation takes the form:

$$y = a + bx,$$

where y, in this case, is the estimated NY State per capita consumption of cigarettes for a given year, x. The regression equation is used to develop a baseline projection of estimated annual per capita cigarette consumption rates in NY State over the timeframe of interest--extending out to 2011—based on past consumption rates. Figure 2-1 shows the historical and projected trend in per capita cigarette consumption.

Figure 2-1. Trend in Cigarette Consumption in NY State per capita



To project total cigarette consumption in NY State over the study period, the projected annual per capita consumption rates are multiplied by the projected annual population in NY State, matched to the same adult segment of the population for which the cigarette consumption rates apply. The population projections are derived by applying the projected population growth rate for NY State over the study period to the reported starting level of the adult population. The NY population for 2002 is from the U.S. Census Bureau, and the annual growth rate is derived from U.S. Bureau of Census population projections for NY State for the years 2005 and 2015.

To the projected number of cigarettes consumed by adults in NY State is added projected cigarette consumption by underage smokers in the State. Youth cigarette consumption is projected by adjusting the starting consumption level by both the projected population growth rate in the State, and the projected rate of decline in smoking rates among underage smokers. The baseline projections of cigarette consumption are developed and presented in section 3.1 of the report.

Baseline Projection of Taxed Purchases of Cigarettes in NY State: Two approaches were considered for projecting the baseline of taxed cigarettes purchased in the State. Taxed purchases are important because they are assumed to represent the portion of cigarette consumption that will comply with the standard if there are no additional diversions specifically driven by the standard. As discussed further in section 2.3.3, a closely related question is the rate at which smokers will substitute non-conforming cigarettes for conforming cigarettes due to price- or preference-driven diversion.

One approach to projecting the baseline of taxed purchases—and the approach taken for the scenario analysis--is to apply the percentage of recently diverted purchases as a constant percentage to the entire projected cigarette consumption baseline. This approach assumes that the percentage of tax-driven diverted purchases will continue at the current rate. It is also

consistent with avoiding a confusion of the standard's estimated impacts with those from future tax increases.

The other approach—considered for use, but rejected—was to project a trendline of tax-driven diversions. This approach was not taken because it would make it difficult to separate out impacts attributable to the standard and those attributable to future tax policy. Moreover, projecting a diversion trend line would require assumptions about future directions of NY State cigarette tax policy relative to that of other states, consumer reaction, and assumptions about NY State's success in combating cigarette smuggling and other illegal channels through which cigarettes are diverted—all issues lying outside the focus of this study.

Baseline Projections of Fire Losses Per Quantity of Cigarettes Smoked: Projecting fire losses per quantity of cigarettes smoked begins with the annual historical series of numbers of residential structure fires caused by ignited tobacco products, and the number of civilian deaths, injuries, and current dollar property damage reported to result from these fires. Adjustments are made to remove fires caused by cigar- and pipe-ignition, to factor in estimated firefighter deaths and injuries incurred in these fires, and to factor in unreported civilian deaths and injuries. Property damage is adjusted to a constant dollar basis, eliminating purely inflationary distortions in the value of losses. Each data series of cigarette-caused losses in residential structures is then expressed in terms of losses per unit of cigarettes consumed. This is done by dividing each annual fire loss amount by the associated number of cigarettes consumed in that year. (Again, recall that the fire losses relate to cigarettes consumed rather than taxed sales.)

The method of least squares is then used to estimate the regression equation that captures the trend in each type of fire loss in NY residential structures per quantity of cigarettes consumed. The resulting set of equations is then used to construct the baseline projections for each type of cigarette fire loss.

Analysis Tools

Two analysis tools are used to estimate first- and second-order benefits and costs of the new standard: an EXCEL Spreadsheet and a REMI model for NY State.

Spreadsheet Analysis

Organization of the fire-related input data, development of the sets of baseline projections, and computation of first-order benefits are accomplished within an EXCEL spreadsheet environment. The spreadsheet is an ideal tool for these analytical functions because it facilitates data organization and data manipulations needed to convert the existing data series to a form appropriate to use for the NY State analysis. In a spreadsheet context it is feasible to examine the large number of conditions desired by policy makers.

REMI Model Analysis

Use of a single-area REMI economic forecasting model for NY State facilitates estimation of State-wide economic impacts. The model of NY State is developed by Regional Economic Models, Inc. (REMI) of Amherst, MA, and is current with respect to NY State demographic and economic data. The REMI model is selected for the analysis because it is a widely used and widely accepted approach for forecasting dynamic economic impacts of proposed policies and projects in the United States. [28]

The REMI software system allows the user to fine tune aspects of the calibration using local expertise and available data. The model can be used to predict, for each year in the future, the impact of the proposed policy change on employment and business output for each of 53 industry categories and 94 detailed occupational categories. The model also can be used to predict other variables such as changes in regional personal income, population, business competitiveness, industry wage rates, and industry value added.

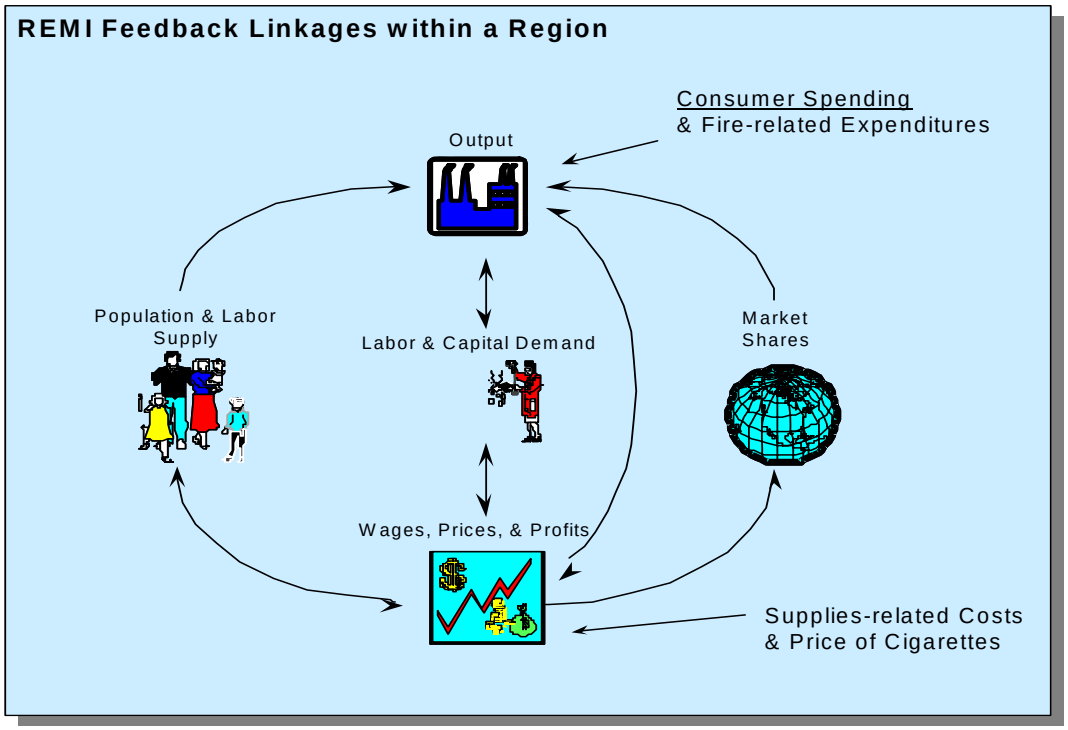
The REMI model effectively combines four components:

- *General economic forecast*, which projects changes in population, employment, business sales, and profits for the region over the 2000-2035 time period;
- *Policy impact*, which estimates how public policy and facilities investment changes business revenues and operating costs in each industry in the region, and the effect of these changes on the product prices, and the region's competitive position and share of national growth;
- *Population trend*, which estimates changes in the migration of working age segment of the region's population in response to changes in demand for labor, wage levels and living costs; and,
- *Input-output analysis*, which accounts for the inter-industry flows of dollars, and the associated indirect and induced economic effects.

These four functions are combined into one integrated model system, which simulates the effects of public or private projects or policy programs on the economy. In operation, the REMI economic simulation model of the regional economy can be broken down into five key economic arenas, illustrated in Figure 2-2 below: (1) output, (2) labor and capital demand, (3) population and labor supply, (4) wage, price and profit, and (5) market shares.

28. The capabilities of the REMI model have been published in national academic journals such as the *American Economic Review*, The *Review of Economics and Statistics*, and *International Regional Science Review*. A REMI model for NY State has been in use by several NY State agencies for a number of years, e.g., Empire State Development, NYSERDA, and NYS-Budget & Finance Office are REMI software license holders.

Figure 2-2. REMI Integrated Model



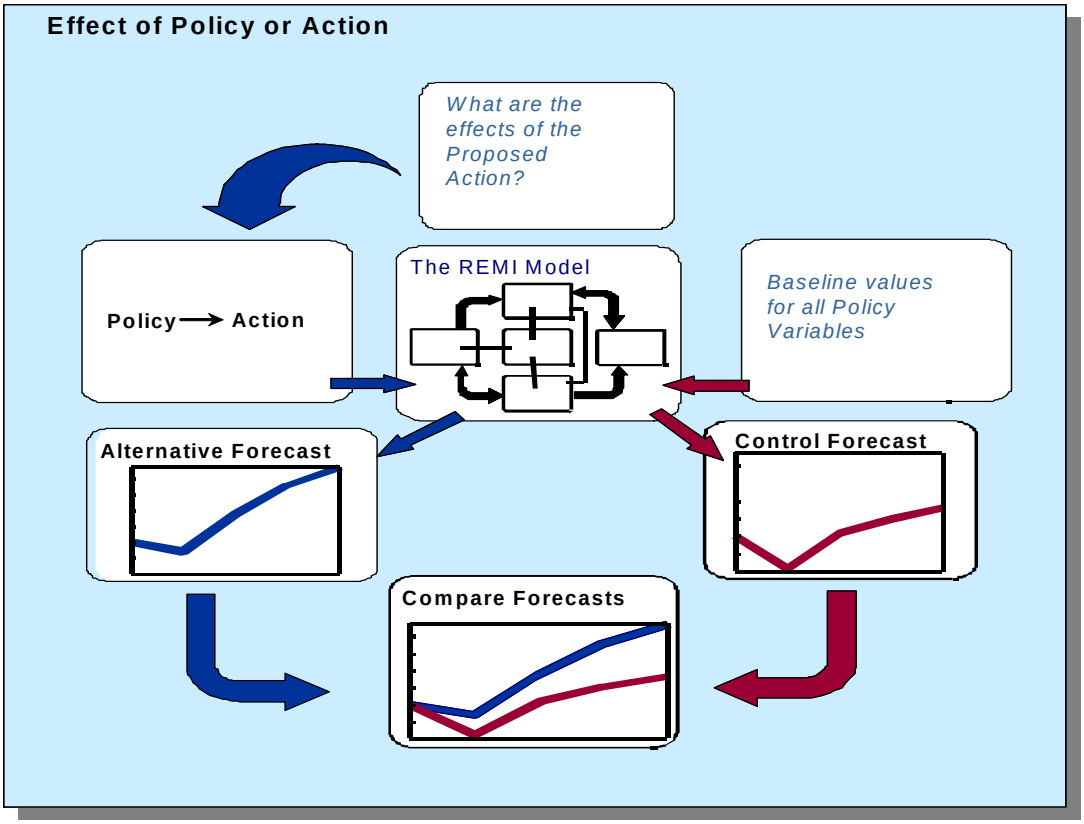
The impacts in this study to be measured using the REMI model are those termed second-order. They include economic impacts driven by (1) projected changes in the factors of production for cigarette manufacture, (2) changes in the quantity of cigarettes purchased in NY State as a result of consumer preference or reaction to cigarette price changes associated with their modification, and (3) reductions in direct property losses due to fewer cigarette-caused fires.

Calibrated to recent demographic and economic data for NY State, the model is capable of measuring annual economic and demographic changes to the year 2035 for a wide number of policy-initiated processes that affect *a)* how specific industries manufacture products such as cigarettes, *b)* how requirements for new types of supplies (or inputs) into cigarette manufacturing shift or create opportunities for supplier firms that are either in-state or out-of-state, *c)* how the price of a new product, such as modified cigarettes, affects the consumer price index (CPI) and ensuing household purchases, *d)* the extent to which New York smokers purchase non-conforming cigarettes from surrounding states, and *e)* expenditures of out-of-pocket property damages avoided

The state's annual economic impacts arising from the above changes are measured in terms of employment (total, and by industry), real disposable income, consumer spending, business sales, gross state product, and excise tax revenue. The impact assessment takes into account effects on wholesale and retail distributors of cigarettes within the state, cigarette manufacturers, and manufacturer supplier firms.

Results of a "control" forecast and "alternative" forecasts are compared and the difference recorded for each of the cases considered. Figure 2-3 illustrates the comparison.

Figure 2-3. REMI Analysis of Forecasts



Integration Across the Two Analysis Tools

The REMI analysis accepts data from the EXCEL spreadsheet analysis. These estimates include changes in fire losses, estimated consumer price changes and preference changes that affect the quantity of expenditures for modified and unmodified cigarettes, and other projections. These estimates are translated into appropriate data inputs to the REMI model through a set of policy variable levers.

Use of Discount Rates

Discount rates are used in the analysis to convert monetary amounts estimated to occur at different times to a common time bases for purposes of comparison. The question of what discount rate to use arises first in section 2.3.2, in conjunction with estimating a possible price increase for modified cigarettes, based on changes in manufacturing costs. A discount rate is needed to annualize upfront modification costs so that they can be combined with annual modification costs. The specification of a discount rate is next required in Chapters 3 and 4 to compute present value equivalents of dollar benefits and costs spread out over the study period.

The Federal government recognizes that, in general, public investments and regulations affect both private investment and consumption. It directs Federal agencies to account for this displacement and to promote efficient investment and regulatory policies by applying a discount rate that reflects the return on private sector investment. Applying a discount rate to monetary amounts, or "discounting," accounts for the fact that a dollar's worth of goods and services received (or spent) in future years is worth less in the economy than a dollar's worth of goods and services received (or spent) now, even when goods and services are measured in terms of "real dollars," that is, dollars adjusted to remove the effects of general price inflation. The economic discount rate provides a measure of the trade-off between goods and services received at different times.

If a benefit will be received at a future time, n years from now, then under generally accepted discounting procedures, this future benefit is discounted to the current time by multiplying the benefit by the discount factor $[1/(1+r)^n]$, where r is the discount rate and n is the number of years in the future.

The discount rate r is specified by OMB for Federal government decision making. In the recent past, OMB has recommended using a real discount rate of approximately 7 % per year for constant-dollar benefit-cost analysis. However, while this study was underway, OMB revised its directive to Federal agencies, and began recommending the use of a real discount rate of approximately 3 percent per year for cost-benefit analysis with long time horizons (OMB, 2004; Appendix C).

This study addresses a state regulatory policy, not subject to the Federal OMB directive on discounting. However, in lieu of specific guidance at the state level, the Federal guideline provides useful guidance for discounting that is followed in this study. Both rates – 7 % and 3 % -- are used in the study. A 7 % rate is used in section 2.3.2 to annualize upfront costs of producing modified cigarettes—which seems appropriate as an approximation of the marginal pretax rate of return on an average investment in the private sector. A 7 % real rate is also used to calculate present value impacts of the standard from the State's perspective over the principal study period. To show sensitivity of the net present value to the discount rate, present value estimates of impacts are also computed for a 3 % real discount rate.

Uncertainties, Alternative Scenarios, and Requirements for Sensitivity Testing

There are a number of uncertainties that may affect the impact of the standard. These uncertainties include the effectiveness of conforming cigarettes in reducing fires from cigarettes dropped in soft furnishings; the extent to which conforming cigarettes will displace non-conforming cigarettes; the effect on manufacturer's costs of modifying cigarettes to conform to the standard and the related pricing consequences; smoker preference for modified versus unmodified cigarettes; and the number of years before the standard is adopted nationwide. There is available information about all of these factors, but their specific values are not known with certainty. To account for the uncertainty, alternative scenarios are modeled, and sensitivity testing is conducted to determine how the impacts will change with alternate input values of key

parameters and the use of alternate assumptions. Based on recent information coming from the early period of NY's Rule implementation, one of the scenarios is identified as currently the most likely, or "best-guess" scenario, and the others as sensitivity results.

Effectiveness of Conforming Cigarettes in Reducing Ignition

The requirement under the standard is that--

> ...no cigarettes…shall be sold or offered for sale in this state unless: (a) such cigarettes have been tested in accordance with the test method prescribed…; and (b) such cigarettes meet the performance standard specified … (Part 429, Sec. 1, Fire Safety Standards for Cigarettes)

The prescribed test method is ASTM Standard E2187-02b *Standard Test Method for Measuring the Ignition Strength of Cigarettes*. Conforming cigarettes are allowed to vary in their measured test performance, provided they meet the minimum requirement; i.e., no more than 25 % of full length may burn on 10 layers of filter paper.

The cigarette manufacturers in their comments on the new standard have argued that "parameters other than cigarette design, including properties of the upholstery fabric, air flow and humidity, profoundly affect cigarette ignition propensity…"[29] They have disputed reliability and appropriateness of the required test method, and have argued that there is not a substantiated link between cigarette ignition strength as measured by the required test method and ignition risk in real world circumstances.[30]

In response, the NY State OFPC has defended the validity and appropriateness of the test method, citing a report by the CPSC that "the test methods are repeatable and reproducible within reasonable limits and that they adequately reflect what happens in the real world when cigarettes are dropped on furnishings."[31] In its response to public comments, the OFPC cites evidence that there is a positive correlation between ignition tests and what is likely to happen under real-life conditions, stating:

> There is reason to expect that compliance with the performance standard… will result in a significant reduction in cigarette-initiated fires. Reducing the heat output and the burning time of a cigarette will reduce the likelihood that it will ignite a fire. (Assessment of Public Comment, NY State Office of Fire Prevention and Control, (OFPC), p. 1)

The probability that a dropped non-conforming cigarette will start a fire is less than 100 %, i.e., not every dropped cigarette starts a fire. The historical relationship between the consumption of non-conforming cigarettes and the incidence of cigarette-caused fires and losses reflects the probability that non-conforming cigarettes will start unwanted fires. Likewise, the probability

29. See, for example, RJ Reynolds Tobacco Company, "Comments on New York's Proposed Cigarette Fire Safety Standard," April 14, 2003, p.4.
30. Ibid.
31. NY State Office of Fire Prevention and Control, "Assessment of Public Comment," p.17.

that a dropped conforming cigarette will start a fire is greater than 0 %, i.e., a dropped conforming cigarette may start a fire.

Rather than state the effect of the standard as a proportional change in the ignition probability of the cigarette, the standard's effect is stated here in terms of a percentage reduction in cigarette-caused fires and associated losses. Based on the advice of NIST technical staff, we assume that a conservative estimate of the effectiveness of conforming cigarettes is 60 %. Sensitivity testing is performed on this effectiveness parameter using step-increments of 10 % to show what happens if the reduction rate ranges between 30 % and 80 %.[32] Each selected effectiveness rate is applied uniformly to all categories of fire losses. It is assumed that the averted fires are, on average, of the same severity as the baseline fires.

In addition to examining effectiveness values between 30 % and 80 %, the study estimates upper-limit benefits based on an effectiveness rate of 100 %. Inclusion of this scenario is not intended to imply that conforming cigarettes may be 100 % effectiveness, but only to provide an upper-limit estimate of potential benefits.

Cost/Price Consequences of Modifications to Make Cigarettes Conforming

A potential driver of second-order impacts is a price change in cigarettes resulting from modifications to comply with the standard. Hence, an important input to the study is the expected change in the price of conforming cigarettes. Yet manufacturers' production costs and pricing decisions are confidential and not readily made publicly available. None of the tobacco companies have revealed their planned pricing policy for conforming cigarettes after the deadline for compliance is reached. In absence of actual data, it is necessary to estimate the resulting impacts based on several potential pricing scenarios. For this purpose, alternate estimating approaches are taken, in lieu of actual price quotes, to project how prices of conforming cigarettes may change after the standard goes into effect.

Approach 1--Zero Price Change Based on Early Pricing of Conforming Cigarettes: In July 2000, shortly before NY State's cigarette fire safety bill was signed into law, Philip Morris began marketing Merit cigarettes that conform to the new standard. According to a statement made by the company:

> Philip Morris USA has made significant progress in its efforts to develop a cigarette that is both reasonably acceptable to consumers and may be less likely to start fires if handled carelessly. Philip Morris USA's patented banded cigarette paper, PaperSelect™, is now available nationwide on the Merit brand family, and all Merit brand packs and cartons now bear the PaperSelect™ logo. PaperSelect™ cigarettes have rings of ultra-thin paper that are applied on the top of a traditional cigarette paper during the paper making process. These rings act as "speed bumps" to slow down the rate at which a cigarette burns as the lit end crosses over them. (Philip Morris USA's Detailed Position on Reduced Ignition

32. These values were used on the advice of NIST's technical staff and the NY State OFPC staff.

Propensity Legislation[33])

During a time that the Merit cigarettes were in competition with non-conforming cigarettes, the company did not raise the price of Merit. Sherman, More, Capri, and a few others have been shown to have significantly reduced ignition strength. Moreover, these have thus far not had their prices raised relative to prices before the law was passed. Although these cigarettes account for a small proportion of the total quantity of cigarettes sold in the NY market, their existence indicated early on that cigarettes with lower ignition propensity can be produced and may be made available by producers without a price increase. Thus, one of the alternate assumptions about prices of conforming cigarettes is that they will not change as a result of the standard.

Approach 2—Price Change Based on Cost Estimates from an Earlier Study: It is possible that prices of conforming cigarettes may be increased once all cigarettes sold in the State are required to meet the standard. At that point they would no longer legally be in competition with non-conforming cigarettes, and the likelihood of an across-the-board increase in price would likely be higher. Moreover, the major cigarette manufacturers may lack incentive to maintain prices if they believe increasing the price of conforming cigarettes in NY State will cause smokers to shift purchases to their non-conforming brands outside the State.

An earlier report--part of the set of studies published in 1987 that analyzed the potential national impacts of low ignition cigarettes--investigated potential costs associated with alternative cigarette modifications.[34] The present standard, while not limiting options to paper modifications, calls out paper modification as an acceptable approach. The focus here is on estimating the potential price change of paper modification.

In the earlier study, the form of paper modification to reduce ignition strength was heavier paper for the entire wrapper, not added bands. The modification was to increase existing paper weight from 24 g/m^2 to 32 g/m^2 at an estimated cost increase of 0.5 % in wholesale cigarette price, and, alternatively, from 24 g/m^2 to 45 g/m^2 at an estimated cost increase of 0.8 %.[35] The lesser of these two projected percentage price increases is applied in this study to the average wholesale cigarette price in NY to estimate the potential price change associated with paper modifications to meet the standard. The lesser price increase is used because the principal paper modification being pursued today appears to entail bands of heavier (less porous) paper rather than heavier weight for the entire wrapper.

Table 2-1 gives the current minimum wholesale and retail cigarette prices in NY State outside New York City and in the City. To estimate the monetary price change from a paper

33. Found at www.philipmorrisusa.com/policies_practices/legislation_regulation/reduced_ignition.
34. Armando M. Lago and Jennifer A. Shannon, "Section 3: Cost Analysis of Options for Self-Extinguishing Cigarettes," *Economic Sector Data for Modeling the Impact of Less Ignition-Prone Cigarettes* Technical Study Group on Cigarette and Little Cigar Fire Safety, Cigarette Safety Act of 1984 (Gaithersburg, MD: National Institute of Standards and Technology, 1987), Table 2, p. 56.
35. The cost estimates assume a four-year grace period for manufacturers to comply. Ibid. This is close to the estimated time between the announcement of the NY Standard and the anticipated time of implementation.

Table 2-1. Minimum Wholesale and Retail Prices of Cigarettes in New York

Effective July 2, 2002

		Minimum sale prices per carton for standard brands* Based on manufacturers' list price of $27.64	
Type of sale	**Agent's markup**	**New York State** (sales **outside** New York City) (agent's basic cost = $42.64)	**New York State/City** (sales **within** New York City) (agent's basic cost = $57.64)
Agent to wholesaler dealer	7/8 % plus 20¢	$43.22	$58.35
Agent to chain store	1 1/2 % plus 20¢	$43.48	$58.71
Agent to retail dealer	3 7/8 % plus 20¢	$44.50	$60.08
Retail sales to the consumer	7 % above the Agent-to-retail dealer price	$47.61 ($4.77 per pack)	$64.28 ($6.43 per pack)

* Minimum prices listed are for standard brands and standard packages (20 cigarettes per pack, 10 packs per carton). The prices do not include any prepaid sales tax. The prepaid sales tax is paid by the agent at the time the cigarette tax stamps are purchased. State and local sales taxes must be collected from the consumer at the time of the retail sale. Sales tax must be collected on the total retail sale price except of sales in NY City. To calculate the sales tax for NY City, it is necessary to subtract the NY City excise tax ($1.50 per pack) from the total retail sale price, and compute the sales tax on the resulting amount.

Source: New York State Department of Taxation and Finance, Publication 509, July 2002.

modification, the average minimum wholesale price within and outside the City is taken as the base wholesale State-wide price.[36] Averaging the agent's wholesale price per carton to retail dealers of $44.50 outside NY City and $60.08 in the City, yields an average NY State wholesale price estimated at $52.29 per carton, or per 200 cigarettes. Applying the 0.5 % increase for the paper modification to this average wholesale price yields an adjusted wholesale price of $52.55 per carton. Applying the 7 % allowable retail markup (see table 2-1) to the adjusted average wholesale price yields an estimated average minimum retail price of $56.23 per carton for modified cigarettes, versus the average minimum retail price of $55.95 per carton for unmodified cigarettes. This estimating approach results in an estimated increase of $0.03 per pack--less than a 0.1 % change in price per pack.

Approach 3—Projected Price Change Based on Partial Cost-of-Compliance Information of a Leading Tobacco Company: Although none of the tobacco companies revealed their future pricing plans for conforming cigarettes, the RJ Reynolds Tobacco Company, in its comments on the OFPC's Notice of Proposed Rule Making, provided information on various costs it had incurred or expected to incur in meeting the standard's requirement. This information is used to identify the types of costs imposed by the standard on tobacco companies, and also to generate a third rough estimate of potential price change for conforming cigarettes. Because the impact assessment focuses on impacts in NY State only, the cost effects on tobacco companies located

36. A weighted average of prices within New York City and outside the City would provide a more accurate average price, but, because the populations and smoking rates within and outside the City are roughly comparable, using a simple average suffices for deriving a ballpark price estimate.

outside the State are of interest to the analysis primarily as they impact the price of cigarettes sold in the State.

Table 2-2 lists the types of costs that cigarette manufacturers may incur in modifying their cigarettes to conform to the standard. The costs are not listed in any particular order of importance. Some are fixed, up-front costs and some are annual costs with fixed and variable components; some are research costs and some are production costs.

RJ Reynolds, in its discussion of compliance with the standard, implied that its approach is based on modification of cigarette paper. The company noted that in its experience, paper used to make conforming cigarettes costs three-to-six times the typical paper costs. Paper costs are variable costs that change directly in relation to the quantity of cigarettes produced.

The company mentioned several up-front, one-time costs associated with producing the conforming cigarettes. The largest of these was an estimated 100,000 hours of R&D labor. Valued, for example, at $100/hr with overhead, this cost totals $10,000,000. Other up-front costs were said to include $1,000,000 for materials, equipment, supplies, and several other costs used in R&D. For consumer testing, the up-front costs were reportedly $4,000,000. Based on the information available, the total up-front costs are estimated at $15,000,000.

The company gave only partial information for annual costs associated with producing conforming cigarettes, including incremental sales costs, operating costs, manufacturing costs, quality assurance costs, and costs of information resources, purchasing, distribution and logistics, and finance. As a "best-guess" estimate based on partial information, the annual costs of implementing the NY standard in a dual cigarette system are estimated to total $5,000,000 in constant dollars per year.

Amortizing the estimated up-front total cost of $15,000,000 over 6 years at an annual real rate of 7 % yields an annual equivalent cost of $3,146,937. The sum of adding these costs to the other costs already stated on an annual basis yields $8.1 million per year.[37]

37. An amortization period of six years is arbitrarily selected to correspond to the study period. Using a real rate of 7.% to amortize the costs is based on average long-term real returns to corporate investment.

Table 2-2. Types of Costs Cigarette Manufacturers May Incur in Complying with the NY Standard

In-house R&D costs to develop and test alternative technologies with lower ignition propensity
Collaborative R&D with suppliers of factors of production to obtain necessary inputs
Product research to adapt modifications across many brands
Consumer preference testing using prototype cigarettes
Additional product research in response to consumer testing to raise acceptance
Increased inventory management costs to account for additional types of inputs to the manufacturing process
Increased quality assurance costs to monitor quality of additional types of inputs
Higher purchase cost of material inputs to make conforming cigarettes
Machine and operator changeover costs to make cigarettes specially for the NY market
Costs of special package marking of cigarettes for the NY market
Costs of testing and certifying the compliance of cigarettes for the NY market
Reprogramming costs to adjust multiple data bases to track NY cigarette inventories separately from other inventories
Costs of processing returned non-conforming cigarettes during product changeover

Source: RJ Reynolds Tobacco Company, "Comments on NY's Proposed Cigarette Fire Safety Standard," April 14, 2003, pp. 30-36.

Table 2-3 lists five major U.S. tobacco companies. Reportedly RJ Reynolds plans to buy Brown and Williamson in 2005 to form Reynolds American, Inc. This would reduce the number from five to four.

Table 2-3. Major U.S. Tobacco Companies

Rating by Size	Name of Company
1	Altria Group (Philip Morris USA)
2	RJ Reynolds Tobacco Holdings
3	British American Tobacco's Brown and Williamson Tobacco
4	Loew's Lorillard Tobacco Company (part of Carolina Group)
5	Vector Group's Liggett

In the absence of data from the other companies, we make the arbitrary assumption that each of the top four companies[38] incurs the annual costs estimated above (based on partial data from RJ Reynolds) to develop conforming cigarettes, for a total of $32.4 million. Further, we arbitrarily assume that each of four smaller companies not listed incurs a constant dollar equivalent of $1,000,000/year. The combined ballpark total is $36.4 million per year over the next six years for the companies to implement the standard. These costs are in addition to the variable costs of cigarettes production. Estimating the incremental cost of producing conforming cigarettes requires an estimate of the annual quantity of conforming cigarettes to be produced over the next six years over which to spread these implementation costs. For the purpose of this rough estimate, the $36.4 million implementation costs is spread over 10 billion cigarettes per year. Whether 10 billion is a high or low estimate depends on the extent of consumer price- or preference diversion away from modified cigarettes. If there are no additional diversions beyond the existing tax-driven diversion, 10 billion cigarettes per year underestimates the number; if there are additional diversions, it may overestimate the number. This approach results in an estimated implementation cost increase of $0.073 per pack.

To estimate the variable costs for paper modification, the cost of paper in making non-modified cigarettes is adjusted for modification. Paper costs for making non-modified cigarettes are taken from an earlier cited study (Lago and Shannon, 1987). That study's analysis of the structure of costs in the cigarette industry showed paper cost to be $0.17 per 1,000 cigarettes (50 packs), in 1986 dollars. Escalating to 2003 prices using the GDP implicit price deflators yields an estimated paper modification cost of $0.25 per 1,000 cigarettes (50 packs), or $0.005 per pack. According to comments by RJ Reynolds, they have experienced paper costs three-to-six times regular costs to make the modified cigarettes. Using the upper end of the range to test a more extreme paper cost effect results in an estimate of $0.03 per pack. Combining the up-front, annual, and variable costs per pack yields an estimated cost increase of $0.10 per pack, considerably more than the $0.03 per pack estimated under Approach 2.

The three approaches to estimating cost of the cigarette modification that will be passed through as a price change resulted in the following: $0.00, $0.03, or $0.10 per pack. The estimated price changes are applied to the reported $5.65 fully taxed retail price per pack in NY State in 2002.[39] The $0.03 per pack estimated cost increase represents 0.5 % of the reported 2002 fully taxed

38. It is assumed that the merged companies will share information and costs associated with compliance.
39. "State Cigarette Tax Rates & Rank," National Center for Tobacco-Free Kides, June 26, 2003.

price, and the $0.10 per pack increase represents 1.8 % of that price. A decision was made to use the two ends of the estimated range: $0.00 and $0.10 per pack in the scenario analyses.

Consumer Diversion of Cigarette Purchases Away from Standard-Conforming Channels

Cigarettes are reportedly addictive. Furthermore, consumers can shift their purchases to other sources in response to a price increase, rather than reduce their total cigarette consumption.[40] In response to a price increase in cigarettes that is limited to NY State, smokers have been documented to shift consumption to retail purchases in surrounding states; to mail, telephone, and internet purchases; to purchases from Indian reservations; and to purchases from illegal sources. Although there is substantial evidence that diversions in sales have taken place in the past—in addition to reductions in consumption—estimates differ as to what extent tax-related price increases have driven reductions in consumption and to what extent they have driven diversions of cigarette purchases from taxed to un-taxed or under-taxed sales.

Tax-Driven Diversion: Historical data show how cigarette purchases in NY State have changed as tax increases have raised prices higher than in most other states.[41] A price differential for cigarettes in New York relative to most of the rest of the country has existed since the 1930s, widening as time has passed. In 2002, both the State and the City enacted large increases in their cigarette excise tax rates, both raising them to $1.50 per pack.

During the past decades, increases in tax rates have been mirrored by decreases in taxed sales in the State, due to a combination of reduced consumption and shifts to untaxed or lower-taxed sources. As NY raised its cigarette tax to higher levels, the percentage of sales of cigarettes per capita in NY that are taxed fell substantially below that in most of the rest of the country. In 2002, U.S. taxed cigarette sales per capita were estimated at 73 packs, while NY City taxed sales per capita were estimated at 45 packs, and the rest of the State had taxed sales per capita estimated at 46 packs. Taxed sales per capita as a percentage of the U.S. average taxed sales per capita were 62 % for NY City and 63 % for the rest of the State.[42]

In addition to sales diverted to smuggled sources, sales have also been diverted in growing numbers to Internet sales and to Indian reservations (not mutually exclusive). A recent study conducted a survey of 88 web sites that sell cigarettes and found that most offer lower prices and many offer tax-free cigarettes. The study also concluded that teens are going online in increasing numbers to buy cigarettes as a means of avoiding identification checks at stores. Reportedly, all that is needed in order for a minor to purchase cigarettes at many of these web

40. As noted earlier, this study holds overall cigarette consumption within NY State fixed for any given year. Reductions in legal, taxed NY State purchases are assumed offset with increases in purchases from other sources. Although it is possible that consumers might respond to a price increase by a combination of shifting consumption and by reducing it overall, this option is not evaluated. Further, as noted earlier, all cigarettes are assumed to have the same toxicity effects. This approach avoids the need to consider the impact of potential changes in health effects.

41. Patrick Fleenor, "Cigarette Taxes, Black Markets, and Crime; Lessons from New York's 50-Year Losing Battle," *Policy Analysis*, No. 468, February 6, 2003.

42. Fleenor, op. cit., Table 2, p. 5.

sites is to check a box stating that they are over the age of 18.[43] The State of New York banned Internet cigarette sales in 2000. A federal appeals court recently upheld the ban, following a challenge in the courts. [44] Internet sales continue to be a source of untaxed sales despite the fact that the NY State Department of Taxation and Finance has implemented new enforcement provisions regarding the sale, shipment, and possession of cigarettes in the State, and the U.S. Court of Appeals reversed the district court ruling that overturned the banning of direct shipment of untaxed cigarettes to NY State.[45]

A private study of cigarette tax revenue sources in NY State estimated in 2001 that smuggling resulted in 70 to 100 million packs in non-taxed sales; that cross-border sales resulted in diverted sales of 30 to 50 million packs; and that internet sales resulted in diverted sales of another 60 to 80 million packs.[46] Thus, the estimated total diversion of sales in 2001, according to this one study, ranged from 160 million to 230 million packs, or, for the upper end of the range, 4.6 billion cigarettes diverted from taxed sales in NY State in 2001.

According to the U.S. Centers for Disease Control (CDC), sales of taxed cigarettes in NY State in fiscal year 2002 totaled 884.4 million packs,[47] or 17.7 billion cigarettes. Using the latter figure, and computing the ratio of taxed to total estimated cigarette consumption (taxed and untaxed in 2002, estimated in table 3-8 of Chapter 3) yields a ratio of 68 %. Alternatively, an earlier study cited provides estimates of taxed sales per capita in NY City and NY State at 45 packs and 46 packs, respectively.[48] Multiplying the average of per capita taxed sales by the NY population for 2002 yields an estimate of total taxed sales of 17.4 billion cigarettes, close to the CDC estimate. Sixty-eight percent of cigarettes consumed are estimated to be purchased through taxed channels (computed by dividing 17.4, total taxed sales, by 26.0, the combined adult and underage cigarette consumption in 2002). The residual, 32 %, is assumed diverted into untaxed or lower tax channels. Scenarios 2-5 in Chapter 3 take into account a tax-driven diversion of cigarettes away from regulated channels at a rate 32 %. Taking into account tax-driven diversion of sales has the effect of reducing the impact of the cigarette fire safety standard, since it means an estimated 32 % of cigarettes consumed in the State will be non-conforming.

Smoker Price Elasticity of Demand for Cigarettes: Price elasticity of demand for cigarettes refers to the percentage change in the quantity of cigarettes demanded resulting from a 1 % increase in price. A recent report of the U.S. Surgeon General contains an extensive review of the effect of price on the demand for tobacco products. According to the report, "…numerous studies of cigarette smoking and other tobacco use, including several recent studies that explicitly account for tobacco's addictive nature, find a strong inverse relationship between price

43. K.M Ribisl, R.S. Williams, and A.E. Kim, "Internet Sales of Cigarettes to Minors," *Journal of the American Medical Association*, 2003, 290, 1356-1359.
44. Joanna Glasner, "Web Tobacco Buyers Get Taxed," *Wired News*, February 19, 2003; available at www.wired.com/news/business/0,1367,57657,00.html.
45. New York State Department of Taxation and Finance, Office of Tax Policy Analysis, "Enforcement Provisions Regarding the Sale, Shipment, and Possession of Cigarettes and Tobacco Products in New York State," TSB-M-03 (1) M, Cigarette Tax, June 2, 2003.
46. Ridgewood Economic Associates, Ltd., *New Cigarette Tax Revenue Sources for New York State*, p. 3.
47. Centers for Disease Control, State Highlights 2002: Impact and Opportunity, April 2002, as reported by the National Center for Tobacco-Free Kids, June 26, 2003.
48. Fleenor, 2003, op cit., Table 2, p. 5.

and consumption." [49]

The report examines the findings of more than 20 previous studies that estimated the price elasticity of demand for cigarettes in the U.S. The report concluded that recent studies using state-of-the-art econometric methods for time series data "produced estimates of the price elasticity of demand in a relatively narrow range, which was centered on -0.4."[50] We use this estimate of the price elasticity of demand in computing the quantity of cigarette sales that are diverted to non-taxed channels as a result of an increase in the price of modified cigarettes. It should be noted that it is assumed that the price elasticity of demand effect drives a diversion in purchases away from conforming cigarettes to non-conforming cigarettes, rather than a reduction in consumption. Thus, a 10 % increase in cigarette price leads to a 4 % reduction in cigarettes purchased through State-regulated channels.

Implicit in the above diversion relationship is the assumption that there is a one-to-one correspondence between purchases from State-regulated and channels not regulated by New York State, some of which are clearly illegal. This assumption ignores the costs and risks that may be associated with evading the cigarette standard. In the real world, legitimate and illegitimate cigarettes are not likely perfect substitutes, and the extent of the price-driven diversion may be overstated in the analysis.

Producer Response and Consumer Preference: Twin interrelated questions bear on the impact the standard will have. 1) To what extent will cigarette producers modify their most popular brands to comply with the standard? 2) How will consumers respond to modified cigarettes? The former question is critical in the face of brand loyalty. While the number of different packaging of cigarettes in the U.S. is reportedly on the order of 1300, a relatively few brands dominate market sales. For example, among high-school smokers, nearly 90 % claim loyalty to just three brands: Marlboro (Philip Morris), Newport (Lorillard), and Camel (Reynolds).[51] While adult smokers have moved to discount brands in recent years in increasing numbers, brand loyalty continues to be important for this group also. Thus, if the cigarette producers focus on modifying their major brands for the NY market, the diversion of sales to non-conforming cigarettes is likely to be less pronounced, other things remaining the same.

The second part of the equation is the extent to which smokers are accepting of the modifications that are made to conform to the standard or even prefer modified, conforming cigarettes over non-conforming cigarettes. To the extent that the producers do not supply conforming cigarettes in the major brand lines when the standard is implemented, and to the extent that smokers resist the modifications that are made, increased diversions of purchases can be expected to non-conforming cigarettes through purchases from surrounding states; by mail, telephone, and internet sales; from Indian reservations, and from smuggled sources. Of course, if smokers in and outside the State actively prefer modified, conforming cigarettes over non-conforming

49. U.S. Department of Heath and Human Services, *Reducing Tobacco Use*; A Report of the Surgeon General, 2000, p. 322.
50. Ibid, p. 326.
51. Lloyd D. Johnston, Patrick M. O'Malley, John E. Schulenberg, "Cigarette Brand Preferences Among Adolescents", *Monitoring the Future*, Occasional Paper 45, The University of Michigan, Institute for Social Research, 1999.

cigarettes, in-State smokers conceivably could reduce the existing tax-related diversion, and out-of-State residents could shift their purchases to New York State, thereby increasing sales of conforming cigarettes.

At this time, information about producer modification plans and timing, and consumer response to modified cigarettes and to the possible absence of certain brands in conforming lines, is uncertain. Because there is more concern about the possible downside than the possible upside, sensitivity analysis is used to test the impact of alternative levels of cigarette purchases diverted in response to assumed negative effects of smoker preferences.

Cigarette manufacturers have indicated their response to the standard and their expectation about consumer reaction. Philip Morris, which accounted for about 43.5 % of cigarette sales in New York for the year ending March 2003,[52] expressed that it expects successful production of a compliant cigarette that is "reasonably acceptable to adult consumers," and, indicated its willingness to license the technology:

> PM USA [Philip Morris USA] has made significant progress in developing a banded paper technology that allows the production of cigarettes that have reduced IP [ignition propensity] while remaining reasonably acceptable to adult consumers. Since July 2000, PM USA has incorporated this technology into its Merit cigarette brand styles produced for sale in the United States. PM USA has publicly stated its willingness to license its patents and trade secrets concerning its banded paper technology to other cigarette manufacturers. ("Comments of Philip Morris USA Inc. on the Proposed New York Fire Safety Standards for Cigarettes," p. iv.)

Further, according to Philip Morris as of April 2003, its "Merit family brand styles are the only nationally available commercial cigarettes that use a specific technology designed for lowering IP."[53] The availability of Merits confirms the existing technical feasibility of producing compliant cigarettes, and statements by the company also reveal that licensing provides a means for companies to comply even if they lack their own in-house cigarette modification research program.

Comments from RJ Reynolds, however, cast concern about consumer response. Emphasizing that "consumers are attuned to changes in cigarette paper,"[54] the company cites as evidence that smokers will resist the product change the declining market share of Philip Morris's Merit brand after it switched to the lower-ignition PaperSelect paper. The cited market share data offered as evidence are the following: In 1999, prior to the paper change, Merit maintained a 1.84 % national market share; the market share dropped to 1.61 % in 2000, the year the paper was changed; in 2001, the share dropped to 1.34 %; in 2002, the share dropped further to 1.07 %; and the share in 2003 was said to have continued to drop. RJ Reynolds cites its own consumer tests

52. Philip Morris USA Inc., "Comments of Philip Morris USA Inc. ('PM USA') on the Proposed New York Fire Safety Standards for Cigarettes," April 15, 2003, p. 1.
53. Ibid, p. 3.
54. RJ Reynolds Tobacco Company, "Comments on NY's Proposed Cigarette Fire Safety Standard," April 14, 2003, p. 37.

as providing additional evidence that consumers resist changes in cigarettes to which they have become accustomed.[55]

From Lorillard, which has a NY market share of approximately 19 %, there are indications that the company is addressing the issue of producing compliant cigarettes across part or all of its 63 different packaging produced for the NY market. However, the company indicates that compliance time is of major concern.[56]

Given the paper technology that has been demonstrated to meet the standard, this study assumes that there is not a technical barrier to production of conforming cigarettes. With regard to consumer response, this study treats it as uncertain, and performs sensitivity analysis of alternate responses. Two scenarios are tested: (1) there is full acceptance by consumers of conforming cigarettes, and (2) consumers divert 10 % of their purchases away from conforming cigarettes sold within the State due to preference considerations, i.e., over and above the existing tax/price-driven diversions.

The assumed upper percentage preference diversion is set lower than that reportedly experienced by Merit for the following reason. While Merit was said to have experienced a short-run market share loss on the order of 40 % after modification, this occurred during a period that the cigarettes competed side-by-side in stores with legally available unmodified cigarettes. That is, it was easy and legal to switch during the time covered. When only conforming cigarettes can legally be sold in NY stores, it will take not only more effort, but possibly illegal effort, on the part of consumers to switch to non-conforming cigarettes. Further, it may be argued that if the public becomes better informed about the fire problem some smokers would actively demand as a desirable feature the lower ignition strength of conforming cigarettes.

On the other hand, as put by Philip Morris, "New York's experience with tax-motivated purchases of cigarettes intended for sale and distribution outside New York demonstrates that adult smokers in New York will be able to find numerous outlets through which they might purchase non-IP-compliant cigarettes if they want to do so."[57] In the stated opinion of Philip Morris, switches on the order of 20 % to 30 % are "realistic possibilities."[58] State enforcement of the standard and of State tax laws is therefore a critical factor to the standard's effectiveness.

Consumer Behavior in Handling Cigarettes: Another aspect of consumer response is a potential change in the way smokers handle reduced ignition cigarettes. As stated by Philip Morris, "they must be handled and disposed of no less carefully than other cigarettes."[59] It is possible smokers may be more careless in disposing of cigarettes they perceive to fire safe. Increases in smoker carelessness could offset performance benefits of cigarettes with lower ignition strength. However, for the purpose of this study, it is assumed that smoker behavior in handling and disposing of cigarettes remains constant.

55. Ibid. pp. 37-38.
56. Lorillard Tobacco Company, "Comments on Proposed Fire Safety Standards for Cigarettes," April 14, 2003, p. 13.
57. Philip Morris, "Comments," April 15, 2003.
58. Ibid, p. 28.
59. Ibid, p. 4.

Alternative Study Periods

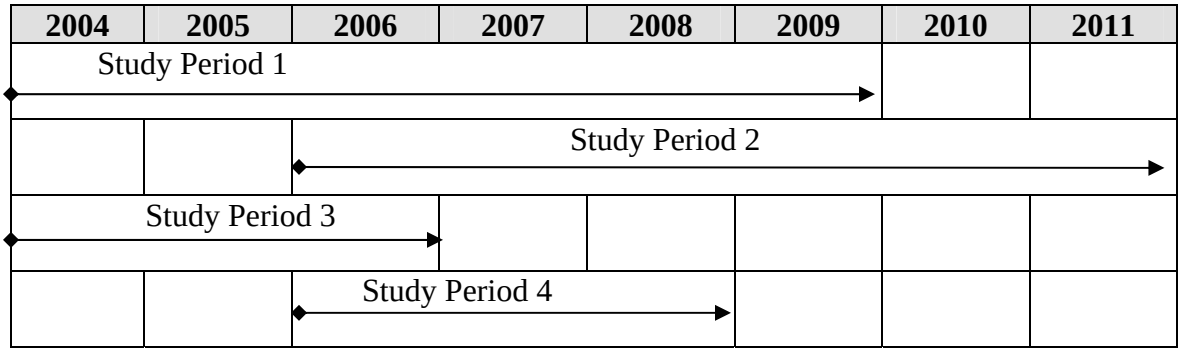
Benefit- and cost-impacts from the new standard are not expected to occur all at once, but rather are expected to recur over a number of years. The appropriate study period depends on when the standard is implemented, and how long the standard is in effect before the rest of the nation follows suit. The timing of a nationwide standard is relevant to the State analysis because it is assumed to effectively eliminate the legal coexistence of modified and unmodified cigarettes in the nation, and also to eliminate the need for separate standards at the state level unless a given state wishes to implement a more stringent standard than the national standard.[60]

In setting the length of the study period, two alternative assumptions were made regarding the timing of implementation: (1) immediately, and (2) with a two year delay; and two alternative assumptions were made regarding the lapse before the rest of the nation adopts a similar standard: (1) a six-year lapse, and (2) a three-year lapse. The longer the elapsed period before a national standard is passed, the larger the fire benefits in NY State attributable to the State standard, other factors being the same. However, the longer the elapsed period, the larger the accrued fire losses outside the State. As noted previously, to the extent that the State standard speeds up implementation of similar standards outside the State, the State standard can be credited with reducing fire losses outside the State.

Figure 2-4 shows the four, alternative timelines to be considered in the study, taking into account the different combinations of implementation time and elapsed time before adoption of a nationwide standard. The first assumes implementation at the beginning of 2004, and six years to a nationwide standard; hence, it extends from the beginning of 2004 to the end of 2009. The second assumes implementation at the beginning of 2006, and six years from the time of implementation to a nationwide standard; hence, it extends from the beginning of 2006 to the end of 2011. The third assumes implementation at the beginning of 2004, and three-years to a nationwide standard; hence, it extends from the beginning of 2004 to the end of 2006. The fourth assumes implementation in 2006 and a three-year lapse to a nationwide standard; hence, it extends from the beginning of 2006 to the end of 2008. The first timeline is used for the principal analysis. The second, third, and fourth are used for sensitivity testing. Regardless of the timeline, dollar effects are expressed as present-value equivalents as of the beginning of 2004.

60. In fact, the possibility of evasion from conforming cigarettes would still exist, but it would exist at a national level, rather than only at the NY State level. A way this might happen is through smuggling of domestically produced unmodified cigarettes intended for export back into the U.S. as untaxed, unmodified product. It is conceivable that this avenue, which exists today, would grow if a nationwide standard were adopted. Furthermore, because NY State taxes on cigarettes are high relative to the rest of the nation, a large part of the smuggling of untaxed, unmodified cigarettes intended for export markets may target NY. At the same time, under a national standard, transactions in untaxed cigarettes intended for domestic markets would entail conforming cigarettes. In any case, it is assumed that a national standard would effectively substitute for the State standard, meaning that the study period for the State analysis should be terminated when a nationwide standard is implemented.

Figure 2-4. Alternative Timelines Used in the Assessment



Summary of Research Tasks Conducted to Perform the Study

To perform the impact assessment, the following research tasks were conducted:

Task 1. Information Collection

A task that continued throughout the study was to collect and review information that allowed definition and modeling of the problem.

Task 2. Development of Study Methodology, Identification of Key Parameters, and Specification of Guiding Assumptions

The second task was to develop the study methodology by which the impact assessment would be conducted, to identify key parameters, and to set forth assumptions.

Task 3. Assessment of First-Order Impacts

The third task was to apply the methodology to develop projections of fire and fire-loss impacts under alternative scenarios, and to develop inputs needed for assessing the second-order impacts.

Task 4. Identification of Affected Businesses in NY State

The fourth task was to identify the extent of involvement of NY State-based manufacturers, intermediate suppliers, and wholesale and retail businesses in cigarette manufacturing and distribution.

Task 5. REMI Assessment of Second-Order Impacts

In the fifth task, the REMI model for NY State was used to estimate State-wide economic effects driven by changes in cigarette prices, consumer preferences, and out-of-pocket fire losses.

Task 6. Analysis of Results

The sixth task entailed analysis of all estimated results, the preparation of tabular and graphical representations of findings, and the drawing of conclusions.

Task 7. Preparation of Final Report

Coincident with task 6, this report was prepared to document the methodology, the source of data inputs, assumptions and the logic behind them, the estimating procedures, the analysis, the results, and the conclusions.

First-Order Impact Assessment: Fire Safety Benefits

Here we forecast the first-order impacts of the cigarette fire safety standard on cigarette-caused residential structure fires and the associated deaths, injuries, and property losses in NY State. We accomplish this by applying the methodology and using the assumptions discussed in Chapter 2, aided by the EXCEL spreadsheet tool. Forecasts are provided for several alternative scenarios, and under sensitivity testing for the conditions and parameters for which there is particular uncertainty. Sources of uncertainties are discussed in detail in Chapter 2, and are only identified here as they are invoked.

First-order impacts are assessed within the context of the following five scenarios, all of which are hypothetical:

1. Scenario 1: All cigarettes projected for consumption in NY State over the study period conform to the fire safety standard and are 100 % effective, yielding maximum possible benefits.
2. Scenario 2: Tax-driven diversion of cigarettes occurs at the current estimated rate of 32 %, reducing the percentage of cigarettes conforming to the fire safety standard, but there are no additional diversions caused the standard. Within this scenario, six different effectiveness levels of modified cigarettes, ranging from 30 % to 80 %, are evaluated. Results are featured for a 60 % effectiveness level.
3. Scenario 3: Price-driven diversion of 0.7 % is combined with the existing tax-driven diversion of 32 %.
4. Scenario 4: Preference-driven diversion of 10 % is combined with the existing tax-driven diversion of 32 %.
5. Scenario 5: Price-driven diversion of 0.7 % and preference-driven of 10 % is combined with the existing tax-driven diversion of 32 %.

Each scenario is progressively less favorable for the standard. Scenario 2 is the base-case scenario, considered the most likely outcome based on early observations. Scenario 1 provides sensitivity results on the upside, and Scenarios 3, 4, and 5 provide sensitivity results under more pessimistic assumptions that entail price increases, or adverse smoker reaction, or both. Each scenario is assessed for each of the four study periods.

The purpose of the first scenario is to establish an estimated upper limit on the potential benefits of solving the cigarette fire problem in residential structures in NY State. It estimates maximum fire-loss benefits if all cigarette-caused fires in NY residential structures were eliminated. It is identical to a valuation of first-order residential fire losses from cigarettes. The following conditions would be required for this first set of estimates to manifest: (1) all cigarettes projected to be consumed in NY State over the study period would be conforming cigarettes, i.e., no tax-driven diversions would occur; (2) conforming cigarettes would be 100 % effective in eliminating cigarette-caused fires and related losses; and (3) the modification of cigarettes to conform with the standard would have no effect on cigarette price or consumer preference.

Clearly, the estimates under these assumptions represent the upper limit of potential benefits.

Derivation of Baseline Projections

Regardless of the scenario, estimating the first-order benefits begins with the derivation of baseline projections.

Fire and Fire Loss Statistics and Required Adjustments

The estimation of the baseline is anchored to recent fire and fire-loss data. The decision was made to derive the fire and fire-loss data for NY State from national annual residential structure fire data and related fire loss data reported to U.S. municipal fire departments, rather than to use available fire and fire loss data series for NY State. The reason was that the national data series are available for a much longer time period, permitting the use of regression analysis to estimate equations needed for projecting the baselines. The NY fire and fire loss data, in contrast, were available for fewer years--insufficient to use in projecting the baseline series over the study period. Moreover, available State data files did not provide the information required for the impact assessment.[61]

On the advice of an expert in the field of fire analysis and research, the study uses national estimates of residential fires caused by lighted tobacco products, excluding matches and lighters, as the starting point for estimating the required fire data series for NY State.[62] Using national data to estimate the NY baseline assumes that the average New Yorker does not have a different propensity to cause fires by cigarettes than the average American. Table 3-1 gives the national data, provided by the National Fire Protection Administration (NFPA) in columns 2, 5, 7, and 9 from 1980 to 1999.

Adjustment to Exclude Cigar- and Pipes-Caused Fires

Because the data include fires from lighted tobacco products, including cigars and pipes, not just cigarettes, the first step in the estimating process is to adjust the data to eliminate fires started by cigars and pipes, because the new standard applies only to cigarettes. The required adjustment is small—a reduction of 1.5 %—based on the small fraction of fires from lighted tobacco products contributed by cigars and pipes.[63] The adjusted estimates for fires, deaths, injuries and property damage nationwide caused by cigarette fires in residential structures are given in columns 3 and 4, 6, 8, and 10 of table 3-1.

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61. The NY smoking fire file includes fires caused by all smoking materials including matches and lighters, and excludes NY City for losses other than deaths. The cigarette fire file includes all fires with a heat source of cigarettes, not just residential fires.

62. Dr. John Hall, Assistant Vice President for Fire Analysis and Research, National Fire Protection Administration (NFPA), provided advice on fire data.

63. The adjustment factor of 1.5 % is the mid-point of a range, 1 % to 2 %, provided by John Hall, Assistant Vice President for Fire Analysis and Research, National Fire Protection Administration (NFPA), who provided advice to the study on necessary adjustments to the national data to make them more suitable for the analysis of cigarette fires.

Adjustment of Property Damage for Inflation

Table 3-2 shows the next adjustment—the adjustment of property damage estimates in column 10 of table 3-1 to eliminate the effects of inflation and to account for the quantity of cigarettes consumed. The Gross Domestic Product (GDP) Implicit Price Deflators listed in column 2 are used to adjust the current dollars of column 10 (table 3-1) to constant 2003 dollars as shown in column 3 of table 3-1. (The base year 2003 GDP index, not shown in column2, is 112.26.) In column 3 constant dollar property damage estimates are given. Billions of cigarettes consumed nationally are stated in column 4, as provided by the NFPA. Column 5 shows the constant 2003-dollar residential property damages expressed in terms of billions of cigarettes consumed. The data in column 5 are among those used in developing the baseline series for fire losses.

Adjustment to Include Firefighter and Unreported Civilian Deaths

Table 3-3 shows in column 2 the estimated number of cigarette fires per billion cigarettes consumed. It shows in column 4 the adjustment to incorporate firefighter deaths, estimated as comprising 2 % of civilian fire deaths.[64] Column 5 shows the adjustment to incorporate unreported civilian fire deaths, estimated at 6.4 % of reported civilian fire deaths. These deaths are unreported in the sense of not having been reported to be caused by fire. Column 6 shows deaths from 1980 through 1999, adjusted for firefighter deaths and unreported civilian deaths, and expressed per billion cigarettes consumed. The data in column 6 are used in developing the projected baseline series for fire losses.

Adjustment to Include Firefighter and Unreported Civilian Injuries

Table 3-4 expresses civilian injuries in terms of the number of cigarettes consumed. It shows in column 3 estimated unreported civilian fire injuries, based on an assumption that these represent 8.7 % of reported injuries after an off-line adjustment for a lesser severity of injuries from unreported fires. Firefighter injuries are estimated in column 4 as double the rate of reported civilian injuries. Column 5 shows the injuries from 1980 through 1999, adjusted for firefighter injuries and unreported civilian injuries, and expressed per billion cigarettes consumed. The data in column 5 are used in developing the projected baseline series for fire losses.

64. The adjustment factors used to account for firefighter deaths and injuries and unreported civilian deaths and injuries were provided by Dr. Hall, NFPA.

Table 3-1. Estimation of U.S. Annual Residential Structure Fires and Related Civilian Deaths, Injuries, and Direct Property Damage Caused by Cigarettes, Based on Fire Data Reported to U.S. Municipal Fire Departments

Year (1)	Residential structure fires caused by lighted tobacco products (2)	Estimated residential structure fires caused by cigarettes (3)	Estimated residential structure fires caused by cigarettes signif. digits (4)	Civilian deaths from residential structure fires caused by lighted tobacco products (5)	Estimated civilian deaths from residential structure fires caused by cigarettes (6)	Civilian injuries from residential structure fires caused by lighted tobacco products (7)	Estimated civilian injuries from residential structure fires caused by cigarettes (8)	Direct property damage from residential structure fires caused by lighted tobacco products (millions of current dollars) (9)	Estimated direct property damage from residential structure fires caused by cigarettes (millions of current dollars (10)
1980	77,200	76,042	76,000	1,924	1,895	4,567	4,498	$333.9	$328.9
1981	70,700	69,640	69,600	2,131	2,099	4,357	4,292	$328.5	$323.6
1982	56,400	55,554	55,600	1,716	1,690	3,956	3,897	$343.1	$338.0
1983	49,000	48,265	48,300	1,575	1,551	4,086	4,025	$277.4	$273.2
1984	49,400	48,659	48,700	1,532	1,509	3,584	3,530	$322.0	$317.2
1985	48,300	47,576	47,600	1,639	1,614	3,502	3,449	$319.3	$314.5
1986	45,500	44,818	44,800	1,399	1,378	3,162	3,115	$314.6	$309.9
1987	42,600	41,961	42,000	1,425	1,404	3,367	3,316	$295.0	$290.6
1988	41,700	41,075	41,100	1,592	1,568	3,749	3,693	$313.7	$309.0
1989	36,700	36,150	36,200	1,215	1,197	3,117	3,070	$300.9	$296.4
1990	33,100	32,604	32,600	1,176	1,158	3,108	3,061	$332.1	$327.1
1991	31,900	31,422	31,400	902	888	2,876	2,833	$417.4	$411.1
1992	30,200	29,747	29,700	1,036	1,020	2,862	2,819	$243.0	$239.4
1993	29,300	28,861	28,900	1,000	985	3,003	2,958	$318.4	$313.6
1994	28,000	27,580	27,600	880	867	2,538	2,500	$304.4	$299.8
1995	27,000	26,595	26,600	1,068	1,052	2,364	2,329	$315.0	$310.3
1996	28,200	27,777	27,800	1,134	1,117	2,582	2,543	$325.7	$320.8
1997	24,800	24,428	24,400	882	869	2,126	2,094	$335.3	$330.3
1998	24,600	24,231	25,200	865	852	2,125	2,093	$316.5	$311.8

Source: Columns 1, 2, 5, 7, and 9 are from data files provided by John Hall, Assistant Vice President for Fire Analysis and Research, National Fire Protection Administration (NFPA). Columns 3, 4, 6, 8, and 10 are adjusted to remove the effects of cigar- and pipe-caused fires by applying an adjustment factor of 1.5 % based on Hall's advice that cigars and pipes account for only about 1 % to 2 % of the residential structure fires caused by lighted tobacco products.

Table 3-2. Estimation of Direct Property Damage from Residential Structure Fires Caused by Cigarettes

Year (1)	GDP Implicit Price Deflator (1996=100) (2)	Estimated direct property damage from residential structure fires caused by cigarettes (millions of constant 2003 dollars) (3)	Billions of cigarettes consumed (4)	Estimated direct property damage from residential structure fires caused by cigarettes per billion cigarettes consumed (thousands of constant 2003 dollars) (5)
1980	57.04	647.2	619	1,046
1981	62.37	582.3	628	927
1982	66.25	572.6	624	918
1983	68.88	445.3	596	747
1984	71.44	498.4	600	831
1985	73.69	479.1	595	805
1986	75.31	461.9	583	792
1987	77.58	420.4	577	729
1988	80.21	432.4	550	786
1989	83.27	399.5	540	740
1990	86.51	424.4	525	808
1991	89.66	514.7	510	1,009
1992	91.84	292.5	500	585
1993	94.05	374.3	485	772
1994	96.01	350.6	486	721
1995	98.10	355.0	487	729
1996	100.00	360.1	487	739
1997	101.95	363.6	480	758
1998	103.20	339.1	465	729

Note: Gross Domestic Product (GDP) Implicit Price Deflators (1996=100) in column 2 are published by the Bureau of Economic Analysis, U.S. Department of Commerce. The GDP Implicit Price Deflator is current dollar GDP divided by constant dollar GDP.

Table 3-3. Estimated Deaths per Billion Cigarettes Consumed

Year (1)	Cigarette fires per billion cigarettes consumed (2)	Reported Civilian deaths per billion cigarettes consumed (3)	Estimated firefighter deaths per billion cigarettes consumed* (4)	Estimated unreported civilian fire deaths per billion cigarettes consumed** (5)	Total estimated deaths, incl reported & unreported civilian & firefighter deaths per billion cigarettes consumed (6)
1980	122.779	3.062	0.061	0.196	3.3
1981	110.828	3.342	0.067	0.214	3.6
1982	89.103	2.709	0.054	0.173	2.9
1983	81.040	2.603	0.052	0.167	2.8
1984	81.167	2.515	0.050	0.161	2.7
1985	80.000	2.713	0.054	0.174	2.9
1986	76.844	2.364	0.047	0.151	2.6
1987	72.790	2.433	0.049	0.156	2.6
1988	74.727	2.851	0.057	0.182	3.1
1989	67.037	2.216	0.044	0.142	2.4
1990	62.095	2.206	0.044	0.141	2.4
1991	61.569	1.742	0.035	0.111	1.9
1992	59.400	2.041	0.041	0.131	2.2
1993	59.588	2.031	0.041	0.130	2.2
1994	56.790	1.784	0.036	0.114	1.9
1995	54.620	2.160	0.043	0.138	2.3
1996	57.084	2.294	0.046	0.147	2.5
1997	50.833	1.810	0.036	0.116	2.0
1998	54.194	1.832	0.037	0.117	2.0
1999	58.621	1.757	0.035	0.112	1.9

* Firefighter deaths are estimated as 2 % of civilian fire deaths, based on the advice of John Hall, NFPA, e-mail correspondence, 12-17-03.

** Unreported civilian fire deaths are estimated at 6.4 % of reported civilian fire deaths, based on the advice of John Hall, NFPA, e-mail correspondence, 12-17-03.

Table 3-4. Estimated Injuries per Billion Cigarettes Consumed

Year (1)	Reported civilian injuries per billion cigarettes consumed (2)	Estimated unreported civilian fire injuries per billion cigarettes consumed, adj for lesser severity* (3)	Estimated firefighter injuries per billion cigarettes consumed** (4)	Total estimated injuries, incl reported & unreported civilian & firefighter injuries per billion cigarettes consumed (5)
1980	7.267	0.632	14.535	22.4
1981	6.834	0.595	13.668	21.1
1982	6.245	0.543	12.489	19.3
1983	6.753	0.587	13.506	20.8
1984	5.884	0.512	11.767	18.2
1985	5.797	0.504	11.595	17.9
1986	5.342	0.465	10.685	16.5
1987	5.748	0.500	11.496	17.7
1988	6.714	0.584	13.428	20.7
1989	5.686	0.495	11.371	17.6
1990	5.831	0.507	11.662	18.0
1991	5.555	0.483	11.109	17.1
1992	5.638	0.491	11.276	17.4
1993	6.099	0.531	12.198	18.8
1994	5.144	0.448	10.288	15.9
1995	4.781	0.416	9.563	14.8
1996	5.222	0.454	10.445	16.1
1997	4.363	0.380	8.725	13.5
1998	4.501	0.392	9.003	13.9
1999	4.314	0.375	8.627	13.3

* Without the adjustment for lesser severity of the unreported fires, they would be estimated at 9 times to 19 times the reported civilian fire injuries, instead of the 0.067 factor used, according to John Hall, NFPA, e-mail correspondence, 12-17-03.

** Firefighter injuries are estimated as double the rate of civilian injuries on the advice of John Hall, NFPA, e-mail correspondence, 12-17-03.

Baseline Fire and Fires Losses Series

Table 3-5 brings forward residential cigarette fires per billion cigarettes consumed (from column 2, table 3-3), cigarette fire deaths in residential structures per billion cigarettes consumed (from column 6, table 3-3), cigarette fire injuries in residential structures per billion cigarettes consumed (from column 5, table 3-4), and property damage caused by cigarette fires in residential structures per billion cigarettes consumed (from column 5, table 3-2). It brings forward the data series for the period 1985 to 1999, dropping the earlier years in order better to reflect the recent declines in residential fires. A least-squares regression line is fitted to each data series, and the resulting equation is then used to project values for the period 2000 to 2011. The resulting trend line for fires per billion cigarettes is sharply down.

Table 3-5. Estimated Cigarette Fires and Resulting Deaths, Injuries, and Direct Property Damage per Billion Cigarettes Consumed

Year (1)	Cigarette fires per billion cigarettes (2)	Total deaths, incl. reported & est. unreported civilian & firefighter deaths per billion cigarettes (3)	Total injuries, incl. reported & est. unreported civilian & firefighter injuries per billion cigarettes (4)	Direct property damage per billion cigarettes (thousands of constant 2003 dollars) (5)
1985	80.0	2.9	17.9	805
1986	76.8	2.6	16.5	792
1987	72.8	2.6	17.7	729
1988	74.7	3.1	20.7	786
1989	67.0	2.4	17.6	740
1990	62.1	2.4	18.0	808
1991	61.6	1.9	17.1	1,009
1992	59.4	2.2	17.4	585
1993	59.6	2.2	18.8	772
1994	56.8	1.9	15.9	721
1995	54.6	2.3	14.8	729
1996	57.1	2.5	16.1	739
1997	50.8	2.0	13.5	758
1998	54.2	2.0	13.9	729
1999	58.6	1.9	13.3	916
proj. 2000	48.3	1.8	13.8	772
proj. 2001	46.5	1.8	13.5	772
proj. 2002	44.7	1.7	13.1	771
proj. 2003	42.8	1.7	12.8	771
proj. 2004	41.0	1.6	12.4	771
proj. 2005	39.1	1.5	12.0	770
proj. 2006	37.3	1.5	11.7	770
proj. 2007	35.4	1.4	11.3	770
proj. 2008	33.6	1.3	11.0	770
proj. 2009	31.8	1.3	10.6	769
proj. 2010	29.9	1.2	10.3	769
proj. 2011	28.1	1.2	9.9	769

Source: Estimates derived from data and assumptions provided by J. Hall, NFPA, as shown in underlying tables 3-1 through 3-4, for residential structures.

Figures 3-1 to 3-4 plot the data for each series. For the period from 1985 to 1999, the actual data estimates are plotted. Except for Figure 3-4, beyond 1999, two projections are shown: one for the least-squares estimates and one for an assumed continuation of losses per billion cigarettes at recent rates. For Figure 3-4, only one projected baseline is shown because there is little difference between the least-squares projection and a projection of recent rates. The least-

squares projections are used in the analysis. The projections of recent rates are shown as a reminder that the estimated effects in the study are conservative and may understate beneficial effects of the standard, particularly the number of future fires avoided.

A reason to expect that the future rate of decline of fire incidence may not be as great as forecast by the least-squares method is that fire prevention and suppression technology implemented mainly in the 1980s and feeding through the system in the 1990s may have largely had its impact. For example, many households have already replaced their old mattresses and upholstered furniture with fire-resistant versions, and many homeowners have already installed fire detectors. The effect of these factors may not continue to be manifested in the fire data at past rates, but rather may level off. Similarly, the projected downward trend in deaths and injuries per billion cigarettes may not continue at the rate projected if causal factors for the decline have bottomed out in their effects. In the case of property losses, a trend over the last decade toward larger and more expensive houses with more expensive furnishings may be offsetting what might otherwise also be declines in losses. Thus, there is reason to believe that the least-squares projections used for the baselines likely understate the future size of the fire problem, and, hence, understate fire-avoidance benefits associated with the standard. More investigation, beyond the scope of this study, would be needed to understand better the factors affecting future trends.

Figure 3-1. Estimated Actual and Projected Fires per Billion Cigarettes Consumed

Figure 3-2. Estimated Actual and Projected Total Deaths per Billion Cigarettes Consumed

(Includes reported and estimated unreported civilian deaths and firefighter deaths)

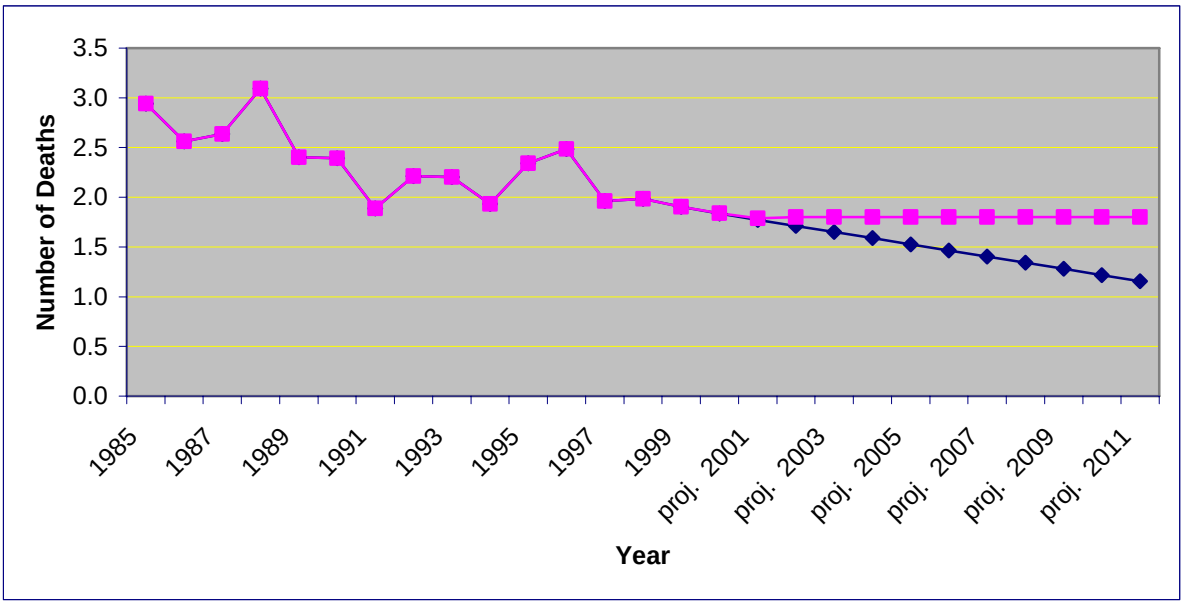


Figure 3-3. Estimated Actual and Projected Total Injuries per Billion Cigarettes Consumed

(Includes reported and estimated unreported civilian injuries and firefighter injuries)

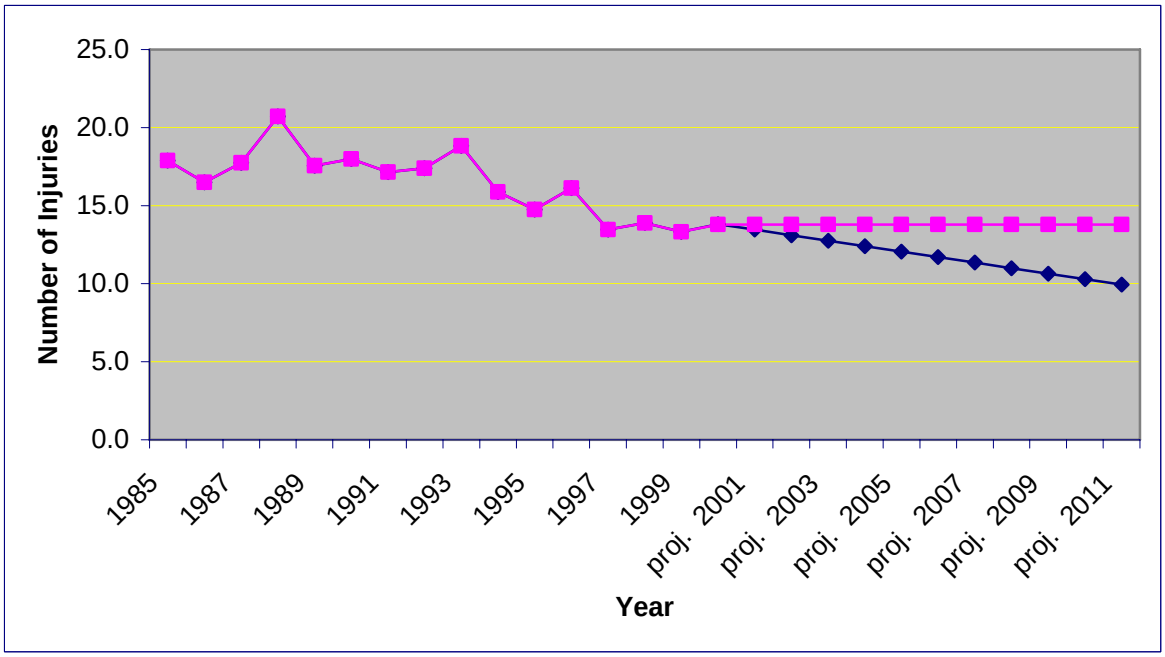
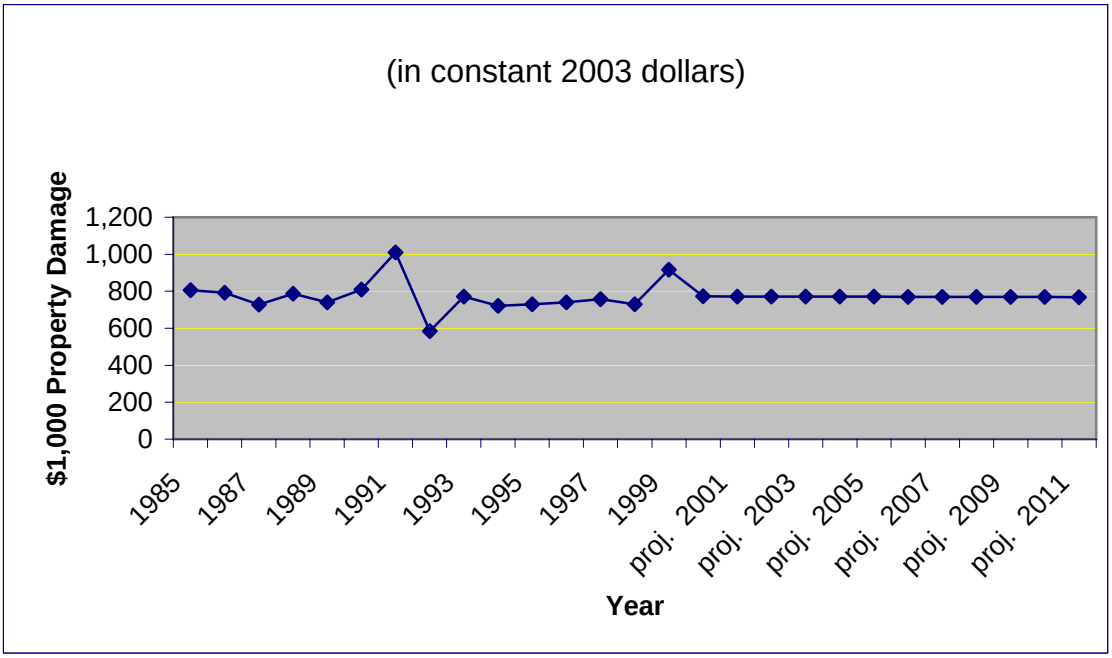


Figure 3-4. Estimated Actual and Projected Direct Property Damage per Billion Cigarettes Consumed



Projected Cigarette Consumption in NY State

The next step is to develop a projection of cigarette consumption in NY State to pair with the fire and loss rate projections per billion cigarettes consumed. These estimates are anchored to national per capita cigarette consumption and NY population data to reduce the problem of understating cigarette consumption in NY State.

The process starts with national domestic per capita cigarette sales to U.S. residents 18 years of age and older, as shown in column 2 of table 3-6, for the period 1985 to 2001.[66,67] Sales are assumed identical to purchases by this population group of domestically produced cigarettes, and it is further assumed that 100 % of domestically purchased cigarettes are consumed in the year purchased.

To make the baseline more reflective of NY State adult smoking rates, a comparison is made of NY adult smoking rates with the rest of the nation. Based on a simple, un-weighted average of state smoking rates in 2000, 22.7 % of adults in the U.S. reported having smoked at least 100 cigarettes during the reporting period. For NY State, the average was 21.6 %.[68] The NY rate

66. Federal Trade Commission Cigarette Report for 2001, Table 1, "Total Domestic Cigarette Unit Sales (in Billions) and Per Capita Sales," Issue date 2003.
67. Per capita consumption projections provided by the U.S. Department of Agriculture differ slightly but are of the same magnitude. U.S. Department of Agriculture, Economic Research Service, "Cigarette Consumption Continues to Slip," *Agricultural Outlook*, January-February, 2001, p. 8.
68. Centers for Disease Control, "State-Specific Prevalence of Current Cigarette Smoking among Adults, 2000," *MMWR Weekly*, Vol. 50 (49), December 14, 2001, Table 1, p.5.

was 95 % of the U.S. average.[69] The lower-than-national-average smoking rate for NY is assumed to translate into lower-than-national-average per capita sales data at the same rate. The estimated per capita consumption data in column 3 of table 3-6 are reduced by 5 %, based on the lower smoking rate for NY in 2000. The percentage computed for 2000 is applied throughout the projected baseline.[70] The results are listed in column 4 of table 3-6 for the years 1985 through 2001.

A least-squares fit of the estimated per capita consumption of domestic cigarettes in NY State over the years 1985 through 2001 produces a regression equation which is then used to project NY State per capita consumption data from 2002 through 2011, as shown in the lower rows of column 3, table 3-6.

69. Basing the comparison on a weighted average instead of a simple average entails weighing the state smoking rates by state adult populations in 2000. A weighted average approach would result in NY State smoking rates 96 % of the U.S. average in 2000. Thus, a simple average or weighted average produces closely similar results.
70. Rather than applying the adjustment factor for the year 2000 to the entire 1985 to 2001 U.S. per capita sales series, applying yearly adjustment factors would be a preferred approach. Lack of data for all states for all the years in the series precluded this approach.

Table 3-6. Estimated Actual and Projected Cigarette Consumption in NY State by Adults

Year (1)	Per capita domestic cigarette sales to U.S. adults* (2)	Estimated and projected per capita consumption by NY adult of domestic cigarettes** (3)	Actual and projected NY adult population*** (4)	Projected number of cigarettes in millions consumed by adults in NY State**** (5)
1985	3,400	3,230	not shown	not shown
1986	3,288	3,124	not shown	not shown
1987	3,190	3,031	not shown	not shown
1988	3,073	2,919	not shown	not shown
1989	2,846	2,704	not shown	not shown
1990	2,827	2,686	not shown	not shown
1991	2,724	2,588	not shown	not shown
1992	2,680	2,546	not shown	not shown
1993	2,414	2,293	not shown	not shown
1994	2,546	2,419	not shown	not shown
1995	2,483	2,359	not shown	not shown
1996	2,467	2,344	not shown	not shown
1997	2,416	2,295	not shown	not shown
1998	2,287	2,173	not shown	not shown
1999	2,175	2,066	not shown	not shown
2000	1,977	1,878	not shown	not shown
2001	1,875	1,781	not shown	not shown
proj. 2002*****	not applicable	1,767	14,544,281	25,694
proj. 2003	not applicable	1,686	14,596,640	24,603
proj. 2004	not applicable	1,604	14,649,188	23,505
proj. 2005	not applicable	1,523	14,701,925	22,397
proj. 2006	not applicable	1,442	14,754,852	21,282
proj. 2007	not applicable	1,361	14,807,970	20,158
proj. 2008	not applicable	1,280	14,861,278	19,026
proj. 2009	not applicable	1,199	14,914,779	17,886
proj. 2010	not applicable	1,118	14,968,472	16,737
proj. 2011	not applicable	1,037	15,022,359	15,579

* Data source for per capita sales is Federal Trade Commission Cigarette Report for 2001, U.S. Federal Trade Commission, 2003.

** Derived by adjusting U.S. per capita cigarette sales (column 3) by the ratio of the percentage of cigarette smoking among NY State adults to the average percentage of cigarette smoking among U.S. adults in all states in 2000.

*** The implied annual rate of growth in NY State's population between 2005 and 2015, based on U.S. Bureau of Census population projections for NY State for 2005 and 2015, is 0.36 %. This rate is applied to the State adult population estimate for 2002 and beyond.

**** Estimated as the projected per capita cigarettes purchased by NY adults each year, multiplied by the projected number of NY adults each year.

***** Year 2002 per capita cigarette consumption is projected by the study, but NY State population is estimated by the U.S. Census Bureau.

The next step in the estimating procedure is to develop a projection of the NY State adult population through 2013. The result of this step is shown in column 4 of table 3-6. The State population estimate for those 18 and over for 2002 is that reported by the U.S. Census Bureau.[71] This age category accounted for 75.3 % of total population in NY State in 2000.[72] To develop the population projections for the subsequent years, the annual population growth rate was calculated from projected population figures given in a population forecast report for NY State that extended out to 2025.[73] The computed annual rate of growth of 0.36 %, an overall growth rate, was then applied to the NY State population estimate for 2002.[74] A geometric growth formula of the form $P_{t+n} = P_t(1+r)^n$ was used to project annual adult population data for the period 2003 through 2013. The resulting data are shown in column 5 of table 3-6.

The final step in projecting baseline cigarette consumption by adults in NY State is to multiply the projected per capita cigarette consumption of adults in the State by the number of adults in the State. The resulting projection of the total number of cigarettes purchased domestically and consumed each year in NY State by the adult population is shown in column 5 of table 3-6. Due to the small projected population increase over the period and the drop in per capita cigarette consumption, the total number of cigarettes consumed in the State is projected to decline from an estimated 23.5 billion in 2004 to 15.6 billion by 2011.

It remains to project underage cigarette smoking in the State. Approximately one-third of NY State high school students were reported to be current users of tobacco products in 2000, and 26.8 % in the same year were reported to be current smokers of cigarettes.[75] The percentage of high school students who smoked exceeded the percentage of adults in the State who smoked (approximately a fifth). Furthermore, 16.3 % of New York youth were reported to be frequent smokers. The number of packs of cigarettes illegally sold to underage youth at current use rates in NY State was estimated at 18.7 million packs annually in the year 2000.[76] At 20 cigarettes per pack, this amounts to 374 million cigarettes consumed by underage smokers in the year 2000.

The 2010 national health objective is to cut the current smoking rates among high school students to no more than 16 %. Current rates of smoking are higher among high school students than among other age groups comprising underage smokers. National surveys suggest that smoking levels among high school students have peaked and are now declining.[77] The

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71. The population estimate for 2002 for adults in NY State is from Table ST-EST2002-ASRO-01- State Characteristic Estimates, Population Division, U.S. Census Bureau, September 18, 2003.
72. American Fact Finder, "Profile of General Demographic Characteristics: 2000," DP-1, Geographic Area: New York, U.S. Census Bureau.
73. The annual population growth rate is calculated from projections for 2005 and 2015 given in "State population ranks: New York's Population Projections 1995-2025," U.S. Bureau of Census, Report PPL-47, 1996.
74. A more precise projection would apply forecasted population growth rates broken down by age groups to each age group. This analysis uses only two age groups—those 18 and older, and those younger than 18. A single, State-wide population growth rate is applied to both groups.
75. Centers for Disease Control, "Youth Tobacco Surveillance—United States, 2000, *Morbidity and Mortality Weekly Report*, Vol. 50, No. SS-4, November 2, 2001, Table 5, p. 50.
76. American Cancer Society, "NY Tobacco Facts;" and National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control. "The Toll of Tobacco in New York," data drawn from "Tobacco Use among High School Students."
77. Centers for Disease Control, "Trends in Cigarette Smoking Among High School Students," Morbidity and Mortality Weekly Report, Vol. 51 (19), 2002

prevalence of current cigarette use among high school students nationally increased from 27.5 % in 1991 to 36.4 % in 1997 and then declined significantly to 28.5 % in 2001, and 21.9 % in 2003. A significant trend was detected also for the frequency of cigarette use, increasing through the 1990s and since declining significantly.[78] These national trends mirror trends in NY State, where the results of 2000 and 2002 Youth Tobacco Surveys indicate recent progress towards reducing smoking by young people. The percentage of all high school students who were current users of cigarettes in the State decreased from 27.4 % in 2000 to 21.3 % in 2002.[79]

Estimates are made of underage cigarette consumption over the period of interest, and the estimated amounts are added to the adult cigarette consumption projections to reflect total cigarette consumption in the State. This adjustment is made in table 3-7.

Column 2 of table 3-7 shows estimated annual underage cigarette consumption for years extending out through 2011. The starting point is the reported annual number of cigarettes

Table 3-7. Baseline Cigarette Consumption in NY State

Year (1)	Projected youth cigarette consumption* (millions of cigarettes) (2)	Projected adult cigarette consumption (millions of cigarettes) (3)	Projected total youth and adult cigarette consumption in NY State (billions of cigarettes) (4)
2000	374	n.a.	n.a.
2001	357	n.a.	n.a.
2002	340	n.a.	n.a.
2003	324	n.a.	n.a.
2004	309	23,505	23.8
2005	295	22,397	22.7
2006	281	21,282	21.6
2007	268	20,158	20.4
2008	256	19,026	19.3
2009	244	17,886	18.1
2010	233	16,737	17.0
2011	222	15,579	15.8

* Youth cigarette consumption is estimated by applying the projected annual rate of decline in cigarette consumption of 0.05, and the projected NY State annual population growth rate of 0.0036 to estimated consumption by youths in NY State in 2000.

consumed by underage smokers in the year 2000 of 374 million. The annual quantity consumed for subsequent years is projected by applying to each previous year the projected annual rate of population growth for NY State of 3.6 %, in combination with an estimated annual rate of

78. Centers for Disease Control, "Cigarette Use among High School Students—United States, 1991-2003, *Morbidity and Mortality Weekly Report*, Vol. 53 (23), June 18, 2004.
79. New York State Department of Health, "Trends in Cigarette Use by Youth in New York State; Youth Tobacco Survey 2000-2002."

decline in underage smoking of 5 %. This rate is lower than the reported rates of decline among high school students observed over in the last few years. But it should be recalled that the recent steep declines followed a decade of increasing rates, such that the trend over the longer run is questionable. The rate used is derived as the required annual rate of decline to bring the reported 27.4 % of high school students in the State in 2000 who were current users of cigarettes down to the national targeted rate in 2010 of 16 %, rounded to the nearest integer. The resulting annual rate of decline in underage smoking used in the analysis is 5 %. Column 4 shows the estimated combined adult and youth cigarette consumption in terms of billions of cigarettes consumed per year.

Now that we have the projected fires and associated losses per billion cigarettes consumed and the consumption of cigarettes in billions, we can generate the baselines of total fires, deaths, injuries, and property damage in NY State caused by cigarettes, needed for the scenario analyses.

Table 3-8 shows the results over the period 2004 through 2011, the years needed to accommodate the four alternative study periods. The projected number of cigarette fires in residences drops from 975 in 2004 to 444 in 2011. The projected number of deaths caused by cigarette fires in residences drops from 38 in 2004 to 18 in 2011. The projected number of injuries caused by cigarette fires in residences drops from 295 in 2004 to 157 in 2011. Property damage from residential fires, expressed in 2003 dollars, is projected to fall from $18.3 million in 2004 to $12.1 million in 2011. These baselines may understate future cigarette consumption, and, hence, are regarded as conservative estimates for estimating the standard's potential fire-avoidance benefits.

Table 3-8. Projected Cigarette Fires, Deaths, Injuries, and Property Losses in NY Residences

(numbers of fires, deaths, and injuries, and dollar value of property loss)

Year (1)	Projected cigarette fires (2)	Projected deaths caused by cigarettes (2)	Projected injuries caused by cigarettes (3)	Projected property damage caused by cigarettes (thousands of constant 2003 dollars) (4)
2004	975	38	295	18,345
2005	888	35	273	17,490
2006	806	32	253	16,636
2007	723	29	231	15,705
2008	649	26	212	14,852
2009	575	23	193	13,923
2010	509	21	175	13,071
2011	444	18	157	12,144

Note: Derived by multiplying the estimated losses per billion cigarettes by the estimated billions of cigarettes consumed in the State.

Scenario One: Establishing Upper-Limit Benefits

Table 3-9 summarizes the first-order maximum potential benefits estimated from totally eliminating cigarette fires in NY residences over each of the four alternative study periods, thereby establishing for this study a ceiling on first-order benefits. The value of the benefits varies depending on the study period selected. Property damage losses avoided are stated in present value 2003 dollars as of the beginning of 2004 for all of the study periods. Two values are given for present value property losses avoided: one based on a discount rate of 3 %, and one based on a discount rate of 7 %.

Table 3-9. Scenario 1 Projected Upper-limit Benefits

Losses Avoided --	
Study Period 1: 2004-2009	
Fires	4616
Deaths	182
Injuries	1457
Property loss (PV in thousands of dollars @ 7% discount rate)	$77,850
Property loss (PV in thousands of dollars @ 3% discount rate)	$87,947
Study Period 2: 2006-2011	
Fires	3705
Deaths	148
Injuries	1221
Property loss (PV in thousands of dollars @ 7% discount rate)	$52,991
Property loss (PV in thousands of dollars @ 3% discount rate)	$73,865
Study Period 3: 2004-2006	
Fires	2669
Deaths	104
Injuries	821
Property loss (PV in thousands of dollars @ 7% discount rate)	$46,001
Property loss (PV in thousands of dollars @ 3% discount rate)	$49,521
Study Period 4: 2006-2008	
Fires	2177
Deaths	86
Injuries	696
Property loss (PV in thousands of dollars @ 7% discount rate)	$36,151
Property loss (PV in thousands of dollars @ 3% discount rate)	$41,990

Note: Establishes an upper limit of benefits by assuming no diversion of cigarette purchases to non-conforming channels and 100% effectiveness of modified cigarettes; shows results for four alternate study periods and for alternate real discount rates of

Assuming that all residential cigarettes fires are averted from the beginning of 2004 through the end of 2009—results in 4,616 fewer fires; 182 fewer deaths; 1,427 fewer injuries; and $77.8 million in property loss avoidance when discounted to present value at a real rate of 7 %, and $87.9 million when discounted at a real rate of 3 %.

Implementing the standard two years later—as shown by the results for Study Period 2—reduces the losses avoided to 3,705 fires, 148 deaths, 1,221 injuries, and $53.0 million in property losses when discounted to present value at a real rate of 7 %, and $73.9 million when discounted at a real rate of 3 %.

Cutting each of these study periods in half obviously cuts the estimated benefits. For the third study period, which starts in 2004 but lasts only three years, the number of cigarette fires avoided is estimated at 2,669; deaths averted at 104; injuries prevented at 821; and property losses avoided at $46.0 million or $49.5 million, depending on which discount rate is applied. For the fourth study period, 2006 to 2008, the benefits potential is reduced to 2,177 cigarette fires avoided; 86 deaths averted; 695 injuries prevented, and $36.2 million or $42.0 million in present value property losses avoided depending on which discount rate is used.

As was indicated previously, these impact projections are unrealistic, primarily because a significant share of cigarettes consumed in the State are purchased outside State-controlled channels, and, hence, will likely not conform to the standard, and, further, the required cigarette modification will not be 100 % effective. As a starting point, and in a sensitivity mode, however, the scenario establishes a useful upper-limit estimate for comparison with other estimates under less favorable conditions.

Scenario Two: Accounting for Existing Tax-Driven Diversion of Cigarettes and Varying Effectiveness Levels of Conforming Cigarettes

This second scenario starts with the baseline fire-losses per billion cigarette projections derived in section 3.1. But it adjusts the baseline cigarette consumption data to reflect the existing estimated tax-driven diversion of cigarette purchases to channels not expected to comply with the standard. As explained in section 2.3.3, the existing tax-driven diversion rate is estimated at 32 %. To focus on the impacts of the standard, it is assumed that the tax-driven rate remains constant over the study period. It is assumed that diverted cigarette purchases will not comply with the standard for lower ignition propensity. Conversely, it is assumed that all cigarettes not diverted will conform to the standard.

To test the magnitude of fire-loss benefits for alternative levels of effectiveness of conforming cigarettes, this second scenario assesses first-order benefits while varying the effectiveness of conforming cigarettes in reducing residential fires over the range of 30 % to 80 %, in 10 % increments. Study Period 1 is used for testing effectiveness levels.

Benefit results are then shown for the four alternative study periods, while holding constant the effectiveness level at 60 %.

Modifying the Cigarette Baseline

The baseline used in the first scenario is adjusted by the estimated current percentage of tax-driven diversions. The result is shown in table 3-10.

Table 3-10. Modification of Baseline NY Cigarette Purchases for a 32 % Tax-driven Diversion to Non-conforming Channels

Year (1)	Projected total youth and adult cigarette consumption in NY State (billions of cigarettes) (2)	Estimated cigarette sales through standard-conforming channels (3)	Projected taxed cigarette purchases in NY State (billions of cigarettes) (4)
2004	23.8	68%	16.2
2005	22.7	68%	15.4
2006	21.6	68%	14.7
2007	20.4	68%	13.9
2008	19.3	68%	13.1
2009	18.1	68%	12.3
2010	17.0	68%	11.6
2011	15.8	68%	10.7

Note: Col. 2 is from table 3-7; the tax-driven diversion rate is explained in section 2.3.3.

First-Order Impacts for Alternative Effectiveness Levels of Modified Cigarettes

The projections of annual benefits from 2004 through 2011 for each type of first-order benefit are shown in table 3-11. The results are given for the existing tax-driven 32 % diversion of cigarettes to non-conforming channels that is not related to the standard. Results are given for levels of effectiveness of modified cigarettes ranging from 30 % to 80 %.

As would be expected, the effectiveness rate of modified cigarettes in reducing cigarette fires has a profound effect on benefits from the standard. Benefits for an 80 % effectiveness level are between two and three times greater than the benefits for a 30 % effectiveness level. Also apparent from table 3-11 are the declines in benefits for years further out in time. These declines reflect the projected falling number of cigarettes projected to be smoked each year as time passes.

Table 3-11. Projected First-order Benefits Based on Tax-driven Diversion of 32 % and a Range of Effectiveness Levels for Reduced Ignition Cigarettes

Benefit Categories (1)	Year (2)	Level 30% (3)	Level 40% (4)	Level 50% (5)	Level 60% (6)	Level 70% (7)	Level 80% (8)
Fires avoided	2004	199	266	332	398	465	531
	2005	181	241	301	362	422	482
	2006	164	219	274	329	384	439
	2007	148	197	246	296	345	394
	2008	132	176	220	264	308	352
	2009	117	156	195	234	274	313
	2010	104	139	174	208	243	278
	2011	90	120	150	180	210	240
Deaths averted	2004	8	10	13	15	18	21
	2005	7	9	12	14	16	19
	2006	6	9	11	13	15	17
	2007	6	8	10	12	14	16
	2008	5	7	9	11	12	14
	2009	5	6	8	9	11	13
	2010	4	6	7	8	10	11
	2011	4	5	6	7	9	10
Injuries prevented	2004	60	80	100	121	141	161
	2005	56	74	93	111	130	148
	2006	52	69	86	103	120	138
	2007	47	63	79	95	110	126
	2008	43	58	72	86	101	115
	2009	39	52	65	79	92	105
	2010	36	48	60	72	84	96
	2011	32	43	53	64	74	85
Property loss avoided (in thousands of constant 2003 dollars)	2004	$3,746	$4,995	$6,244	$7,492	$8,741	$9,990
	2005	$3,560	$4,746	$5,933	$7,119	$8,306	$9,492
	2006	$3,396	$4,529	$5,661	$6,793	$7,925	$9,057
	2007	$3,210	$4,280	$5,351	$6,421	$7,491	$8,561
	2008	$3,024	$4,032	$5,041	$6,049	$7,057	$8,065
	2009	$2,838	$3,785	$4,731	$5,677	$6,623	$7,569
	2010	$2,676	$3,568	$4,460	$5,352	$6,244	$7,135
	2011	$2,467	$3,290	$4,112	$4,934	$5,757	$6,579

Note: Based on projected baseline of cigarettes adjusted for an estimated 32% tax-driven diversion rate.

Table 3-12 summarizes the projected first-order benefits for the alternate study periods, holding the effectiveness level of conforming cigarettes constant at 60 %. As may be seen, at the high end, estimated first-order benefits comprise the avoidance of 1,883 cigarette fires, 74 deaths, 595 injuries, and between $32 and $36 million in present value dollars of property damages. At the low end—based on implementing the standard in 2006 and only three years before a similar national standard takes effect—estimated benefits comprise the avoidance of 889 fires, 35 deaths, 284 injuries, and between $15 and $17 million in present value dollars of property damages. Again we see that delaying the onset of benefits and realizing them for only three years cuts the estimated projected first-order benefits of the standard dramatically as compared to immediate implementation and a longer time over which to realize the benefits.

Table 3-12. Scenario 2 Projected First-order Benefits

Losses Avoided --	
Study Period 1: 2004-2009	
Fires	1,883
Deaths	74
Injuries	595
Property loss (PV in thousands of dollars @ 7% discount rate)	$31,759
Property loss (PV in thousands of dollars @ 3% discount rate)	$35,878
Study Period 2: 2006-2011	
Fires	1,512
Deaths	61
Injuries	498
Property loss (PV in thousands of dollars @ 7% discount rate)	$24,743
Property loss (PV in thousands of dollars @ 3% discount rate)	$30,140
Study Period 3: 2004-2006	
Fires	1,089
Deaths	42
Injuries	335
Property loss (PV in thousands of dollars @ 7% discount rate)	$18,765
Property loss (PV in thousands of dollars @ 3% discount rate)	$20,201
Study Period 4: 2006-2008	
Fires	889
Deaths	35
Injuries	284
Property loss (PV in thousands of dollars @ 7% discount rate)	$14,756
Property loss (PV in thousands of dollars @ 3% discount rate)	$17,139

Note: Based on tax-driven diversion of 32% of cigarette purchases to non-conforming cigarettes; a 60% effectiveness rate for conforming cigarettes; four alternate study periods; and alternate real discount rates of 3% and 7% per annum.

Scenario Three: Accounting for Modification-Induced Price-Driven Diversion of Cigarettes and Existing Tax-Driven Diversion

As in the second case scenario, this third scenario takes into account diversion in response to a potential increase in the price of modified cigarettes. It also takes into account the estimated existing 32 % in tax-driven diversion of cigarette purchases not related to the standard. The results are shown based on an assumed effectiveness level of 60 % for reduced ignition cigarettes.

The estimated price elasticity of demand for cigarettes, discussed in Chapter 2, is estimated at -0.4. The estimated upper boundary price increase for modified cigarettes of $0.10/pack, or a 1.8 % increase in per pack price, is associated with an estimated diversion of 0.7 %. Clearly, the modified-induced price-driven diversion is quite small in comparison with the existing tax-driven diversion. Table 3-13 shows the year-by-year benefits projections, based on applying the price-driven 0.7 % diversion to projected taxed cigarette purchases in NY State, which reflect the estimated 32 % tax-driven diversion. The benefits projections in table 3-13 are all based on an effectiveness level of 60 %.

Table 3-13. Scenario 3 First-order Benefits, Based on a Price-driven Diversion of 0.7 % and a 60 % Effectiveness Level for Conforming Cigarettes

Year (1)	Projected taxed cigarette purchases in NY State (billions of cigarettes) (2)	Estimated purchases of conforming cigarettes taking into accounted an estimated 0.7% price-driven diversion (billion of cigarettes) (3)	Estimated fires avoided (3)	Estimated deaths averted (4)	Estimated injuries prevented (5)	Estimated property damage avoided (thousands of constant 2003 dollars) (6)
2004	16.2	16.1	395	15	120	$7,440
2005	15.4	15.3	359	14	111	$7,070
2006	14.7	14.6	327	13	102	$6,745
2007	13.9	13.8	294	12	94	$6,376
2008	13.1	13.0	262	10	86	$6,006
2009	12.3	12.2	233	9	78	$5,637
2010	11.6	11.5	207	8	71	$5,314
2011	10.7	10.6	179	7	63	$4,900

Note: The price-driven diversion attributed to the standard is applied to a base that incorporates the existing tax-driven diversion.

Table 3-14 summarizes the first-order benefits for the third scenario for each of the alternative study periods. It may be seen from table 3-14 that the benefits remain robust under this scenario. For the 2004-2009 study period, estimated fires avoided exceed 1,800; deaths averted exceed 70; injuries prevented approximate 600; and the estimated avoided present value property damage ranges between $31.5 and $35.6 million. At the low end—for a study period of only

three years and a starting date in 2006—benefits are about half as much.

Table 3-14. Scenario 3 Projected First-order Benefits

Losses Avoided --	
Study Period 1: 2004-2009	
Fires	1,870
Deaths	74
Injuries	590
Property loss (PV in thousands of dollars @ 7% discount rate	$31,537
Property loss (PV in thousands of dollars @ 3% discount rate	$35,627
Study Period 2: 2006-2011	
Fires	1,501
Deaths	60
Injuries	495
Property loss (PV in thousands of dollars @ 7% discount rate	$24,570
Property loss (PV in thousands of dollars @ 3% discount rate	$29,929
Study Period 3: 2004-2006	
Fires	1,081
Deaths	42
Injuries	333
Property loss (PV in thousands of dollars @ 7% discount rate	$18,634
Property loss (PV in thousands of dollars @ 3% discount rate	$20,060
Study Period 4: 2006-2008	
Fires	883
Deaths	35
Injuries	282
Property loss (PV in thousands of dollars @ 7% discount rate	$14,653
Property loss (PV in thousands of dollars @ 3% discount rate	$17,019

Note: Diversion of cigarette purchases to non-conforming channels is based on a tax-driven 32 % diversion, followed by a modification-induced, price-driven diversion of 0.7 %. An effectiveness level of 60 % is assumed for conforming cigarettes. Dollar values are discounted to a present value equivalent as of the beginning of 2004 using alternate real discount rates of 7 % and 3 % per annum.

Scenario Four: Accounting for Modification-Induced Preference-Driven Diversion of Cigarettes and Existing Tax-Driven Diversion

This scenario takes into account the impact of the standard in the face of an adverse reaction by smokers. It is too early to know what smoker reaction will be to conforming cigarettes. As part of the sensitivity analysis, a hypothetical preference-driven diversion rate is tested. Table 3-15 shows the annual impacts based on a 10 % diversion rate applied to the projected baseline of taxed purchases that reflects existing tax-driven diversion. The combined tax- and preference-driven diversion rates equal 38.8 %.[80]

Table 3-15. Scenario 4 First-order Benefits, Based on a Preference-driven Diversion of 10 % and a 60 % Effectiveness Level for Conforming Cigarettes

Year (1)	Projected taxed cigarette purchases in NY State (billions of cigarettes) (2)	Estimated purchases of conforming cigarettes taking into accounted an estimated 10% preference-driven diversion (billion of cigarettes) (3)	Estimated fires avoided (3)	Estimated deaths averted (4)	Estimated injuries prevented (5)	Estimated property damage avoided (thousands of constant 2003 dollars) (6)
2004	16.2	14.6	358	14	108	$6,743
2005	15.4	13.9	325	13	100	$6,407
2006	14.7	13.2	296	12	93	$6,114
2007	13.9	12.5	266	11	85	$5,779
2008	13.1	11.8	238	9	78	$5,444
2009	12.3	11.1	211	9	71	$5,109
2010	11.6	10.4	187	8	64	$4,816
2011	10.7	9.6	162	7	57	$4,441

Note: The preference-driven diversion attributed to the standard is applied to a base that incorporates the existing tax-driven diversion.

Table 3-16 summarizes the first-order benefits for the fourth scenario for each of the four alternative study periods, based on a preference-driven 10 % diversion rate. Benefits are lower for the fourth scenario than for the third.

80 The computation for the total diversion rate given a 32 % tax-driven diversion rate and a 10 % preference-driven rate, is a follows: 0.32 + (0.68)(0.10) = 0.388 or 38.8 %

Table 3-16. Scenario 4 Projected First-order Benefits

Losses Avoided --	10% preference-driven
Study Period 1: 2004-2009	
Fires	1,695
Deaths	67
Injuries	535
Property loss (PV in thousands of dollars @ 7% discount rate	$28,583
Property loss (PV in thousands of dollars @ 3% discount rate	$32,290
Study Period 2: 2006-2011	
Fires	1,361
Deaths	54
Injuries	448
Property loss (PV in thousands of dollars @ 7% discount rate	$22,269
Property loss (PV in thousands of dollars @ 3% discount rate	$27,126
Study Period 3: 2004-2006	
Fires	980
Deaths	38
Injuries	302
Property loss (PV in thousands of dollars @ 7% discount rate	$16,889
Property loss (PV in thousands of dollars @ 3% discount rate	$18,181
Study Period 4: 2006-2008	
Fires	800
Deaths	32
Injuries	256
Property loss (PV in thousands of dollars @ 7% discount rate	$13,280
Property loss (PV in thousands of dollars @ 3% discount rate	$15,425

Note: Diversions of cigarette purchases to non-conforming channels are based on a tax-driven 32 % diversion, followed by a modification-induced preference-driven diversion of 10 %, or by a modification-induced preference-driven diversion of 25 %. An effectiveness level of 60 % is assumed for conforming cigarettes. Dollar values are discounted to a present value equivalent as of the beginning of 2004 by application of alternate real discount rates of 7 % and 3 % per annum.

Scenario Five: Accounting for Combined Modification-Induced Price- and-Preference-Driven Diversion of Purchases and Existing Tax-Driven Diversion

The final scenario applies both the price- and the preference-driven diversions to the projected baseline of taxed purchases of cigarettes. This baseline already is reduced by the existing tax-driven diversion; hence, the combined effective rate of diversion applied to it is 10.63 %.[81] The total effective diversion rate that alternatively could be applied to the projected cigarette consumption baseline is 38.8 %.[82]

The projected year-by-year results are shown in table 3-17, and the aggregated results for the four study periods are shown in table 3-18. Because the estimated price-driven diversion is tiny compared with the assumed preference diversion, the results are little changed from those of scenario case four in which the 10 % preference diversion is considered apart from a modification-induced price change. A point that may be taken from these results is that an adverse preference effect has a greater potential to reduce effectiveness of the standard than a price increase based on estimated differential manufacturing costs.

Table 3-17. Scenario 5 First-order Benefits, Based on Combined Price- and Preference-driven Diversions and a 60 % Effectiveness Level for Conforming Cigarettes

Year	Projected taxed cigarette purchases in NY State (billions of cigarettes)	Estimated purchases of conforming cigarettes taking into accounted an estimated 0.7% price-driven diversion and 10%	Estimated fires avoided	Estimated deaths averted	Estimated injuries prevented	Estimated property damage avoided (thousands of constant 2003 dollars)
(1)	(2)		(3)	(4)	(5)	(6)
2004	16.2	14.5	356	14	108	$6,696
2005	15.4	13.8	323	13	99	$6,363
2006	14.7	13.1	294	12	92	$6,071
2007	13.9	12.4	264	10	85	$5,738
2008	13.1	11.7	236	9	77	$5,406
2009	12.3	11.0	210	8	70	$5,073
2010	11.6	10.4	186	8	64	$4,783
2011	10.7	9.6	161	7	57	$4,410

Note: The baseline shown in col. 2 reflects an existing tax-driven diversion of 32 %. A reduction of 10.63 % is applied to column 2 to adjust for combined price- and preference-driven diversions, taking

81. Computed as (0.10 + 0.007) – (0.10)(0.007) = 0.1063 or 10.63 %. The rate is the same whether the price-driven or the preference-driven diversion is assumed to occur first. However, given that purchases diverted for one reason are no long available to divert for another reason, it is necessary to take into account the interaction.
82. Computed as 0.32 + (0.68)(0.007) + (0.68)(1-0.007)(0.10) = 39.4 %.

into account interactions between these two types of diversion.

The next chapter extends the impact assessment of the standard by evaluating projected second-order economic impacts.

Table 3-18. Scenario 5 Projected First-order Benefits

Losses Avoided --	
Study Period 1: 2004-2009	
Fires	1,683
Deaths	66
Injuries	531
Property loss (PV in thousands of dollars @ 7% discount rate	$28,383
Property loss (PV in thousands of dollars @ 3% discount rate	$32,064
Study Period 2: 2006-2011	
Fires	1,351
Deaths	54
Injuries	445
Property loss (PV in thousands of dollars @ 7% discount rate	$22,113
Property loss (PV in thousands of dollars @ 3% discount rate	$26,936
Study Period 3: 2004-2006	
Fires	973
Deaths	38
Injuries	299
Property loss (PV in thousands of dollars @ 7% discount rate	$17,281
Property loss (PV in thousands of dollars @ 3% discount rate	$18,054
Study Period 4: 2006-2008	
Fires	794
Deaths	31
Injuries	254
Property loss (PV in thousands of dollars @ 7% discount rate	$13,187
Property loss (PV in thousands of dollars @ 3% discount rate	$15,317

Note: Diversions of cigarette purchases to non-conforming channels are based on an existing tax-driven 32 % diversion, followed by a modification-induced price-driven diversion of 0.7, and followed by a modification-induced preference-driven diversion of 25 %. An effectiveness level of 60 % is assumed for conforming cigarettes. Dollar values are discounted to a present value equivalent as of the beginning of 2004 by application of alternate real discount rates of 7 % and 3 % per annum.

Second-Order Economic Impact Assessment

This chapter focuses on the State-wide economic impacts that result from key aspects of the adoption of a lower ignition cigarette standard for NY State. These economic impacts are measured using the REMI (Regional Economic Models, Inc) economic forecasting model for NY State. This analysis tool is used to describe the economic implications over time when NY households and businesses experience a policy-induced change affecting income and business sales.

The societal impacts that are indeed the motivating factor behind regulating a safer cigarette – namely the number of deaths and injuries avoided – lie outside of the REMI measured economic impacts. REMI is not designed to compute economic impacts based on these types of changes. Certainly injury avoidance carries a monetary consequence, namely a demand shift away from the need for medical and health services, which for the out-of-pocket portion, goes into general consumer spending. The economic impact caused by this redirection of household income from reduced medical expenditures, however, does not show the positive benefit that we logically recognize when we reduce injuries and deaths. REMI does not compute the emotional cost of grief or suffering, for example. It is an economic model, not a psychological model.

There is also a deficiency in REMI when it is used to measure the positive impact of the standard in reducing property losses from fire. REMI's treatment of the impact of reducing property losses in the economic framework indeed seems counter-intuitive. Any event that destroys structures (e.g. fire, flood, and tornado) removes capital stock from an economy – be it factories or houses. Within the REMI framework (and in keeping with observed mainstream economic measures such as GDP), property losses are followed by a positive economic impact created by the investment (through insurance monies) to re-build and restore the level of housing stock. Therefore a scenario in the REMI model describing fewer property losses (e.g., less property damage from cigarette-caused fires) would actually produce a dampening effect on the NY economy, rather than the benefit that we might expect. Likewise, increased medical expenditure is treated in REMI as having a positive economic impact. The model, in other words, is not able to differentiate between new construction resulting from increased investment by a growing population and replacement construction to rebuilt homes burned by cigarette-caused fires. It is not able to differentiate between new medical expenditure resulting from having world-class medical facilities and increased medical expenditure resulting from a rise in burn victims.

For this reason, the non-out-of-pocket property loss savings, and the averted injury-related medical spending are excluded from this REMI analysis of the standard's impact. This step is necessary to insure that reductions in property losses and injuries from cigarette fires are consistently treated throughout the analysis. In addition, this analysis does not attempt to assess any impact on health insurance or home-owners and rental insurance premiums.

Because some of the second-order economic effects are overlapping, care must be taken to avoid double counting. For example, job impacts for "*all sectors*," encompass, but are not limited to, those shown for the *retail*, *wholesale*, and *warehousing* sectors. Similarly, the *Gross State*

Product (GSP) effects implicitly include the *personal income* effects. Clearly issues of double counting and of using multiple units of measure for different effects make it impossible to provide simple summations of overall net second-order impacts.

Potential Impacts on Businesses in NY State

There are several possible ways through which the implementation of this regulation can create impacts on NY State businesses. In the realm of direct impacts would be cigarette manufacturers based in NY State, and the potential for a specific type of paper manufacturer, if present in NY State, to get new orders as the modified cigarette product is readied for sale through NY State outlets. Beyond these direct impacts, there are businesses involved in the warehousing, distribution, and sale of cigarettes that are likely to be affected by the level of acceptance for this product by smokers in the State, and changeover to the new product. Beyond these businesses – which are tied either to cigarette manufacturing, distribution, or sales – will be consideration of impacts on other types of NY State businesses as smoking households experience changes in their expenditures related to cigarette purchases, out-of-pocket savings tied to averted property losses, and the rest of their consumer basket.

A discussion follows for each segment of business potentially impacted as a result of the regulation.

Cigarette Producers

For the most part, the cigarette producers are not located in NY State. The most recent published data available from the Bureau of Labor Statistics (based on 2001) shows that NY State employment in *Cigarette* Manufacturing is attributed to a single establishment with 20 to 99 employees (reported as a range for confidentiality).

In addition, Lorillard Tobacco Company has NY links. The company was founded in NY City more than 200 years ago, and its parent company, the Loews Corporation, is located in New York. Cigarette sales, mainly sales of it popular brand *Newport*, accounted for 13.5 % of Loews revenue in 1998.[83] Lorillard has slightly more than 100 employees in NY.[84]

Decision-making within each manufacturer will determine which facilities around the country will manufacture modified cigarettes for the NY State market. Even if NY State were host to significant cigarette manufacturing activities, the regulation will present a change in the cost of doing business for all manufacturers (regardless of their location) with brands currently selling in the State. Early implementers, such as Philip Morris with the introduction of the *Merit* cigarette, may experience less of a cost increase. As will be examined below (and as was discussed earlier in Chapter 2), there is the potential that manufacturers may recoup these added costs by increasing the price of cigarettes sold in NY State. The potential for a manufacturer to experience a market-share reduction due to low consumer preference for its conforming brand in

83. "Newport lifts Lorillard," The Business Journal of the Greater Triad Area, Greensboro, NC, April, 19, 1999
84. Lorillard Tobacco Company, "Comments on Proposed Fire Safety Standards for Cigarettes," April 14, 2003, p. 4.

NY State will likely be off-set by the potential for a NY State smoker to shift the purchase of a conforming brand to *out-of-State* non-conforming brands. *(See discussion below.)* Therefore a cutback in overall cigarette manufacturing activity (and jobs) for any one manufacturer nationwide is not expected to result because of the NY State regulation.

Suppliers to Cigarette Production

While there may be little cigarette manufacturing activity in NY State, the question remains whether the regulation produces any direct impacts for NY State firms that manufacture cigarette paper. Of the State's *Paper Manufacturing* firms (*SIC 2621/NAIC 322121 – Paper Mills (except Newsprint)*, only one produces cigarette paper. Schweitzer-Mauduit International, with U.S. headquarters in Alpharetta GA, has a location in Ancram, NY and employs between 100 and 249 people. Cigarette manufacturers point to the fact that there are few firms currently in the business of making cigarette paper. Schweitzer co-developed Philip Morris' *PaperSelect™* low-ignition paper technology used on the *Merit* brand (which Philip Morris has announced it will license to other cigarette manufacturers), and has independently developed the *print-banded papers (PBS)* also exhibiting lower-ignition propensity. Schweitzer's other U.S. facilities are in Spotswood, New Jersey and Lee, Massachusetts. The NJ facility, which makes the low-ignition papers, has attested that it has enough plant capacity to produce either *PaperSelect™* and/or *PBS* papers to supply 100 % of the estimated cigarettes sold in NY State. A possible future development would be for Schweitzer's Ancram plant to also manufacture the low-ignition papers. This decision could possibly increase the number of jobs based in NY State. Since there is no indication of a corporate-decision to this outcome, we have not included this possibility in the analyses developed below.

At the outset of the study there was concern as to whether either of these paper technologies would be commercially viable to produce within the regulation's short implementation window and would be able to meet the standard's self-extinguishing criterion. Given the scarcity of suppliers, it was thought that there might be added costs to produce the conforming paper that would be passed onto the cigarette manufacturers and then onto NY State smokers. Variants of possible price increases are discussed in Chapter 2, and how price increases could affect NY State households are demonstrated below.

However, as the study neared completion, there reportedly were no supply problems. As of mid-October, 2004, it was reported according to the NY Department of Health that 97 % of tobacco companies have met the new standard.[85]

> It's looking fine, said Peter Constantakes, spokesman for the department. All the manufacturers we talked to said they will be complying. We've received (fire safe) certification for over 95 percent of all the brands we sell in this state. And that includes all major brands. (Erin Duggan, Capitol Bureau)

In the longer-term, the regulation may lead to a trend for lower-ignition papers elsewhere in the country that could support additional suppliers/manufacturers of these specialty papers.

85. Erin Duggan, "'Fire-safe' cigarettes move onto state's shelves," Capitol Bureau, June 25, 2004.

However, the REMI modeling does not attempt to examine such a scenario at this time. To do so would require an in-depth assessment of the *Paper Mills* sector domestically and abroad that is beyond the scope of this study.

Warehouse Storage and Distribution

The impact results estimated for warehouse storage and distribution are due to possible changes in NY State households making a greater portion of their cigarette purchases out-of-State for reasons of either product preference or pricing. The study examines how such changes in cigarette purchases are in turn estimated to affect the businesses involved with in-State cigarette sales. But, due to the lack of data, the study does not estimate potential direct costs of compliance imposed by the regulation on the State's warehousing and distribution sector, such as costs of changing over product inventory or carrying dual stocks of product. Compliance might also bring about the need for more jobs in the warehousing and distribution sector (additional labor costs) to accomplish these regulation-created tasks.

Agents, Wholesalers, and Retailers

The impact results estimated for agents, wholesalers, and retailers are those created by the regulation's potential to send more sales out-of-State. Again, because of a lack of data, the study does not estimate potential direct costs to NY-based tobacco agents (who serve multiple states in some instances) of implementing a second inventory management system. Nor does it attempt to assess the regulatory cost to be shouldered by the State's cigarette wholesalers and retailers.

To the extent that any direct regulatory cost, or secondary economic impact, affects the small business sector disproportionately, the REMI results cannot distinguish firm-by-firm sensitivities because it is an industry-level model. Organizations such as the Empire State Distributors & Wholesalers Association, as well as the New York Association of Convenience Stores could provide insight into the extent of small business impacts based on their knowledge of the composition and ownership of its member businesses.

Scenario Two: Second-Order Economic Impacts

Scenario 2 assumes existing tax-driven diversion of purchases, but no price- or preference-driven diversions. From among the first-order benefits of reduced fire losses (averted deaths, injuries, and property losses), we focus in the REMI analysis on impacts estimated to arise from savings to NY State households from fewer out-of-pocket expenses related to the property losses reported in tables 3-11 and 3-12. The out-of-pocket component reflects adjustments for insurance deductibles, under-insured and uninsured households (owners and renters), and estimated unreported losses. Derivation of the out-of-pocket property loss burden is shown in Appendix A.

The impacts are measured for rates of conforming cigarette effectiveness ranging from 30 % to 80 %, in 10 % increments. These savings are redirected by households into other types of consumer purchases, which create economic impacts in terms of jobs, personal income, and NY

Gross State Product (GSP). Table 4-1 demonstrates the impacts associated with out-of-pocket savings to households as a function of varied levels of product effectiveness.

The fire loss benefits are a function not only of the effectiveness of compliant cigarettes, but how pervasive this product becomes among NY State smokers. The results assume a "rate of adoption" among NY State smokers reflective of the background existing tax-driven diversion of cigarettes consumed in the State to out-of-State sources. These assumptions correspond to those for Scenario 2 of Chapter 3.

As the results below demonstrate, the more effective the modified cigarette is at reducing fire-related property losses, the larger the positive second-order economic impact created from households' out-of-pocket savings. It should be reinforced that these savings and their related impacts are only a small reflection of the true fire-reduction benefits, foremost lives saved, injuries avoided, and the full value of property preserved.

Table 4-1 shows year-by-year job gains, additional personal income, and increased business sales from household out-of-pocket savings on property losses avoided.

Table 4-2 summarizes year-by-year impacts in terms of present value dollars (PV $) and average annual jobs gained for the two study intervals, 2004-2009 and 2004-2006.

Table 4-1. Scenario 2 Projected Impacts from Household out-of-Pocket Savings on Property Losses Avoided, 2004 to 2009

Effective-ness level	NY State impact	2004	2005	2006	2007	2008	2009
30 %	Total Jobs Gained	16	13	13	14	11	12
	Personal Income (million 2003 $)	0.659	0.589	0.520	0.624	0.557	0.657
	Business Sales (million 2003$)	1.398	1.398	1.398	1.398	1.398	1.144
	GSP (million 2003 $)	0.763	0.763	0.763	0.763	0.763	0.624
40 %	Total Jobs Gained	21	18	17	19	14	16
	Personal Income (million 2003 $)	0.779	0.824	0.809	0.908	0.725	0.876
	Business Sales (million 2003$)	1.906	1.779	2.033	2.161	1.652	1.652
	GSP (million 2003 $)	1.041	0.971	1.110	1.180	0.902	0.902
50 %	Total Jobs Gained	27	21	21	21	16	19
	Personal Income (million 2003 $)	1.020	0.942	1.041	1.079	0.892	0.985
	Business Sales (million 2003$)	2.415	2.288	2.415	2.415	1.652	1.779
	GSP (million 2003 $)	1.319	1.249	1.319	1.319	0.902	0.971
60 %	Total Jobs Gained	30	23	26	23	21	21
	Personal Income (million 2003 $)	1.139	1.119	1.330	1.249	1.115	1.204
	Business Sales (million 2003$)	2.923	2.669	3.050	2.796	2.415	2.161
	GSP (million 2003 $)	1.596	1.457	1.665	1.527	1.319	1.180
70 %	Total Jobs Gained	35	31	29	28	22	25
	Personal Income (million 2003 $)	1.319	1.413	1.388	1.476	1.282	1.423
	Business Sales (million 2003$)	3.558	3.558	3.177	3.431	2.669	2.796
	GSP (million 2003 $)	1.943	1.943	1.735	1.874	1.457	1.527
80 %	Total Jobs Gained	39	33	32	31	27	26
	Personal Income (million 2003 $)	1.619	1.531	1.619	1.646	1.561	1.532
	Business Sales (million 2003$)	4.066	3.812	3.558	3.685	2.923	3.177
	GSP (million 2003 $)	2.220	2.082	1.943	2.012	1.596	1.735

Table 4-2. Scenario 2 Summarized Impacts from Household out-of-Pocket Savings on Property Losses Avoided, 2004 to 2009 and 2004 to 2006

Effectiveness level	Impact	Interval 2004 to 2006	Interval 2004 to 2006
30 %	Avg. Annual Jobs Gained	13	14
	Personal Income (million PV $)	$3.26	$1.67
	Business Sales (million PV $)	$7.36	$3.95
	GSP (million PV $)	$4.02	$2.16
40 %	Avg. Annual Jobs Gained	17	18
	Personal Income (million PV $)	$4.44	$2.27
	Business Sales (million PV $)	$10.12	$5.39
	GSP (PV $m)	$5.52	$2.94
50 %	Avg. Annual Jobs Gained	21	23
	Personal Income (million PV $)	$5.38	$2.83
	Business Sales (million PV $)	$11.77	$6.71
	GSP (million PV $)	$6.43	$3.66
60 %	Avg. Annual Jobs Gained	24	27
	Personal Income (million PV $)	$6.46	$3.38
	Business Sales (million PV $)	$14.52	$8.15
	GSP (million PV $)	$7.93	$4.45
70 %	Avg. Annual Jobs Gained	29	32
	Personal Income (million PV $)	$7.49	$3.88
	Business Sales (million PV $)	$17.41	$9.72
	GSP (million PV $)	$9.51	$5.31
80 %	Avg. Annual Jobs Gained	32	35
	Personal Income (million PV $)	$8.59	$4.50
	Business Sales (million PV $)	$19.25	$10.80
	GSP (million PV $)	$10.51	$5.90

Note: Present values are shown for a 3 % discount rate.

Table 4-3 shows year-by-year the projected impacts from lower property loss based on an assumed two-year delay in implementation. When property loss is again prevented at the 60 % effectiveness level, the State will experience 24 more jobs in 2006, $1.0 million in additional personal income, and $2.9 million in business sales ($1.6 million of which is *gross state product*). In 2011, economic impacts are 14 more jobs, $0.8 million additional personal income, and $1.7 million of business sales ($0.9 million of which is *gross state product*). These are all positive benefits.

Table 4-3. Scenario 2 Projected Impacts from Household out-of-Pocket Savings on Property Losses Avoided, 2006 to 2011

Effective-ness level	NY State impact	2006	2007	2008	2009	2010	2011
30 %	Avg. Annual Jobs Gained	12	14	9	12	10	7
	Personal Income (m 2003$)	0.463	0.568	0.446	0.547	0.645	0.528
	Business Sales (m 2003$)	1.398	1.398	1.144	0.889	1.398	0.889
	GSP (m 2003$)	0.763	0.763	0.624	0.486	0.763	0.486
40 %	Avg. Annual Jobs Gained	17	18	12	15	11	11
	Personal Income (m 2003$)	0.694	0.851	0.613	0.821	0.752	0.739
	Business Sales (m 2003$)	1.906	2.033	1.525	1.398	1.652	1.398
	GSP (m 2003$)	1.041	1.110	0.833	0.763	0.902	0.763
50 %	Avg. Annual Jobs Gained	21	20	15	16	13	11
	Personal Income (m 2003$)	0.809	0.908	0.725	0.766	0.752	0.739
	Business Sales (m 2003$)	2.288	2.415	1.779	1.525	1.906	1.398
	GSP (m 2003$)	1.249	1.319	0.971	0.833	1.041	0.763
60 %	Avg. Annual Jobs Gained	24	23	20	18	16	14
	Personal Income (m 2003$)	1.041	1.136	0.948	0.985	0.914	0.845
	Business Sales (m 2003$)	2.923	2.923	2.161	1.906	2.033	1.652
	GSP (m 2003$)	1.596	1.596	1.180	1.041	1.110	0.902
70 %	Avg. Annual Jobs Gained	29	30	23	22	20	18
	Personal Income (m 2003$)	1.157	1.363	1.171	1.149	1.289	1.057
	Business Sales (m 2003$)	3.304	3.558	2.669	2.542	2.415	1.906
	GSP (m 2003$)	1.804	1.943	1.457	1.388	1.319	1.041
80 %	Avg. Annual Jobs Gained	35	32	26	24	22	20
	Personal Income (m 2003$)	1.330	1.476	1.393	1.313	1.343	1.321
	Business Sales (m 2003$)	3.939	3.939	3.050	2.923	3.050	2.288
	GSP (m 2003$)	2.151	2.151	1.665	1.596	1.665	1.249

Table 4-4 summarizes year-by-year positive impacts from out-of-pocket savings on property losses avoided. The benefits are given in terms of present value dollars and average annual jobs gained for two study intervals, 2006 to 2011, and 2006 to 2008.

Table 4-4. Scenario 2 Summarized Impacts from Household out-of-Pocket Savings on Property Losses Avoided, 2006 to 2011 and 2006 to 2008

Effectiveness level	IMPACT	Interval 2006 to 2011	Interval 2006 to 2008
30 %	Avg. Annual Jobs Gained	10	11
	Personal Income (million PV $)	$2.88	$1.39
	Business Sales (million PV $)	$6.46	$3.72
	GSP (million PV $)	$3.53	$2.03
40 %	Avg. Annual Jobs Gained	14	15
	Personal Income (million PV $)	$4.03	$2.04
	Business Sales (million PV $)	$9.00	$5.16
	GSP (million PV $)	$4.91	$2.82
50 %	Avg. Annual Jobs Gained	16	18
	Personal Income (million PV $)	$4.25	$2.31
	Business Sales (million PV $)	$10.30	$6.13
	GSP (million PV $)	$5.62	$3.35
60 %	Avg. Annual Jobs Gained	19	22
	Personal Income (million PV $)	$5.32	$2.95
	Business Sales (million PV $)	$12.40	$7.57
	GSP (million PV $)	$6.77	$4.13
70 %	Avg. Annual Jobs Gained	24	28
	Personal Income (million PV $)	$6.50	$3.48
	Business Sales (million PV $)	$14.94	$9.00
	GSP (million PV $)	$8.16	$4.92
80 %	Avg. Annual Jobs Gained	27	31
	Personal Income (million PV $)	$7.39	$3.96
	Business Sales (million PV $)	$17.47	$10.33
	GSP (million PV $)	$9.54	$5.64

Note: Present values are computed with a discount rate of 3 %.

Scenario Three: Second-Order Economic Impacts

Changes in within-State sales can be driven by (a) potential price increases tied to the cigarette manufacturers' cost to produce a modified product for the NY State market, (b) smokers' overall preference response to the modified cigarette, and (c) a combination of both. This section

examines the economic impacts created by a potential price change (assuming no preference-created diversion of sales) because manufacturers incur costs to produce the low-ignition cigarette for the NY State market, and taking into account background existing tax-driven diversion. Price increases of 0.5 % or 1.8 % are examined. Property loss benefits are re-stated and the ensuing economic impacts are presented for the price increase of 1.8 %.

The potential for a price increase by manufacturers who want to continue to sell their brands in NY State and comply with the regulation will add to the existing tax-driven diversion to out-of-State sources. A price increase will also affect the price differential on cigarettes when compared to the national average price, and raise the dollar outlay on the portion of real cigarette consumption that will be purchased in State. This latter aspect is a cost burden.

Scenario Three Sales and GSP Effects

The impact on NY State sales of key sectors involved with making cigarettes available, and the broader *Gross State* Product (GSP) impact come about in the same manner that the current tax differential creates diverted purchases. New diversions of cigarette consumption will create some savings in disposable income. However, if the modified product costs more, then not only are there NY State businesses that will see fewer cigarette dollars, there is also more expenditure for those NY State households that keep their purchases within the taxed channels. For these households there is less disposable income to spend on other things sold by other businesses in the State.

There are direct industry consequences when cigarette purchases are diverted to out-of-State sources. For every $1 of sales diverted outside NY State, the wholesale sector loses $0.26, retail outlets lose $0.20, and the warehousing sector loses $0.03.[86] These shortfalls in activity for each of these sectors means a certain number of jobs will be affected. These are discussed later. These adverse sector effects do not account for the possibility that a cigarette manufacturer will stop selling a brand entirely in NY State as a result of the regulation.

Tables 4-5 and 4-6 show the combined effects of the two potential price increases on projected NY sales and GSP given no delay in implementation and a delay of two years, respectively.

86. As noted in the *final demand* vector for Tobacco Consumption in the Input-Output matrix produced by the U.S. Department of Commerce.

Table 4-5. Scenario 3 Projected Sales and GSP Impacts Related to Modification-induced Price Increases, 2004 to 2009

Price Change	Dollar Impacts (million 2003$)	2004	2005	2006	2007	2008	2009
0.50%	GSP	-24.3	-24	-21.7	-19.6	-18	-16
	as % of baseline	-0.003%	-0.003%	-0.003%	-0.002%	-0.002%	-0.002%
	Warehousing Sales	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2
	as % of baseline	-0.003%	-0.002%	-0.002%	-0.002%	-0.001%	-0.001%
	Retail outlet Sales	-6.1	-6	-5.5	-5	-4.6	-4.2
	as % of baseline	-0.010%	-0.009%	-0.009%	-0.008%	-0.007%	-0.006%
	Wholesale Sales	-6.1	-5.9	-5.5	-5	-4.6	-4.2
	as % of baseline	-0.008%	-0.008%	-0.007%	-0.006%	-0.006%	-0.005%
1.80%	GSP	-97.6	-88.3	-82.6	-76.8	-70.6	-65.8
	as % of baseline	-0.013%	-0.012%	-0.011%	-0.010%	-0.009%	-0.008%
	Warehousing Sales	-1.1	-0.9	-0.9	-0.8	-0.7	-0.7
	as % of baseline	-0.009%	-0.007%	-0.007%	-0.006%	-0.005%	-0.005%
	Retail outlet Sales	-23.5	-21.7	-20.3	-18.9	-17.4	-16.1
	as % of baseline	-0.038%	-0.034%	-0.032%	-0.029%	-0.027%	-0.025%
	Wholesale Sales	-22.8	-21.1	-19.8	-18.4	-17	-15.8
	as % of baseline	-0.032%	-0.028%	-0.026%	-0.023%	-0.021%	-0.019%

Note: The minus signs indicate negative effects.

Table 4-6. Scenario 3 Projected Sales and GSP Impacts Related to Modification-induced Price Increases, 2006 to 2011

Price Change	Dollar Impacts (million 2003$)	2006	2007	2008	2009	2010	2011
0.50%	GSP	-23.2	-20.5	-18.6	-16.5	-16	-15.4
	as % of baseline	-0.003%	-0.003%	-0.002%	-0.002%	-0.002%	-0.002%
	Warehousing Sales	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2
	as % of baseline	-0.003%	-0.002%	-0.002%	-0.002%	-0.001%	-0.001%
	Retail outlet Sales	-5.7	-5.1	-4.7	-4.2	-4	-3.8
	as % of baseline	-0.009%	-0.008%	-0.007%	-0.006%	-0.006%	-0.006%
	Wholesale Sales	-5.6	-5.2	-4.7	-4.3	-4.1	-3.8
	as % of baseline	-0.008%	-0.007%	-0.006%	-0.005%	-0.005%	-0.005%
1.80%	GSP	-87.6	-79.5	-73.1	-67.2	-62.1	-56.5
	as % of baseline	-0.012%	-0.011%	-0.009%	-0.008%	-0.008%	-0.007%
	Warehousing Sales	-1	-0.9	-0.8	-0.7	-0.6	-0.6
	as % of baseline	-0.009%	-0.007%	-0.006%	-0.005%	-0.004%	-0.004%
	Retail outlet Sales	-20.9	-19.2	-17.7	-16.3	-15	-13.8
	as % of baseline	-0.033%	-0.030%	-0.028%	-0.025%	-0.023%	-0.021%
	Wholesale Sales	-20.5	-18.9	-17.5	-16.2	-15	-13.7
	as % of baseline	-0.028%	-0.025%	-0.023%	-0.020%	-0.018%	-0.016%

Scenario Three Employment Effects

We focus on the impacts concentrated on those NY State industries most tied to a dollar of cigarette sales (omitting the cigarette manufacturing industry), and how a price increase will affect them. Tables 4-7 and 4-8 show the projected employment impacts from the two possible price increases examined for implementation in 2004 and 2006, respectively. The effect of the later implementation is to reduce the size of the effect because of the underlying declines in the projections of annual cigarettes consumed in NY State that reduces the diversion effect.

In this context, the sum of the jobs losses over *warehousing, retail outlets,* and *wholesaling activities* in the State does not account for the full extent of job losses in the State. The reason for this is that almost 68 % of real cigarette consumption is purchased in NY State at a now higher price. This cost burden reduces broad household spending and eliminates additional jobs.

From among the three sectors most involved in cigarette delivery to the consumer (excluding the manufacture of the product) the employment impact is greatest in *Retail* despite the slightly larger role played by the *wholesaling* sector. This can be explained as the following: even though the sales impacts are comparable for *retail* and *wholesale* as shown in Tables 4-5 and 4-6 above, labor productivity within these sectors are different. There is a greater *output-per-worker* in the *wholesale* sector than in the *retail* sector. Another reason for *retail* to exhibit larger employment losses has to do with the added expense of continuing to purchase cigarettes in NY State under a higher price, and that affects a broader portion of the consumer basket, much of it provided through retail channels.

Table 4-7. Scenario 3 Projected Employment Impacts Related to Modification-induced Price Increases, 2004 to 2009

Price Change	Employment Impacts	2004	2005	2006	2007	2008	2009
0.50%	Total Avg. Annual Jobs	-384	-372	-329	-289	-258	-223
	as % of baseline	-0.004%	-0.004%	-0.004%	-0.003%	-0.003%	-0.002%
	Warehousing	-2	-2	-2	-1	-1	-1
	Retail outlets	-100	-96	-86	-77	-69	-61
	Wholesale	-38	-35	-31	-28	-25	-22
1.80%	Total Jobs	-1,557	-1,374	-1,249	-1,134	-1,018	-927
	as % of baseline	-0.018%	-0.016%	-0.014%	-0.013%	-0.011%	-0.010%
	Warehousing	-8	-7	-7	-6	-5	-4
	Retail outlets	-386	-347	-317	-288	-260	-237
	Wholesale	-140	-126	-113	-101	-91	-81

Table 4-8. Scenario 3 Projected Employment Impacts Related to Modification-induced Price Increases, 2006 to 2011

Price Change	Employment Impacts	2006	2007	2008	2009	2010	2011
0.50%	Total Avg. Annual Jobs	-350	-301	-266	-230	-217	-203
	as % of baseline	-0.004%	-0.003%	-0.003%	-0.003%	-0.002%	-0.002%
	Warehousing	-2	-2	-1	-1	-1	-1
	Retail outlets	-89	-78	-70	-62	-58	-53
	Wholesale	-33	-29	-25	-22	-20	-18
1.80%	Total Avg. Annual Jobs	-1,325	-1,175	-1,050	-944	-855	-761
	as % of baseline	-0.015%	-0.013%	-0.012%	-0.011%	-0.010%	-0.008%
	Warehousing	-7	-6	-5	-5	-4	-4
	Retail outlets	-328	-295	-266	-240	-217	-193
	Wholesale	-118	-105	-93	-83	-74	-66

Scenario Three Impacts on Personal Income

Once again there are implications for State-wide personal income as jobs are lost due to greater diversion of cigarette purchases caused by a price increase; some employment shifts in-State as the content in the consumer basket of NY State households changes; and households bear an added cost to buy cigarettes in-State. Tables 4-9 and 4-10 show the projected income effects of the two potential price changes alternatively assuming implementation in 2004 and in 2006.

Table 4-9. Scenario 3 Projected Personal Income Effects Related to Modification-induced Price Increase, 2004 to 2009, Million 2003 $

Price Change	2004	2005	2006	2007	2008	2009
0.50%	-15.4	-16.4	-15.9	-14.9	-14.1	-13
as % of baseline	-0.002%	-0.002%	-0.002%	-0.002%	-0.002%	-0.002%
1.80%	-62.6	-61.3	-60.5	-58.6	-55.8	-53.3
as % of baseline	-0.009%	-0.008%	-0.008%	-0.008%	-0.007%	-0.007%

Table 4-10. Scenario 3 Projected Income Effects Related to Modification-induced Price Increase, 2006 to 2008, Million 2003 $

Price Change	2006	2007	2008	2009	2010	2011
0.50%	-14.5	-13.8	-13.3	-12.3	-12.1	-11.9
as % of baseline	-0.002%	-0.002%	-0.002%	-0.002%	-0.001%	-0.001%
1.80%	-55	-54.2	-52.7	-50.6	-48.2	-45.4
as % of baseline	-0.007%	-0.007%	-0.007%	-0.006%	-0.006%	-0.005%

Scenario Three Impact on Out-of-Pocket Property Loss Benefits

A price increase in response to the standard will drive NY State smokers to divert purchases out-of-State and these will be purchases of non-compliant cigarettes. This added deviation affects the projected number of deaths, injuries, and property losses averted. The more the standard is circumvented by increased purchases of out-of-State non-compliant cigarettes, the smaller the benefits arising from fires averted. Tables 4-11 and 4-12 show the projected second-order economic impacts of out-of-pocket property losses for the default (60 %) product effectiveness level, for a price increase of 1.8 %, and for implementation in 2004 and 2006, respectively.

Table 4-11. Scenario 3 Projected Impacts Related to out-of-pocket Property Losses Averted with 60 % Product Effectiveness and a Modification-induced Price Increase, 2004 to 2009

Price Increase	Resulting Impacts	2004	2005	2006	2007	2008	2009
1.8 %	Total Avg. Annual Jobs	29	25	26	23	20	20
	Personal Income (million 2003 $)	1.0	1.0	1.0	1.0	1.0	1.0
	Business Sales (million 2003 $)	3.0	3.0	3.0	3.0	2.0	2.0
	GSP (million 2003 $)	2.0	2.0	2.0	2.0	1.0	1.0

Table 4-12. Scenario 3 Projected Impacts Related to out-of-pocket Property Losses Avoided with 60 % Product Effectiveness and a Modification-induced Price Increase, 2006 to 2011

Price Increase	Resulting Impacts	2006	2007	2008	2009	2010	2011
1.8 %	Total Avg. Annual Jobs	24	23	20	19	14	14
	Personal Income (million 2003 $)	1.0	1.1	0.9	1.0	1.0	0.8
	Business Sales (million 2003 $)	2.9	2.9	2.2	2.0	2.0	1.5
	GSP (million 2003 $)	1.6	1.6	1.2	1.1	1.1	0.8

Scenario Three Impact on Cigarette Excise Tax Revenues

Table 4-13 shows changes in cigarette excise tax collections based on a possible price increase changing in-State purchases. The average excise tax per pack of $1.50 is held constant.

Over the four alternative study periods, the estimated present-value losses in excise tax revenue are as follows: For a six-year study period starting in 2004, $6.0 million; for a six-year study period starting in 2006, $5.1 million; for a three-year study period starting in 2004, $3.3 million; and for a three-year study period starting in 2006, $2.9 million.

Table 4-13. Scenario 3 Projected Losses in Cigarette Excise Tax Revenue, 2004 to 2011

Year	Price Changes (millions of dollars)	
	+0.5 %	+1.8 %
2004	$0.4	$1.2
2005	$0.3	$1.2
2006	$0.3	$1.1
2007	$0.3	$1.1
2008	$0.3	$1.0
2009	$0.3	$1.0
2010	$0.3	$0.9
2011	$0.2	$0.8

Scenario Four: Second-Order Economic Impacts

Now we examine a possible preference-driven sales diversion response from NY State smokers of 10 % of the annual projection of cigarettes purchased through taxed channels. This assessment holds the NY State average price and the national average cigarette price constant (hence the price differential remains constant).

Recall the direct industry consequences when cigarette purchases are diverted to out-of-State sources. For every $1 of sales diverted outside NY State, the wholesale sector loses $0.26, retail outlets lose $0.20, and the warehousing sector loses $0.03.[87] These shortfalls in activity for each of these sectors means a certain number of jobs will be affected. These adverse sector effects do not account for the possibility that a cigarette manufacturer will stop selling a brand entirely in NY State as a result of the regulation.

Scenario Four Sales and GSP Impacts

The sales impact for each of the three critical sectors linked to cigarette purchases are discussed next, along with the impact on *Gross State Product (GSP).*[88] It is the sales impact on an industry that determines the job impacts; these are discussed subsequently. The extent that each industry is involved in a dollar of cigarette purchases determines the magnitude of sales and job impacts. The re-spending of NY State household savings from out-of-State cigarette purchases partially replaces the lost business activity in NY State with some other type of purchase in-State. In the tables that follow we see regardless of the level of extra diversion to out-of-State sources, that

87. As noted in the *final demand* vector for Tobacco Consumption in the Input-Output matrix produced by the U.S. Department of Commerce.

88. The concept of *gross state product* measures the portion of a dollar of sales that reflects the addition of NY State labor and capital to enhance (*or add value, hence value-added*) intermediate goods on the way to making a finished product. *Valued-added* is a sub-set of *sales*.

wholesalers forfeit the most sales, followed by *retail outlets*, and then *warehousing*.

The projected sales and GSP impacts shown in Tables 4-14 and 4-15 estimate how the State's value added changes as the economy adjusts to both a dislocation of cigarette purchases and added household savings. Again, the impacts are slightly less severe when the policy implementation is pushed forward two years, reflecting the underlying, downward trending of NY State projections of annual cigarettes consumed.

Table 4-14. Scenario 4 Projected Sales and GSP Impacts From 10 % Preference-driven Sales Diversion, 2004 to 2009

% of Consumption that will be Diverted	Dollar Impacts (m 2003$)	2004	2005	2006	2007	2008	2009
10 %	GSP	-237.8	-225.3	-206	-185.4	-164.5	-142.7
	As % of Baseline	-0.032	-0.030	-0.027	-0.023	-0.020	-0.017
	Warehousing Sales	-2.5	-2.3	-2.1	-1.9	-1.7	-1.5
	As % of Baseline	-0.022	-0.019	-0.017	-0.015	-0.013	-0.011
	Retail Outlet Sales	-139.3	-132.9	-125.7	-118.1	-110.9	-103.2
	As Percent of Baseline	-0.223	-0.210	-0.196	-0.182	-0.170	-0.158
	Wholesale Sales	-198.5	-188.8	-178.6	-167.5	-157.1	-145.9
	As % of Baseline	-0.275	-0.254	-0.233	-0.212	-0.193	-0.175

Table 4-15. Scenario 4 Projected Sales and GSP Impacts From 10 % Preference-driven Sales Diversion, 2006 to 2011

% of Consumption that will be Diverted	Dollar Impacts (m 2003$)	2006	2007	2008	2009	2010	2011
10 %	GSP	-218.4	-206.4	-187.5	-166.5	-146.0	-125.1
	As % of Baseline	-0.028	-0.026	-0.023	-0.020	-0.017	-0.014
	Warehousing Sales	-2.3	-2.1	-1.9	-1.7	-1.5	-1.3
	As % of Baseline	-0.018	-0.016	-0.014	-0.012	-0.011	-0.009
	Retail Outlet Sales	-126.8	-120.0	-113.0	-105.4	-98.3	-90.3
	As Percent of Baseline	-0.198	-0.185	-0.173	-0.162	-0.151	-0.136
	Wholesale Sales	-180.0	-169.6	-159.5	-148.4	-138.0	-127.1
	As % of Baseline	-0.235	-0.214	-0.196	-0.178	-0.161	-0.145

Scenario Four Employment Effects

In addition to the effect of a dollar diverted to an out-of-State purchase because of a preference for a non-conforming cigarette, there is a price differential associated with the diversion that results in extra disposable income for NY State smoking households. This extra income has to be considered in the analysis of increasing diversion of cigarette purchases. Table 4-16 shows both the employment impacts from a 10 % preference-driven diversion of sales out-of-State and the associated household savings from the price differential.

Table 4-16. Scenario 4 Projected Employment Impacts from a 10 % Preference-driven Sales Diversion, 2004 to 2009

% of Consumption that will be Diverted	Employment Impacts	2004	2005	2006	2007	2008	2009
10 %	Total Avg. Annual Jobs	-3,120	-2,856	-2,503	-2,161	-1,832	-1.514
	As % of Baseline	-0.036	-0.032	-0.028	-0.024	-0.020	-0.017
	Warehousing	-20	-18	-16	-13	-11	-9
	Retail Outlet Sales	-2,284	-2,128	-1,988	-1,809	-1,663	-1,518
	Wholesale Sales	-1,219	-1,126	-1,025	-927	-840	-754

If an additional 10 % of NY State annual cigarette consumption were to be met from out-of-State purchases, there will be 3,120 fewer jobs in the State in 2004 compared to the pre-regulation setting, and 1,514 fewer jobs in 2009. Yet when we examine the sector-specific results for just 2004, we see that these three sectors alone experience job losses of 3,523 across the State. That some of the negative job impacts in the three key sectors are off-set with job creation elsewhere in State's economy is attributable to the extra income NY State smoking households realize (which gets re-spent) through out-of-State purchases of cheaper cigarettes. While the wholesale sector loses the largest share of a dollar when cigarette purchases go out-of-State, in employment terms it is the *rest of retail* sector that forfeits the greatest number of jobs due to the more labor-intensive nature of retail compared to wholesale activities.

Results are shown in Tables 4-17 for the alternate policy periods starting in 2006. The underlying cause for the fewer job losses associated with delaying implementation is that the projection of cigarettes consumed in the State is declining which reduces the diversion effect over time.

Table 4-17. Scenario 4 Projected Employment Impacts from 10 % Preference-driven Sales Diversion, 2006 to 2011

% of Consumption that will be Diverted	Employment Impacts	2006	2007	2008	2009	2010	2011
10 %	Total Avg. Annual Jobs	-2,710	-2,472	-2,159	-1,842	-1,542	-1.237
	As % of Baseline	-0.031	-0.028	-0.024	-0.021	-0.017	-0.014
	Warehousing	-17	-15	-13	-11	-9	-8
	Retail Outlet Sales	-1,93	-1,847	-1,702	-1,557	-1,421	-1,262
	Wholesale Sales	-1,035	-942	-854	-768	-690	-613

Scenario Four Impacts on Personal Income

There are implications for State-wide personal income as jobs are lost due to greater diversion of cigarette purchases and some employment shifts in-State as the content of the consumer baskets of NY State households changes. As was observed for the previous cases, and as may be seen by comparing the results of tables 4-18 and 4-19 the impacts are slightly less severe when the policy implementation occurs in 2006 instead of 2004, due to the underlying, downward trending of projected annual cigarettes consumed.

Table 4-18. Scenario 4 Projected Personal Income Impacts from 10 % Preference-driven Sales Diversions, 2004 to 2009, Millions 2003 $

% of Consumption that will be Diverted	2004	2005	2006	2007	2008	2009
10 %	-104.2	-102.1	-93.5	-82.9	-71.0	-58.1
As % of baseline	-0.014	-0.014	-0.012	-0.011	-0.009	-0.007

Table 4-19. Scenario 4 Projected Income Effects from 10 % Preference-driven Sales Diversions, 2006 to 2011, Millions 2003 $

% of Consumption that will be Diverted	2006	2007	2008	2009	2010	2011
10 %	-92.8	-90.9	-83.1	-72.8	-61.5	-49.4
As % of baseline	-0.012	-0.012	-0.010	-0.009	-0.007	-0.006

Scenario Four Impact on Out-of-Pocket Property Loss Benefits

Economic impact results of lower out-of-pocket property losses are shown in tables 4-20 and 4-21 under each of the potential preference-driven diversion responses.

Table 4-20. Scenario 4 Projected Impacts Related to Out-of-pocket Property Losses Avoided with 60 % Product Effectiveness, 2004 to 2009

% of Consumption that will be diverted	Resulting Impacts	2004	2005	2006	2007	2008	2009
10 %	Total Avg. Annual Jobs	27	21	22	21	16	17
	Personal Income (m 2003$)	1.1	1.0	1.0	1.0	0.9	1.0
	Business Sales (m 2003$)	2.8	2.4	2.4	2.4	1.8	1.6
	GSP (m 2003$)	1.5	1.3	1.3	1.3	1.0	0.9

Table 4-21. Scenario 4 Projected Impacts Related to Out-of-pocket Property Losses Avoided With 60 % Product Effectiveness, 2006 to 2011

% of Consumption that will be diverted	Resulting Impacts	2006	2007	2008	2009	2010	2011
10 %	Total Avg. Annual Jobs	22	20	15	16	13	11
	Personal Income (m 2003$)	0.9	1.0	0.8	0.8	0.8	0.7
	Business Sales (m 2003$)	2.4	2.4	1.6	1.5	1.6	1.5
	GSP (m 2003$)	1.3	1.3	0.9	0.8	0.9	0.8

Scenario Four Impact on Cigarette Excise Tax Revenue

Changes in cigarette excise tax collections based on a possible preference factor changing in-State purchases are shown in table 4-22. An average excise tax per pack of $1.50 is assumed.

In present value terms, the stream of projected losses in excise tax revenues associated with the 10 % diversion over the six-year study period with implementation in 2004, amount to total losses of $75.9 million. For the three-year study period with implementation in 2004, present value losses of excise tax revenue total $44.8 million.

Table 4-22. Scenario 4 Projected Losses in Cigarette Excise Tax Revenue, 2004 to 2011 (Millions Of Dollars)

	No Price Change
Year	**+10 % Preference-driven Diversion to Out-of-State Purchases**
2004	$17.9
2005	$17.0
2006	$16.2
2007	$15.3
2008	$14.5
2009	$13.6
2010	$12.8
2011	$11.9

Scenario Five: Second-Order Economic Impacts

This section covers the economic impacts that are projected to result from diversions due to a combination of a preference-driven diversion of 10 % and a price-driven diversion of 0.7 %. For simplicity in conducting the REMI analysis, price- and preference-rate diversion rates are added, and the interaction between them is not taken into account. If the rates were to be taken in sequence--reflecting that purchases can only be diverted once-- instead of added, the resulting diversion impacts would be only slightly less. A 0.7 % price and a 10 % preference diversion rate would result in less than 0.00078 % difference if added versus taken in sequence.

Scenario Five Sales and GSP Effects

Business sales impacts in NY State under the combined preference-price factors, will foremost affect the three critical sectors involved in cigarette sales in the State. However, the cost burden of a price increase applied to the portion of real consumption that is transacted in-State will play out against the savings reaped on the new purchases going out-of-State. The interplay of these effects affects how general household spending is allocated among NY State businesses. Tables 4-23 and 4-24 show the projected sales and GSP impacts from the combined factors, with implementation alternatively in 2004 and 2006.

Table 4-23. Scenario 5 Projected Sales and GSP Impacts Related to Combined Preference and Price Changes, 2004 to 2009

% of Consumption that will be diverted	Dollar Impacts (m 2003$)	2004	2005	2006	2007	2008	2009
10.7%	GSP	-330.7	-309.6	-285.5	-258.6	-230.9	-205.3
	as % of baseline	-0.045%	-0.041%	-0.037%	-0.033%	-0.028%	-0.025%
	Warehousing Sales	-3.5	-3.2	-3	-2.7	-2.4	-2.1
	as % of baseline	-0.030%	-0.027%	-0.024%	-0.021%	-0.018%	-0.015%
	Retail outlets Sales	-163.9	-155.7	-147.3	-138.1	-129.3	-120.4
	as % of baseline	-0.262%	-0.246%	-0.230%	-0.213%	-0.198%	-0.185%
	Wholesale Sales	-224.2	-212.7	-201.1	-188.4	-176.4	-163.9
	as % of baseline	-0.311%	-0.286%	-0.262%	-0.238%	-0.217%	-0.196%

Table 4-24. Scenario 5 Projected Sales and GSP Impacts Related to Combined Preference and Price Changes, 2006 to 2011

% of Consumption that will be diverted	Dollar Impacts (m 2003$)	2006	2007	2008	2009	2010	2011
10.7%	GSP	-302.5	-282.7	-256.9	-230.9	-206.4	-177.8
	as % of baseline	-0.039%	-0.036%	-0.031%	-0.028%	-0.024%	-0.020%
	Warehousing Sales	-3.2	-2.9	-2.7	-2.4	-2.1	-1.8
	as % of baseline	-0.026%	-0.022%	-0.020%	-0.017%	-0.015%	-0.012%
	Retail outlets Sales	-148.8	-140.4	-131.8	-122.8	-114.5	-104.9
	as % of baseline	-0.232%	-0.217%	-0.202%	-0.188%	-0.176%	-0.158%
	Wholesale Sales	-203	-191.1	-179.4	-166.9	-155.3	-142.7
	as % of baseline	-0.264%	-0.241%	-0.220%	-0.200%	-0.182%	-0.163%

Scenario Five Employment Effects

The results in tables 4-25 and 4-26 below reveal that if NY State smokers have an adverse preference for the modified cigarette and if there is a price increase in NY State, more jobs are lost than in the previous cases considered, and the losses are pronounced in *retail* and *wholesale* sectors.

Table 4-25. Scenario 5 Projected Employment Impacts from Combined Preference and Price Changes, 2004 to 2009

% of Consumption that will be Diverted	Employment Impacts	2004	2005	2006	2007	2008	2009
10.7 %	Total avg. annual jobs	-4,590	-4,150	-3,689	-3,228	-2,777	-2,386
	as % or baseline	-0.052	-0.047	-0.042	-0.036	-0.031	-0.027
	Warehousing	-28	-25	-22	-19	-16	-13
	Retail outlets	-2,689	-2,493	-2,304	-2,114	-1,939	-1,770
	Wholesale	-1.376	-1,268	-1,154	-1,043	-943	-847

Table 4-26. Scenario 5 Projected Employment Impacts from Combined Preference and Price Changes, 2006 to 2011

% of Consumption that will be Diverted	Employment Impacts	2006	2007	2008	2009	2010	2011
10.7 %	Total avg. annual jobs	-3,966	-3,585	-3,143	-2,737	-2,350	-1,936
	as % or baseline	-0.045	-0.040	-0.035	-0.031	-0.026	-0.022
	Warehousing	-24	-21	-19	-16	-14	-11
	Retail outlets	-2,340	-2,160	-1,984	-1,813	-1,655	-1,466
	Wholesale	-1.168	-1,061	-961	-864	-776	-688

Scenario Five Impacts on Personal Income

There are implications for State-wide personal income as jobs are lost due to greater diversion of cigarette purchases caused by the combination of preference and price factors. Some employment shifts in-State as the content in the consumer basket of NY State households changes; and households bear an added cost to buy cigarettes in-State. Tables 4-27 and 4-28 show projected effects on personal income of a combined modification-induced adverse preference reaction and price increase.

Table 4-27. Scenario 5 Projected Personal Income Impacts Related to Combined Preference and Price Changes, 2004 to 2009, Million 2003 $

% of Consumption that will be Diverted	2004	2005	2006	2007	2008	2009
10.7 %	-162.8	-159.2	-150.2	-137.3	-121.9	-107.0
as % of baseline	-0.022	-0.021	-0.020	-0.018	-0.015	-0.013

Table 4-28. Scenario 5 Projected Personal Income Impacts Related to Combined Preference and Price Changes, 2006 to 2011, Million 2003 $

% of Consumption that will be Diverted	2006	2007	2008	2009	2010	2011
10.7 %	-144.4	-141.6	-131.8	-120.0	-106.9	-90.6
as % of baseline	-0.019	-0.018	-0.017	-0.015	-0.013	-0.011

Scenario Five Impact on Cigarette Excise Tax Revenue

Table 4-29 shows changes in cigarette excise tax collections based on a combined effect of a 10 % preference response with the 0.7 % price-driven diversion. The average excise tax per pack of $1.50 was held constant.

Table 4-29. Scenario 5 Projected Losses in Cigarette Excise Tax Revenue, 2004 to 2011 (Millions of Dollars)

YEAR	Price-driven diversion of 0.7 % and Preference-driven diversion of 10 %
2004	$19.1
2005	$18.2
2006	$17.3
2007	$16.4
2008	$15.5
2009	$14.5
2010	$13.6
2011	$12.7

When the price- and preference-driven diversions are combined, the resulting losses in excise tax revenue in present value dollars over the alternative study periods are as follows: For a six-year study period and implementation in 2004, $81.1 million; For a three-year study period and implementation in 2006, $47.9 million.

From a tax revenue standpoint, the extent to which NY State households re-spend savings--created by diverting purchases to lower priced, out-of-State cigarettes--on in-State *taxable* purchases, there will be some mitigation of the shortfall in cigarette excise tax collections shown here. This analysis, however, does not estimate the potential for added sales tax revenue.[89]

89. The average rate of NY State taxation per $1cigarette consumption is 36 %, compared to a rate per $1 non-tobacco taxable consumption in NY State of 4.25 %.

Summary and Conclusions: Impacts of the NY State Cigarette Fire Safety Standard on Human Costs and the State's Economy

The Standard and the Study

In 2000, New York State became the first state in the nation to set a cigarette-ignition performance standard. Entitled "Fire Safety Standards for Cigarettes," the standard is intended to reduce the risk that cigarettes will ignite upholstered furniture, mattresses, and other household furnishings and cause fatalities, injuries, and property damage. Under the standard, only cigarettes that meet the standards can be legally sold throughout the State after a period of 180 days following adoption of the Rule implementing the legislation.

This study was commissioned by the National Institute of Standards and Technology, with sponsorship by the NY State Office of Fire Prevention and Control, in support of the cigarette "fire safety" legislation. The charge of the study was to develop first-order impacts of the new cigarette fire safety standard in terms of numbers of deaths, injuries, and direct dollars of fire property damage. It was also to develop second-order economic impacts in terms of reduced out-of-pocket insurance costs, impacts on in-State businesses, changes in State-wide income, jobs, and Gross State Product (GSP), and changes in State excise tax revenue. The Study's focus was to be on effects within the State.

The study assumes that any price-driven or preference-driven diversion of purchases away from conforming cigarettes will be fully offset by purchases of non-conforming cigarettes. Diversions of purchases are assumed to occur through mail order, telephone, and Internet orders, from Indian reservations, or through illegal channels.

Scenarios Analyzed

The study provides quantitative estimates of impacts for five scenarios selected to highlight the effect of variables of particular interest from a policy standpoint. Table 5-1 summarizes in a matrix the scenarios and distinguishes them by their key assumptions.

The first scenario defines the playing field by estimating the upper limit of prospective benefits. The second scenario may be considered the base case. It takes into account the existing tax-driven diversion of cigarettes, and assumes that manufacturers successfully provide conforming cigarettes that smokers accept and do not raise the price over that of non-conforming cigarettes. The third, fourth, and fifth scenarios provide progressively pessimistic outlooks, reflective of price increases for conforming cigarettes, adverse preference reactions of smokers to conforming cigarettes, and a combination of both adverse price and preference changes.

The study provides extensive sensitivity testing of results to alternative data and assumption. Changes in results are demonstrated in response to changes in the assumed effectiveness level of conforming cigarettes in reducing fires (30 % to 80 % and 100 %), in the percentage of existing

tax-driven diversion of purchases (0 %, 32 %), in the percentage price change (0 %, 1.8 %), in the preference change (0 %, -10 %), in the discount rate used to compute present value monetary values (3 %, 7 %), in the timing of the standards implementation (2004 or 2006), in the timing of the adoption of a national standard (after 6 years or after 3 years).

Table 5-1. Matrix of scenarios

Scenario	Assumed Effectiveness of Modified Cigarettes	No Diversion	Tax-driven Diversion = 32 %		
			Tax-driven Diversion Only	+ Modification-induced, Price-increase-driven Diversion	+ Modification-induced, Preference-driven Diversion
				0.7 %	10 %
1	100 %	X			
2	30 % to 80 %*		X		
3	60 %			X	
4	60 %				X
5	60 %			X	X

* Scenario 2 includes sensitivity analysis for effectiveness values of modified cigarettes ranging from 30 % to 80 %, in 10 % steps. Monetary values for all scenarios are computed with both a 3 % and a 7 % discount rate. All scenarios are assessed for four study period periods.

Assessment Approach

A benefit-cost framework was used for the impact assessment. Two principal analysis tools were used to estimate the benefits and costs of the new cigarette fire safety standard. Development of baseline projections and estimation of first-order impacts were facilitated by use of the EXCEL spreadsheet. Estimation of second-order economic impacts was performed using the REMI forecasting model for NY State.

A set of projected baselines was developed for the impact assessment. For estimating cigarette fires and associated losses, three baselines were projected: (1) a projection of annual cigarette consumption in NY State from the present through 2011, (2) a projection of annual taxed cigarette purchases in NY State from the present through 2011, and (3) projections of annual fires and fire losses per unit quantity of cigarettes consumed in NY State from the present through 2011. Annual cigarette consumption in the State was estimated because it is the within-State consumption that drives cigarette fires in the State. Annual taxed cigarette purchases in the State were estimated because the standard is expected to affect cigarettes purchased through channels that are subject to State regulation and oversight. The substantial quantity of cigarettes consumed within the State that are purchased outside-regulated channels weakens the ability of the standard to affect the cigarette-caused fire problem. Developing separate baselines for in-State cigarette consumption, taxed cigarette purchases, and fire losses per quantity of cigarettes consumed facilitated the impact predictions.

There are many uncertainties surrounding the projections, although some of these reduced or eliminated as the study neared its conclusion. At the beginning of the study, it was uncertain when the standard would be implemented and the timing was subjected to sensitivity testing. Now it is known that implementation occurred in mid-2004. At the beginning of the study, it was uncertain if manufacturers would supply conforming cigarettes across all the major brands. Now it is known that supply does not appear to be a problem, with cigarette brands comprising 95 % of the national market share reportedly certified as compliant. At the beginning of the study, it was uncertain how pricing would be affected by the modifications to make cigarette conforming to the standard. Thus far, it appears that manufacturers are supplying conforming cigarettes at essentially the same price as non-conforming cigarettes. These developments are favorable to the success of the standard.

Critical factors about which uncertainty remains include the effectiveness of conforming cigarettes in reducing cigarettes fires; smoker acceptance of conforming cigarettes; future pricing policy; the number of years before a similar standard is adopted nationwide; and the rate at which future smoking rates will change. In addition, there is uncertainty about what the trend in the future incidence of fires and related losses would have been without the standard, i.e., there uncertainty about the accuracy of the underlying baselines used to estimates effects of the standard. Alternative scenarios have been modeled and sensitivity testing has been conducted to help take into account the uncertainty.

Estimated Impacts under Alternative Scenarios

Chapters 3 and 4 presented detailed projections of multiple major first- and second-order impacts of the fire safety standard under alternative scenarios of particular interest to the commissioners of the study. The challenge of this summary section is to draw on those results to portray the overall potential impact of the standard.

Sections 5.3.1 through 5.3.5, which follow discuss the impacts shown in table 5-2. The table summarizes impacts based on five scenarios, immediate implementation of the standard, and a six-year elapse period before a national standard is adopted. Thus the discussion of results first centers on the study period, 2004 to 2009. The first part of the table shows first-order impacts—fire losses avoided; and the second part shows second-order economic impacts.

Scenario One Impacts

Results for the first scenario are summarized in column 4 of table 5-2. These are upper limit estimates of potential benefits from completely solving the cigarette fire problem in NY residences. At the upper limit, there are an estimated 4,616 cigarette fires to be avoided, 182 deaths to be averted, 1,457 injuries to be prevented, and $78 million in present value property damage to be avoided. These are the estimated benefits in the unlikely event that all cigarettes consumed in NY State conform to the standard and, in the unlikely event that conforming cigarettes are 100 % effective in preventing fires. The lower part of column 3 shows that large positive second-order economic impacts for this scenario, due in part to the assumed higher performance of conforming cigarettes and in part to attributing the assumed elimination of the 32

% tax-driven diversion to the standard. Though an unrealistic scenario, it is useful in assessing the potential. The more effective the conforming cigarettes in reducing fire loss and the greater extent to which cigarettes consumed in the State are conforming, the closer to achieving this upper limit the standard will approach.

Scenario Two (Base-Case) Impacts

Of the scenarios considered, the scenario results summarized in column 3 of table 5-2 represent what is considered the base case. These are the estimated results if manufacturers successfully supply a conforming cigarette that smokers broadly accept, and without any significant change in price. Only the existing background tax-driven diversion of cigarettes away from conforming cigarettes is reflected. With this scenario, fires avoided are estimated at 1,883, deaths averted at 74, injuries prevented at 595, and property losses avoided at $32 million in present value.[90] In the lower part of column 4, the associated REMI results show small second-order economic benefits from out-of-pocket reductions of property losses attributable to the standard.

Scenario Three Impacts

Results for the third scenario are summarized in column 5 of table 5-2. This scenario is based on the higher of the two estimated possible price increases, and reflects the existing background tax-driven diversion. Because even the higher of the estimated price increases is relatively small, the effects of the price-driven diversion are relatively small—little different from those of the base-case scenario.

Results show 1,870 cigarette fires avoided, 74 deaths averted, 590 injuries prevented, and $32 million (present value) of property losses avoided. Results of the REMI analysis show second-order economic costs for this scenario due to the price-driven diversion of cigarettes. GSP is reduced by $388.5 million, part of which is accounted for by a decrease in warehousing sales of $4.1 million, decreased retail outlet sales of $95.0 million, and decreased wholesale sales of $92.6 million – all in present value. Personal income is negatively affected on the order of $281.4 million (present value). Excise tax revenues drop by an estimated $5.3 million (present value). Employment is adversely affected as jobs drop, particularly in retail outlets. Benefits from reduced out-of-pocket fire losses offset costs to a small extent. If manufacturers raise prices of conforming cigarettes appreciably, significant price-driven diversion of cigarettes away from conforming channels would be predicted. As a consequence, negative second-order economic impacts would rise.

90. Not adjusted for double counted resulting from including the out-of-pocket estimates in both the first-order property losses and in the second-order State-wide economic impacts.

Table 5-2. Summary of Impacts for Five Scenarios, 7 % Discount Rate, 2004 to 2009

Impacts	Type of Effect	*Base-Case* Scenario	Sensitivity Tests			
			Scenario	Scenario	Scenario	Scenario
		2	1	3	4	5
		60% effectiveness level	100% effectiveness level	60% effectiveness level		
		No Standard-Driven Diversion; Background Diversion	No Standard-Driven Diversion; No Background Diversion	Price-diversion of 0.7%; Background Diversion	Preference-diversion of 10%; Background Diversion	Preference diversion of 10%; Price-Diversion of 0.7%;
[1]	[2]	[3]	[4]	[5]	[6]	[7]
First-order Impacts - Fire Losses Avoided	Fires Avoided	1,883	4,616	1,870	1,695	1,683
	Deaths Avoided	74	182	74	67	66
	Injuries Avoided	595	1,457	590	535	531
	Property Losses Avoided (mill PV$)	$32	$78	$32	$29	$28
Second-order Economic Impacts	**Sales & GSP Effects** (mill PV$)					
	Impact on GSP	$0.0	$3,444.5	-$388.5	-$941.0	-$1,311.3
	Warehousing Sales	$0.0	$35.6	-$4.1	-$9.7	$13.7
	Retail Outlet Sales	$0.0	$2,015.5	-$95.0	-$586.8	-$687.2
	Wholesale Sales	$0.0	$2,824.2	-$92.6	-$833.2	-$938.2
	Personal Income Effects (mill PV $)	$0.0	$1,619.8	-$281.4	-$415.5	-$676.8
	Out-of-Pocket Loss Reductions (mill PV$)					
	Personal Income	$5.7	$8.8	$5.7	$4.8	$4.8
	Business Sales	$12.9	$18.4	$12.8	$10.8	$10.7
	GSP	$7.0	$10.3	$7.0	$5.9	$5.9
	Impact on Excise Tax Revenue	$0.0	$249.5	-$5.3	-$75.9	-$97.0
	Persistent Job Change	24	8,832	-1,191	-2,310	-3,470
	as % of annual employment	0.00%	0.10%	-0.01%	-0.03%	-0.04%

Scenario Four Impacts

Results for the fourth scenario are summarized in column 6 of table 5-2 for a 10 % preference diversion. Results are 1,695 cigarette fires avoided, 67 deaths averted, 535 injuries prevented, and $29 million in present value property losses avoided. Second-order economic effects are more negative overall than in the preceding scenario because the assumed diversion is larger. In fact, the potential extent of a preference-driven diversion remains uncertain at this time.

Scenario Five Impacts

Results of the fifth scenario appear in column 7 of table 5-2. Combining the possibilities of the price- and preference-driven diversions produces the least favorable results for the standard, of the scenarios considered. Estimated results are as follows: 1,683 cigarette fires avoided, 66 deaths averted, 531 injuries prevented, and $28 million in present value property losses avoided.

Results of the REMI analysis show sizable second-order economic costs over the six year study period. GSP is estimated to drop by $1,311 million in present value, with much of this drop occurring in wholesale sales. Personal income declines by $677 million. Excise tax revenue collected falls by nearly $100 million. Job losses increase, with most of the losses coming in the retail outlet sector, but remain small as a percentage of annual employment. Small second-order benefits result from reduced out-of-pocket fire losses. Clearly, if manufacturers both raise prices and supply a conforming cigarette that smokers reject, large diversions of cigarettes into unregulated channels are predicted, and substantial second-order economic costs are estimated.

Effects of a Shorter Elapsed Time until a National Standard is Adopted

Table 5.3 shows results for the same scenarios as summarized in table 5.2, except that the study period is for a three-year period, instead of a six-year period. Extending from 2004 to 2006, the shorter period reduces the both the benefits and the costs—as compared with those for the longer study period pertaining to table 5.2.

Looking only at effects within the State of New York, the quicker a national standard is adopted, the shorter the time the State can take credit for the fire avoidance effects of its standard, other factors remaining the same. Thus, a shorter study period is associated with lower within-State fire avoidance benefits. At the same time, if there are negative effects arising from price increases or smoker rejection, the shorter the time before a national standard is adopted, the shorter the time that the State incurs the negative second-order effects of diversion of purchases to out-of-State channels.

If the New York standard accelerates early adoption of a national standard, then the State may take credit for national fire-loss benefits over the accelerated period. Furthermore, adoption of a national standard may reduce the prevalence of cigarette diversion into out-of-State channels. To include this potential benefit requires that we broaden our perspective beyond what happens within the State—which puts it beyond the perspective of this study.

Effect of a later time of implementing the Standard

The later the standard is implemented, the lower the fire-reduction benefits, other factors remaining the same. To the extent that there are second-order economic costs, a later implementation time reduces the costs. The net effect depends on the comparative size of the benefits and costs. Provided manufacturers successfully supply a conforming cigarette without appreciably raising the price, it makes economic sense for the State to implement the standard as soon as possible.

It should be noted that at the time the study approach was formulated, effects of implementing the standard at a later date were of interest. However, recently the standard has been implemented, and the alternative of a later implementation date is no longer relevant to the State.

Effect of Alternative Effectiveness Levels of Conforming Cigarettes

Other things equal, higher effectiveness levels of modified cigarettes raise benefits without raising second-order costs, improving the net benefits of having the standard. If manufacturers supply cigarettes that exceed the requirements of the standard, the benefits may exceed those estimated for the default effectiveness level of 60 %. Tables 3-11 and 4-1 showed the sensitivity of results under Scenario Two to varying effectiveness levels.

Study Limitations

The study has assessed a number of outcome possibilities of prime interest to NY State officials, to NIST technical advisers, and possibly to officials in other states. It has conducted extensive sensitivity analysis on selected parameters. However, it has neither covered all possible scenarios, nor quantified all possible impacts.

The analysis of first-order benefits has been limited to losses associated with residential fires caused by cigarettes. Not included are non-residential fires caused by cigarettes, such as forest fires, and fires caused by cigarette lighting materials, such as matches and lighters. The analysis of fire-related deaths and injuries has been limited to numbers of deaths and injuries. Not included are the pain and suffering of victims and of family and friends, related treatment costs, funeral costs, lost income, costs of temporary housing, loss of pets, reductions in insurance premiums, and other tangible and intangible costs of fire losses. The analysis of property losses from cigarette-caused residential fires has included the dollar value of destroyed property and the secondary effects tied to the estimated reduced out-of-pocket cost from these property losses. Not included are dislocation costs or the intangible costs of irreplaceable items.

The study assumes that smoker price and preference reactions result in diversions of cigarette purchases to non-conforming channels. Further, the smoking-related health effects of smoking a conforming or a non-conforming cigarette are assumed not to differ. Hence, under the assumptions of the study there are no estimated changes in smoking-related health effects and related medical costs. But to the extent that the cigarette modification causes smokers to change their cigarette consumption rather than to shift their purchases between conforming and non-conforming channels, there will be consequences in terms of smoking-related health effects and related medical costs.

The study assumes existing tax-driven diversions will be to non-conforming cigarettes. But, it is possible that some of the tax-driven diversions will be conforming. For example, Indian Reservations

located in the State may sell conforming cigarettes. To this extent, the estimated 32 % existing diversion may lead to an understatement of the standards positive impacts.

Implications of Findings

The standard requiring less fire-prone cigarettes affords NY State the opportunity to cut the incidence of cigarettes-caused fires, thereby reducing the toll of deaths, injuries, and property loss in the State from these fires. This impact analysis has highlighted the extent of potential benefits and costs under alternative conditions. It has provided results for a base-case scenario and sensitivity analysis for more and less optimistic conditions.

Estimates are that if NY could completely solve its cigarette fire problem in residences, approximately 4,600 cigarette fires, 180 related deaths, 1,500 related injuries, and $80 million in present value related property damage could be avoided over a six-year period, from 2004 through 2009. Taking into account the existing tax-driven diversion of cigarettes into channels that are assumed not to offer complying cigarettes reduces these potential benefits but leaves substantial benefits to be realized by the standard. If cigarette companies make cigarettes that smokers like and sell them at a price close to that of non-complying cigarettes, the standard is estimated to have significant positive benefits and few negative effects. And, to the extent that cigarettes perform better than assumed in this scenario, the net benefits will be higher. On the other hand, if manufactures fail to supply a complying cigarette that smokers broadly accept or if they raise prices of complying cigarettes appreciably, second-order economic costs are generated.

Recent developments appear favorable to a positive outcome for NY's "Fire Safety Standards for Cigarettes." The standard has been implemented. Early reports are that cigarettes certified as complying with the standard are being provided in the popular brands at prevailing prices. If manufacturers prove successful in delivering a product that receives broad smoker acceptance over time, the overall impact of the standard is expected to be cost-beneficial.

Table 5-3. Summary of Impacts for Selected Scenarios, 7 % Discount Rate, 2004 to 2006

		Base-Case Scenario	Sensitivity Tests			
			Scenario	Scenario	Scenario	Scenario
		2	1	3b	4a	5
		60% effectiveness level	100% effectiveness level	60% effectiveness level		
Impacts	Type of Effects	No Standard-Driven Diversion; Background Diversion	No Standard-Driven Diversion; No Background Diversion	Price-diversion of 0.7%; Background Diversion Included	Preference-diversion of 10%; Background Diversion	Preference-diversion of 25%; Price-Diversion of 0.7%;
[1]	[2]	[3]	[4]	[5]	[6]	[7]
First-order Impacts - Fire Losses Avoided	Fires Avoided	1,089	2,669	1,081	980	973
	Deaths Avoided	42	104	42	38	38
	Injuries Avoided	335	821	333	302	299
	Property Losses Avoided (mill PV$)	$19	$46	$19	$17	$17
Second-order Economic Impacts	**Sales & GSP Effects** (mill PV$)					
	Impact on GSP	$0	$2,144.1	-$235.8	-$587.2	-$812.5
	Warehousing Sales	$0	$22.4	-$2.6	-$6.1	-$8.5
	Retail Outlet Sales	$0	$1,199.4	-$57.5	-$348.9	-$409.4
	Wholesale Sales	$0	$1,682.7	-$55.9	-$496.2	-$559.5
	Personal Income Effects (mill PV $)	$0	$1,010.7	-$161.4	-$262.9	-$413.8
	Out-of-Pocket Loss Reductions (mill PV$)					
	Personal Income	$3.1	$4.6	$3.1	$2.7	$2.7
	Business Sales	$7.6	$10.8	$7.6	$6.6	$6.6
	GSP	$4.1	$5.9	$4.1	$3.6	$3.6
	Impact on Excise Tax Revenue	$0.0	$147.2	-$3.1	-$44.8	-$47.9
	Persistent Job	26	10,603	-1,371	-2,803	-4,143
	as % of annual employment	0.00%	0.12%	-0.02%	-0.03%	-0.05%

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Appendix A. Estimation of Out-of-Pocket Property Losses

There are three components to the estimate of out-of-pocket property losses arising from cigarette-caused residential fires in NY State:

1. Uninsured property losses[91]

2. Unreported property losses from residential fires

3. Deductibles for insured, reported fire property losses

To estimate the first component, we start with the number of housing units in New York State and their form of occupancy. According to the U.S. Census Bureau, there were 7,679,000 housing units in NY State in 2001; 53.9 % occupied by homeowners; 46.1 % occupied by renters.[92]

We then examine the percentages that do and do not have residential property insurance. U.S. percentages of insured and uninsured by form of occupancy were obtained from the Insurance Research Council, as shown below for the year 2001:

	Have Insurance	**No Insurance**	**Don't Know**
Homeowners	88 %	8 %	4 %
Renters	48 %	46 %	6 %

(Source: Insurance Research Council)

For each form of occupancy, the analysis apportioned the "don't know category" equally into those that don't have insurance and those that do. Thus, the estimates used are that an estimated 10 % of homeowners do not have insurance, and estimated 49 % of renters do not have insurance on contents.[93] It was assumed that owners of rental property insure at the same rate on the structure as homeowners.

It was assumed that fires will be incurred in owner-occupied and renter-occupied residences at same rate and that average property loss is the same. This allows us to use the average cost per structure fire, reported at $16,844 in 2002, to derive the deductible. Based on examination of residential insurance policies, it is assumed that 75 % of loss is on structure and 25 % is on content. The above ownership and uninsured percentages are used to estimate uninsured losses for homeowners and owners of rental residences. The percentage for renters is applied only to the contents at their occupancy rate.

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91. Underinsured losses are not included in the estimates.
92. U.S. Census Bureau, Table #940, for NYS, 2001.
93. Instead of equally apportioning the 'don't know" category, apportioning it proportionally would leave the adjusted renters "no insurance" category unchanged at 49 %, and it would change the homeowners "no insurance" category from 10 % to 8.3 %. Thus the estimation procedure may overestimate uninsured homeowners by 1.7 %.

To estimate the second component, unreported property losses, we rely on an earlier study that estimated property losses in unreported smoking fires to range from 4.0 % to 6.5 % of losses in reported smoking fires.[94] Within this range, we choose the average value, expressed as an integer, of 5 %.

To estimate the third component, deductibles, it is assumed that on average, fire insurance policies carry a deductible of $500 per claim. This is a rough approximation, based on examination of residential insurance policies. The first two components, uninsured and claims not filed are first estimated and subtracted from estimated fire damage to estimated filed claims. The dollar value of filed claims per billion cigarettes is divided by the average cost per structure fire to estimate the number of claims per billion cigarettes. This in turn is multiplied by the estimated deductible amount per claim to derive the estimated deductions for claims filed per billion cigarettes.

Table A-1 shows the derivation of out-of-pocket property losses per billion cigarettes consumed, starting with the baseline property-damage projections and using the information given above.

Table A-1. Estimation of Out-of-pocket Insurance Losses

Year (1)	Direct property damage per billion cigarettes (in $2003) (2)	Estimated uninsured structure and content losses of homeowners and owners of rental property per billion cigarettes (3)	Estimated uninsured content losses of renters per billion cigarettes (4)	Estimated unfiled, eligible claims (5)	Estimated deductions for claims filed per billion cigarettes (6)	Total estimated out-of-pocket property losses per billion cigarettes (7)
proj. 2004	$770,808	$68,197	$43,529	$32,954	$18,586	$163,267
proj. 2005	$770,492	$68,169	$43,512	$32,941	$18,578	$163,200
proj. 2006	$770,176	$68,141	$43,494	$32,927	$18,571	$163,133
proj. 2007	$769,860	$68,113	$43,476	$32,914	$18,563	$163,066
proj. 2008	$769,543	$68,085	$43,458	$32,900	$18,556	$162,999
proj. 2009	$769,227	$68,057	$43,440	$32,886	$18,548	$162,932
proj. 2010	$768,911	$68,029	$43,422	$32,873	$18,540	$162,865
proj. 2011	$768,595	$68,001	$43,404	$32,859	$18,533	$162,798
proj. 2012	$768,278	$67,973	$43,387	$32,846	$18,525	$162,731
proj. 2013	$767,962	$67,945	$43,369	$32,832	$18,517	$162,664

Notes on derivation:

Column 2 shows baseline property loss projections per billion cigarettes consumed.

Column 3 is derived by estimating the structure loss component as 75% of total property damage and content loss as 25 %. Homeowners occupy 53.9 % of residential housing units in NY State and approximately 10 % lack fire insurance. It is assumed that owners of rental residences lack fire insurance for the buildings at the same rate as homeowners. It is assumed that 10% of structural losses are uninsured by owners and that 10 x 53.9 % of content losses are uninsured by homeowners.

Column 4 is derived by multiplying the estimated 25 % content loss times the 46.1 % of residences occupied by renters, and, in turn, by the approximately 49 % who lack fire insurance.

94. John R. Hall, Jr., "Expected Changes in Fire Damages from Reducing Cigarette Ignition Propensity," *Technical Study Group Cigarette Safety Act of 1984*, October 1984, p.7.

Column 5 is derived by assuming that 5 % of insured losses are relatively small and are not reported in order to avoid adverse consequences on insurability.

Column 6 is derived in several steps. By subtracting uninsured and unfiled claims per billion cigarettes from estimated damage per billion cigarettes estimated filed claims per billion cigarettes are estimated. The total of estimated filed claims is divided by the average cost per structure fire of $16,844 to estimate the number of claims. It is then assumed that on average there is $500 deductible per claim.

Column 7 is the sum of estimated uninsured, unfiled, and deductible losses.