

**INITIAL EVALUATION OF THE
EFFECTIVENESS OF REDUCED IGNITION
PROPENSITY CIGARETTES IN
REDUCING CIGARETTE-IGNITED FIRES:
CASE STUDIES OF THE NORTH
AMERICAN EXPERIENCE**

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Initial Evaluation of the Effectiveness of Reduced Ignition Propensity Cigarettes in Reducing Cigarette-Ignited Fires: Case Studies of the North American Experience

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The analyses, observations, and evaluations contained in this document are wholly those of the
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A shortened version of this study will be submitted for publication.*

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EXECUTIVE SUMMARY

This study examined the effect of reduced ignition propensity cigarettes on cigarette-ignited and smoking material fire incidence.

Of 10 Canadian provinces and 49 U.S. states with reduced ignition propensity legislation implemented at the time of the study, 3 had sufficient fire incident data for case study. Data from Alberta and Ontario, Canadian provinces with robust fire incident collection systems before and after the implementation of reduced ignition propensity legislation, were analyzed. Data from New York, the first state to implement reduced ignition propensity cigarettes, were also analyzed though its data are less complete than the provinces.

Case studies consisted of analyses of fire and fire loss trends, per capita fire incidence, and fire incidence per tobacco consumption. In Alberta, the case study focused on the effect of reduced ignition propensity cigarettes on *cigarette-ignited fire incidence*. In Ontario and New York, the focus was the effect of reduced ignition propensity cigarettes on *smoking material fire incidence* because of differences in how cigarette fires are grouped in the data collection systems.

These initial results indicate that the implementation of reduced ignition propensity cigarettes did not result in the predicted decrease of smoking material related fires and deaths. There is even less effect when cigarette fires are controlled for changes in cigarette consumption. The data show no substantive decrease attributable to reduced ignition propensity cigarettes.

Ontario

In Ontario, the implementation of reduced ignition propensity cigarettes had no substantive effect in decreasing smoking material related fires, deaths and fire injuries. Trend analyses of overall smoking material fires, deaths, and injuries demonstrated that existing trends were continued or, in the case of injuries, were mild increases. In particular, the trend analysis of residential smoking material fires, the primary focus of smoking material fire improvement, did not show the predicted decrease of smoking material related fires—rather, the data show no effect. The large predicted decreases in fires and deaths were not evident.

Smoking material fires also showed no increased reduction in comparison to other, non-smoking fires. On the contrary, fires from other heat sources decreased faster than smoking material fires, regardless of the implementation of reduced ignition propensity cigarettes. An unexpected result was an increase in smoking material fire deaths per smoking material fire.

Analyses controlling for smoking population changes and for changes in cigarette consumption also found that the implementation of reduced ignition propensity cigarettes did not result in the predicted decrease of smoking material related fires.

In summary, based on the analyses undertaken with existing data from Ontario, the implementation of reduced ignition propensity cigarettes did not produce decreases in smoking material fires and fire losses above established trends and did not produce the magnitude of predicted reductions.

Alberta

As in Ontario, the implementation of reduced ignition propensity cigarettes in Alberta had no substantive effect in decreasing smoking material related fires, deaths and fire injuries. With the exception of injuries, trend analyses of overall smoking material fires, deaths, and injuries demonstrated that the implementation of reduced ignition propensity cigarettes did not result in predicted reductions. Injuries from cigarette-ignited fires showed some improvement, however, the numbers of both deaths and injuries from cigarette-ignited are very small and changes in trends may be more indicative of expected fluctuations rather than actual trend changes.

Trend analyses of cigarette-ignited fires in a selected set of scenarios and in residential properties—both situations RIP cigarettes were designed to address—also do not show the anticipated reductions from the implementation of RIP cigarettes.

As with Ontario, an unexpected result was an increase in smoking material fire deaths per smoking material fire.

Analyses controlling for smoking population changes and for changes in cigarette consumption also found that the implementation of RIP cigarettes did not result in the predicted decrease of smoking material related fires.

In summary, based on the analyses with existing data from Alberta, the implementation of RIP cigarettes did not produce substantive decreases in smoking material fires and fire losses and did not produce the magnitude of predicted reductions.

Analyses of cigarette fire data by the Alberta Fire Commissioner staff similarly concluded that a reduction in cigarette fires could not be seen from the numbers of fires, deaths, or injuries from the 1999-2008 fire data.

New York

As in Ontario and Alberta, the available data from New York do not show a substantive effect from the implementation of reduced ignition propensity cigarettes in decreasing smoking material fires or deaths. The decline in smoking material deaths has been ongoing; post-implementation declines follow the trend set prior to implementation. As with Ontario and Alberta, an unexpected result was an increase in smoking material fire deaths per smoking material fire.

Analyses controlling for smoking population changes and for changes in cigarette consumption also found that the implementation of RIP cigarettes did not result in the predicted decrease of smoking material related fires. Again, as with Ontario and Alberta, the data show no overall effect.

In summary, based on analyses with the available data for New York, the implementation of RIP cigarettes did not produce substantive decreases in smoking material fires and fire losses and did not produce the magnitude of predicted reductions.

Reducing Cigarette Fires Further

While the evidence to support the effectiveness of the implementation of RIP cigarettes in reducing cigarette fires is not seen in the three case studies, other measures have proven to be effective in reducing fires and fire losses. These measures include public fire education; installation, maintenance, and heeding of smoke alarms; improvements to the ignitibility of upholstered furniture and mattresses; and the use of residential sprinklers.

INTRODUCTION

This report is an initial evaluation of the effectiveness of reduced ignition propensity cigarettes as implemented in the U.S. and Canada. Smoking material fires, primarily cigarette fires, have been the leading cause of fatal fires in the United States for over 30 years. They also are the leading cause of fire deaths in Canada, and other nations.

There are several ways to reduce fires from cigarettes. They include making the items most often ignited by cigarettes—upholstered furniture and bedding—more fire-resistant; increasing the use and maintenance of smoke alarms; having smokers behave more safely when using cigarettes; reducing smoking; and reducing the ignition propensity of cigarettes. This evaluation focuses on the effectiveness of reduced ignition propensity cigarettes in reducing cigarette fires and losses.

To the authors' knowledge, this is the first major evaluation of reduced ignition propensity cigarettes to be published. The most definitive aspect of the evaluation used Canadian data. The U.S. data proved to be difficult to use, in part from the voluntary nature of U.S. fire data collection; New York was the only state with available data.

The initial results do not show the substantial reduction in cigarette-ignited fires that was predicted.

Cigarettes and Fires

The absolute number of fires, including cigarette-ignited fires, has been declining over many years. Yet the relative proportion of fire incidence attributable to cigarette-ignited fires in the U.S. has been virtually unchanged since the 1976 initiation of nationally collected incident-based fire data. This proportion is keenly reflected in fatal fires: each year, 12% to 15% of all fatal fires and 15% to 25% of fatal fires in residences are caused by cigarettes as the primary heat source.¹ These percentages reflect only those fires for which the heat source is known, which for residential fires, is approximately 50% fires. Between 2006 and 2008, an estimated annual average of 64,200 cigarette fires occurred in the United States.² Of these fires, an estimated 15,500 to 19,000 cigarette fires occurred in residences alone.³ In Canada, an estimated 2,400 cigarette fires occurred annually between 1992 and 2000, the most recent national estimate of cigarette fires.⁴

In the U.S., cigarette fires account for approximately 4% of fires responded to by fire departments across the Nation and result in an average of approximately 650 to 700 deaths; 1,000 to 1,600 injuries; and approximately \$570 million in property loss each year.⁵ In residential buildings, cigarette fires account for only 2% of fires yet they pose the greatest life safety risk: the fatality rate per 1,000 fires is more than 8 times greater in cigarette fires in buildings than in other residential building fires. The injury rate per 1,000 fires is more than 3 times greater in cigarette fires than in non-cigarette residential building fires.⁶

Statistics such as these were the impetus for the development of standards to reduce the ignition propensity of cigarettes.

U.S. efforts to make cigarettes less prone to ignite fires culminated in the Cigarette Safety Act of 1984 and the Fire Safe Cigarette Act of 1990, both of which stimulated research to make cigarettes more “fire-safe”. The subsequent legislative and research initiatives succeeded in the first State-based legislation in New York State in 2003 to establish “ignition propensity” standards for cigarettes. Based on the New York legislation, Canada followed suit in 2004 to become the first nation to enact legislation requiring all cigarettes sold in Canada to be “fire safe”. Vermont and California soon followed. By March 2010, all 50 U.S. States and the District of Columbia had adopted fire-safe cigarette regulations. By July 1, 2011, all U.S. state-based fire-safe cigarette legislation will be implemented.⁷

Model legislation, based on the New York State legislation and used by Canada and most (if not all) states proposes to “reduce the likelihood that cigarettes will cause fires and result in deaths, injuries, and property damages”. The performance standard for testing and measuring cigarette ignition strength is ASTM Standard E2187, *Standard Test Method for Measuring the Ignition Strength of Cigarettes*.

Known as both FSC (fire-safe cigarette or fire standards compliant) and RIP (reduced ignition propensity), the cigarettes are designed to limit the risk that a cigarette will ignite combustible materials, upholstered furniture, a mattress, or other household furnishings. They are designed to stop burning when left unattended, but otherwise have the same characteristics as other cigarettes. They are not designed to resist ignition in trash, mulch, or brush, where there is more ventilation to support a fire. The ignition test involves placing a lit cigarette on 10 layers of filter paper and tracking the percent of cigarettes that extinguish before burning their length. A trial is 40 cigarettes. The passing standard is no full length burn on 75% of cigarettes tested. That is, at least 75% of the set of cigarettes tested will self-extinguish before burning the full length of the cigarette.

Projected Effect of the U.S. and Canadian Regulations

As part of the Technical Study Group on Cigarette and Little Cigar Fire Safety that was established from the Cigarette Safety Act of 1984, estimates of the expected changes in U.S. fire losses from reducing cigarette ignition propensity were derived from a series of detailed analyses. The estimates of loss reduction were substantial: 58% to 64% for deaths alone.⁸ Projections of these reductions, produced by the National Fire Protection Association (NFPA) in 2010, suggest that reductions of 50% to 70% in smoking material fires in structures would be achieved by 2012. Associated projections of the reduction in deaths from smoking material structure fires would be 56% to 77%. These estimated reductions are relative to 2003.⁹

When the estimates for the reduction of smoking material fires in structures are projected to rough estimates for all smoking material fires in the U.S., overall effect of reduced ignition propensity cigarettes would be a reduction of 13% to 18%; the estimate of the effect of reduced ignition propensity cigarette on all smoking material fire deaths would be a reduction of 54% to

75%. Structure fires account for approximately a quarter of all smoking-related fires but nearly all smoking-related fire deaths.¹⁰

As part of the regulatory impact analysis in Canada, Health Canada undertook its own assessment of the potential reduction in cigarette fires.¹¹ Using a different methodology, which relied in part on test results from the U.S. Technical Study Group on Cigarette and Little Cigar Fire Safety, Health Canada determined that a range of 32% to 68% reduction in cigarette fires and fire losses was the best estimate of fire and fire loss reduction from manufactured cigarettes as a result of the cigarette ignition propensity standard. With an estimated 14% of cigarettes as non-manufactured (and for which the standard would not apply¹²), the resulting estimated reduction range for all cigarette-ignited fires is 28% to 58%.

Scope of Evaluation

The evaluation here focuses primarily on the Canadian experience with RIP cigarettes as the available data appeared to be the most complete and reliable. As additional U.S. data were not as readily available, the U.S. experience is represented by New York alone.

The original intent of the U.S. portion of the evaluation was to focus on New York and California, two of the first states to enact legislation. These two populous states represent nearly 20% of the U.S. population and could provide a reasonable basis for an evaluation. Five other states with late RIP cigarette effective dates and robust data collection (Florida, Michigan, Minnesota, Ohio, and Texas) were selected as “control” states, against which the results from New York and California could be compared. Data submitted to the National Fire Incident Reporting System (NFIRS) was initially used. The original state data were subsequently used.

Consistent reporting is crucial to the evaluation; every attempt was made to address the problem of variations in fire department participation in the U.S. data by choosing sets of fire departments in each evaluation and control state that reported each year for several years before and after the standard went into effect. However, even the departments that consistently report do not appear to consistently submit all of their data each year. Determining the population associated with these fire departments also proved to be unworkable.

Thus, it was not possible to determine trends up or down using the U.S. state-based data.

However, estimates of New York State’s smoking material fires and fire deaths have been published and are currently used as the primary source of information on the U.S. experience with RIP cigarettes.¹³ These estimates are the best data available. Similar estimates for California’s smoking material fires and fire deaths have not been published.

In Canada, the major provinces require fire departments to report all fire incidents. Fires with losses are investigated to determine the cause of the fire; the data appear to be of good quality. Although some available data do not differentiate between cigarettes and other smoking material, other sources show that the vast majority of smoking material fires are from cigarettes.¹⁴ As it is the best data available, data for smoking material fires is used whenever data for cigarette fires is unavailable.

Other evaluation methods were also investigated but were determined to be beyond the scope of this initial evaluation.

Terminology

For consistency, the term “RIP” is used throughout the remainder of the report when referring to cigarettes that comply with the reduced ignition standards. Common terms equivalent to RIP also seen in articles, reports, websites, and other materials include FSC (fire-safe cigarette or fire standard compliant), RIPC (reduced ignition propensity cigarettes), and RCIP (reduced cigarette ignition propensity). The term “RIP cigarettes” refers to cigarettes that comply with the ASTM Standard E2187. Further, “pre-RIP” refers to the period prior to the implementation of RIP-compliant cigarettes; “post-RIP” similarly refers to the period after the implementation of RIP-compliant cigarettes.

Data from Ontario is for “lit smokers material” which comprises cigarettes, cigars, and pipes (no lighters and matches). This definition is the equivalent of the U.S. “smoking material”. For consistency, the term “smoking material” is used when the data include cigarettes, cigars, and pipes.

Previous Analyses of RIP Cigarettes

As smoking is a major cause of residential fire deaths, many U.S. states include data on smoking fires and losses in their summary data or their annual reports. New York (effective June 28, 2004) and California (January 1, 2007) have not yet published data; the Coalition for Fire-Safe Cigarettes, however, has published estimates of the New York State data. Vermont is the first of the initial three states to enact RIP cigarette regulations to publish information on smoking or cigarette fires and deaths before and after the implementation of the regulations. Other states with later implementation dates—Maine, Massachusetts, Oregon, and Delaware—also have published limited data. Maine, undertook an evaluation one year after the implementation of RIP cigarettes. Although the Maine evaluation is more descriptive than evaluative, it nevertheless was an attempt to understand the effect of RIP-compliant cigarettes.

Evaluations of RIP cigarettes in reducing cigarette-ignited fires and fire deaths have not yet been published by Health Canada, Canada’s federal department responsible for national public health. It is the agency primarily responsible for health and safety issues associated with tobacco. Until approached for data for this project, Ontario and Alberta, provinces with robust fire data collection systems, had not conducted provincial evaluations of RIP cigarettes.

The published data are summarized below.

New York

According to the Coalition for Fire-Safe Cigarettes, New York has seen a significant reduction in cigarette related fire deaths since the implementation of the RIP cigarette law in June 2004.

The Coalition observes that there “were 24 cigarette fire deaths per year in New York in 2006-2007 (the first full year when it should not have been possible to legally buy a non-compliant cigarette in New York), a one-third (35%) decline from 38 per year in 2002-2003.”¹⁵ This count of smoking materials fire deaths does not take into account trends in smoking prevalence over these years.

Table 1. New York State Smoking Material Fires, 2000-2007 and State Smoking Material Fire Deaths, 1997-2007

Year	Smoking Materials Fires	Smoking Materials Fire Deaths
1997		49
1998		38
1999		40
2000	1957	45
2001	2223	45
2002	2279	39
2003	2618	38
2004	2456	31
2005	2035	33
2006	1851	22
2007	2207	27
2008		

The New York cigarette fire safety standard went into effect June 28, 2004.

Source: Coalition for Fire-Safe Cigarettes, based on February 2009 statistics from the New York Office of Fire Prevention, <http://firesafecigarettes.org/itemDetail.asp?categoryID=107&itemID=1512&URL=In%20the%20news/The%20New%20York%20Experience> (accessed February 6, 2011).

Vermont

Vermont was the second state in the U.S. to require all cigarettes sold in the state to meet the ASTM criteria for RIP-compliant cigarettes. The requirement was effective as of May 1, 2006. Vermont included a summary analysis of cigarette fire losses in its *2009 Annual Report of the Fire Marshal*. They found that over the 10-year period 2000-2009, cigarettes had been the leading cause of fire deaths in Vermont but were declining.

No fire deaths attributed to cigarettes were reported in 2007 or 2008. Leading causes of civilian fire deaths are shown in Table 2, where cigarettes are combined with other smoking material. Two fire deaths related to cigarettes were reported in 2009. The number of fire deaths per year is so low that one cannot evaluate the effect of RIP cigarettes using that statistic.

The *2009 Annual Report of the Fire Marshal* also reports that during 2007 and 2008, the number of structure fires caused by cigarettes decreased by 40%, but that in 2009, the number of structure fires caused by cigarettes returned to the level of fires caused by cigarettes prior to 2006.¹⁶

Table 2. Cause of Civilian Fire Deaths in Vermont, 2000-2009

Civilian Fire Deaths Vermont											
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	10 year Total
Smoking Materials	5	2	1	2	0	1	2	0	0	2	15
Heating Equipment	0	1	2	6	0	0	1	2	0	2	14
Electrical	4	0	0	3	0	0	1	1	1	0	10
Vehicle Collision	0	4	0	4	0	0	0	0	0	0	8
Open Flame	1	0	0	1	0	0	0	1	3	1	7
Cooking	0	0	1	0	0	0	1	1	0	1	4
Explosion	0	0	0	1	0	0	0	0	0	0	1
Unintentional	1	1	0	0	0	0	0	0	2	0	4
Undetermined	11	1	1	1	0	8	1	3	2	1	29
Totals	22	9	5	18	0	9	6	8	8	7	92

Source: Howe, R., York, N., Greenia, M.D., and Baranowski, S. 2009 *Annual Report of the Fire Marshal*. Vermont Department of Public Safety, Division of Fire Safety, p. 6. 2009.

Maine

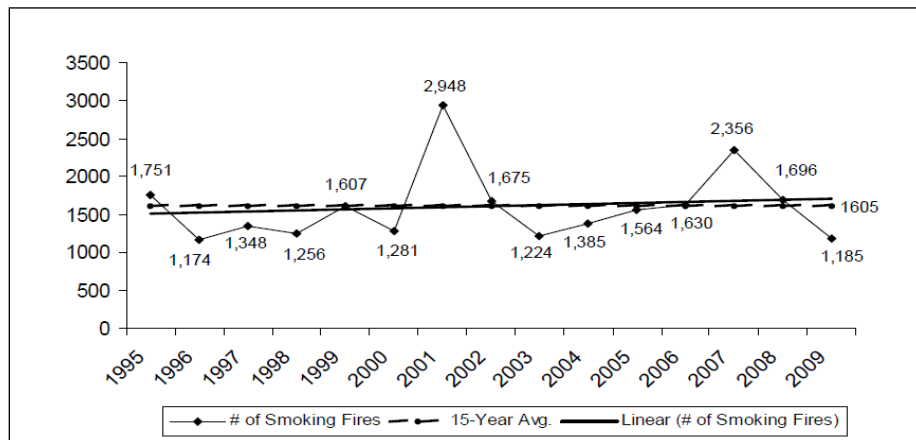
On January 1, 2008, RIP legislation took effect in Maine. A year after the effective date of the legislation, Maine produced a preliminary report on the effectiveness of the implementation of RIP cigarettes. The report found that fire deaths from smoking ranged between 1 and 9 during the 1998 -2007 period. In 2008, three smoking-related fatalities were reported: one was due to the careless disposal of cigarettes and two were due to smoking while on oxygen. The report noted that this latter type of cigarette fire fatality involved older adults and was not likely to be remedied by RIP cigarette brands. A fourth fatality was possibly smoking-related. The report concluded that the 2008 data on cigarette fires, deaths, and the details on occupancy type and items first ignited provide little information as to the effectiveness of Maine’s reduced ignition propensity cigarette law as it was only one year of data.¹⁷

Massachusetts

RIP legislation took effect in Massachusetts on January 1, 2008. *The Massachusetts Fire Problem: Annual Report of the Massachusetts Fire Incident Reporting System 2009*, reports that smoking fires have had a slightly increasing trend for the last 15 years, 1995-2009. The report notes, as displayed in Figure 1, that in 2009 the number of recorded smoking fires was the lowest on record since 1986 and one that was well below the 15 year average of 1,605 smoking fires.¹⁸

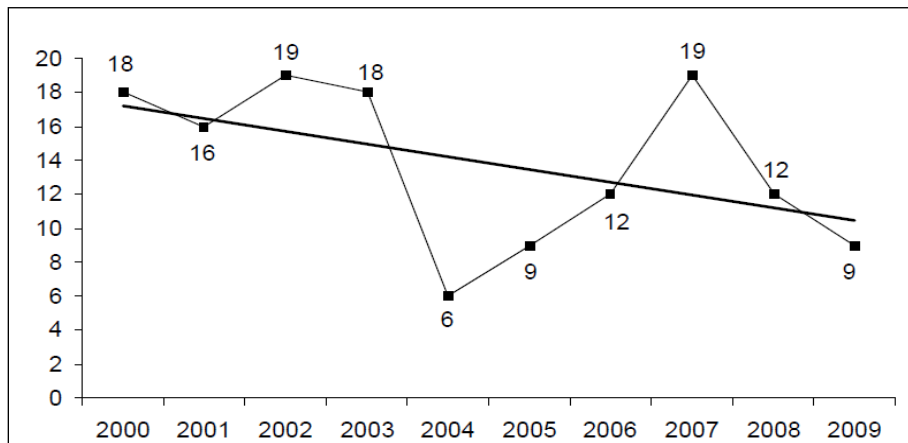
Smoking death data from Massachusetts are shown in Figure 2.

Figure 1. Massachusetts Smoking Related Fires, 1995-2009



Source: State Fire Marshal, *The Massachusetts Fire Problem: Annual Report of the Massachusetts Fire Incident Reporting System 2009*. Massachusetts Department of Fire Services, p. 137. 2009.

Figure 2. Massachusetts Smoking Fire Deaths, 2000-2009

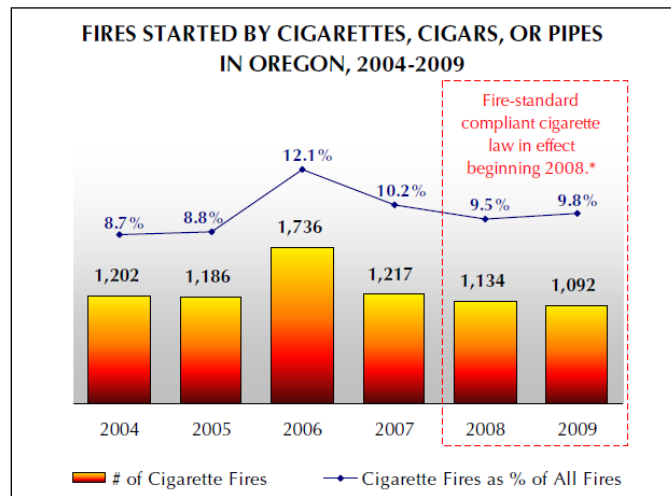


Source: State Fire Marshal, *The Massachusetts Fire Problem: Annual Report of the Massachusetts Fire Incident Reporting System 2009*. Massachusetts Department of Fire Services, p. 138. 2009.

Oregon

RIP cigarette legislation took effect in Oregon on January 1, 2008. Data presented by the Oregon Office of the State Fire Marshal show a decrease in the number and an increase in the percentage of fires started by cigarettes, cigars, and pipes since the RIP legislation took effect (Figure 3).¹⁹

Figure 3. Oregon Fires Started by Cigarettes, Cigars, or Pipes, 2004-2009



Source: Data Unit, *Cigarette Fires in Oregon, 2004-2009*. Oregon Office of the State Fire Marshal. 2010.

As shown in Table 3, the numbers of fires and deaths caused by cigarettes, cigars, and pipes have decreased over the 4 years, 2006-2009. The number of injuries decreased from 2006 to 2008, but rose slightly during 2009. Similarly the estimate of total property loss also decreased from 2006 to 2008 but rose in 2009.

Table 3. Oregon Casualties and Property Loss from Fires Started by Cigarettes, 2004-2009

Year	# of Fires Started by Cigarettes*	Injuries	Deaths	Est. Total Property Loss
2004	1,202	44	13	\$4,953,761
2005	1,186	28	10	\$4,323,870
2006	1,736	33	8	\$4,957,238
2007	1,217	24	6	\$3,178,736
2008	1,134	22	7	\$3,017,445
2009	1,092	26	3	\$4,451,987

*Includes cigarettes, cigars, and pipes.

Source: Data Unit, *Cigarette Fires in Oregon, 2004-2009*. Oregon Office of the State Fire Marshal. 2010.

Delaware

On January 1, 2009, RIP legislation took effect in Delaware. In a review of the Delaware Reduced Ignition Propensity Cigarette Program, the Office of the State Fire Marshal’s annual report notes that prior to the RIP program (2008), 49 fires were investigated by the Office of the State Fire Marshal (OSFM) as possibly being caused by cigarettes. A total of 3 injuries and 1 death were the result of these cigarette fires. In 2009, the OSFM investigated 18 fires as possibly being caused by cigarettes. No deaths or injuries were reported as being caused by cigarettes in 2009 (Table 4).²⁰

Apart from this fire investigation information, no data were provided on the actual number of fires caused by cigarettes.

Table 4. Delaware Office of the State Fire Marshal: Fires Caused by Cigarettes, 2008-2009

Year	Fires Investigated by the OSFM	Injuries	Deaths	Property Damage
2008	49	3	1	\$ 370,260
2009	18	0	0	\$ 115,130

Source: Office of the State Fire Marshal, *57th Annual Report*, State of Delaware, Office of the State Fire Marshal, p. 13. 2010.

In summary, the data published after the introduction of RIP cigarettes are not conclusive of positive effects of the cigarettes and are considerably below the predicted reduction in smoking related fires and fire deaths. The data do not show a significant decrease attributable to the implementation of RIP cigarettes, at least through the published data.

METHODS AND SOURCES

Data Collection

Fire and demographic data were collected for Ontario, Alberta, New York, California, and five control states. With the exception of published estimates of the New York smoking material data, the initial analyses showed that the U.S. fire incident data were not sufficiently consistent and complete and prevented further analysis. Ontario and Alberta were chosen as the primary focus of this case study as both provinces have robust data collection systems and participation in provincial fire incident data systems is required.^{21, 22, 23}

Fire Data

Lit smoking material data for Ontario were provided by the Office of the Fire Marshal. Accompanying the data was a short narrative description and preliminary evaluation. Ontario does not have a separate data code for cigarettes; only the larger category of “lit smoking material” was therefore available for analysis. Experience with U.S. fire data has shown that cigarette fires comprise 90% to 95% of U.S. smoking material structure fire data. Data from Alberta indicate that in Alberta, 99% of lit smoking material (cigarettes, cigars, and pipes) are cigarettes. Data provided by the Ontario Fire Marshal staff excluded arson or other deliberately set fires, which was appropriate for the analysis.

Total fire incidence and non-loss fire incidence data for Ontario were retrieved from the Ontario Fire Marshal’s website, <http://www.ofm.gov.on.ca/en/Media%20Relations%20and%20Resources/Statistics/default.asp>.

Total fire and cigarette-ignited fire data for Alberta were provided through the Fire Statistics Information System, Alberta Emergency Management Agency. The Alberta Fire Commissioner’s staff also provided initial observations on cigarette-ignited fires after the law went into effect. Alberta is the only province with a separate data code for cigarettes; the data from Alberta were therefore exclusively cigarette-ignited fires. Data provided by the Alberta Emergency Management Agency included all fires.

Both Ontario Fire Marshal and Alberta Fire Commissioner staff noted that RIP cigarettes would not preclude deliberate ignitions nor would the RIP standard apply to those ignitions. A small set of data for the subset of fires for which RIP cigarettes were originally designed and would apply—unintentional residential fires with cigarette ignitions of upholstered furniture, bedding, and related flammable materials—was included in the Alberta data. Residential fire data were also available from Ontario.

Data on New York State overall fires and fire deaths were obtained from *Fire in New York*, the annual statistical report based on fire, accident, and burn injury reports submitted to the New York State Fire Reporting System and produced by the New York State Office of Fire Prevention and Control. The New York State Fire Reporting System is the central data collection mechanism for New York State fire departments. Fire reporting is not required in New York

State. Most fire departments participate in the New York State Fire Reporting System. It is not known, however, if all fire incidents from the participating fire departments are captured at the state level. Several notable fire departments, e.g., the New York City Fire Department, which protects approximately half the population in the state, do not consistently report as evidenced by the published participation statistics. *Fire in New York* and individual fire department participation statistics by month were found at <http://www.dhSES.ny.gov/ofpc/fire-incident-reporting-system/statistical-information.cfm>.

New York State smoking material fire and fire death estimates were obtained from the Coalition for Fire-Safe Cigarettes (www.firesafecigarettes.org). No smoking material fire injury estimates were available. Their estimates are derived from February 2009 statistics from the New York Office of Fire Prevention.²⁴

Population and Demographic Data

Population and demographic data for Ontario were retrieved from the Ontario Ministry of Finance, demographic population projections, Table 3: *Ontario population and selected characteristics, 2001-2036*, <http://www.fin.gov.on.ca/en/economy/demographics/projections/table3.html>.

Population data for Alberta were retrieved from “Alberta’s Official Population”, http://municipalaffairs.gov.ab.ca/documents/LGS/Alberta_Official_Pop_History.pdf.

Percentage of the 15 and over population for Ontario and Alberta was retrieved from Statistics Canada, 2006 Census: Analysis series, Table 2: *Percentage of the population aged less than 15 years in the last 50 years, Canada, provinces and territories*, <http://www12.statcan.gc.ca/census-recensement/2006/as-sa/97-551/table/t2-eng.cfm>.

Population and demographic data for New York were retrieved from the U.S. Census Bureau, *Population Estimates*, Table 2. Annual Estimates of the Resident Population by Sex and Age for New York: April 1, 2000 to July 1, 2009, <http://www.census.gov/popest/states/asrh/SC-EST2009-02.html>.

Smoking Prevalence Data

Smoking prevalence data for Ontario and Alberta were primarily retrieved from Health Canada Health Concerns, Tobacco, Research, Tobacco Use Statistics, http://www.hc-sc.gc.ca/hc-tps/tobac-tabac/research-recherche/stat/_ctums-esutc_2009/ann-histo-eng.php :

- Table 2 - Percentage of current smokers, by province and age group, age 15+ years, Canada, 1999 to 2009,
- Table 4 - Percentage of daily smokers, by province and age group, age 15+ years, Canada 1999 to 2009, and
- Table 6 - Average number of cigarettes smoked per day among daily smokers, by age group and sex, age 15+ years, Canada 1999 to 2009.

Smoking prevalence data for Alberta was also retrieved from *Tobacco Use in Canada, 2011, Propel Centre for Population Health Impact*, Table 2.1: Smoking prevalence by province, 1999-2009 (Data Source: CTUMS, 1999-2009).

Smoking prevalence data for New York was retrieved from the Centers for Disease Control and Prevention, State Tobacco Activities Tracking and Evaluation (STATE) System, <http://apps.nccd.cdc.gov/statesystem/TrendReport/TrendReports.aspx>.

Tobacco Sales and Consumption Data

Tobacco sales data in Ontario and Alberta were primarily retrieved from Health Canada, Tobacco, Research, The Tobacco Industry, <http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/indust/sales-ventes/on-eng.php>. Estimates and data on total sales and estimated contraband sales were taken from *Estimating the volume of Contraband Sales of Tobacco in Canada* produced by Physicians for a Smoke-Free Canada.

New York tobacco sales data were taken from *The Tax Burden on Tobacco*, Historical Compilation, Volume 45 by Orzechowski and Walker.²⁵ Estimates of total tobacco sales were found in *An Update – Additional Cigarette Tax Revenue Sources for New York State*, an analysis undertaken by Brian P. O’Connor, Ph. D. for the New York Association of Convenience Stores.²⁶

Evaluation Metrics

The most straightforward metric is the change in the absolute numbers of reported fires, deaths, and injuries. However, because fires are rarely the result of a single factor and because fires are declining overall, this seemingly obvious metric, while mandatory to consider, was only one of several considered in the analysis. The metrics evaluated and the analyses undertaken included:

- Trend analyses of fires, fire deaths, and fire injuries of fires overall and smoking material fires (Ontario) or cigarette-ignited fires (Alberta)
- Trend analyses of smoking material fires in residential structures (Ontario)
- Trend analyses of fires, fire deaths, and fire injuries of cigarette-ignited fires in residential properties (Alberta)
- Trend analyses of fires, fire deaths, and fire injuries of cigarette-ignited fires in ignition scenarios (Alberta)
- Comparison of average number of smoking material fires (Ontario) or cigarette-ignited fires (Alberta) before and after RIP cigarettes were implemented
- Smoking material loss fires (Ontario) or cigarette-ignited fires (Alberta) vs. other unintentional loss fires
- Fire deaths per smoking material loss fires (Ontario) or cigarette-ignited fires (Alberta)

- Smoking material loss fires (Ontario) or cigarette-ignited fires (Alberta) per smoking population
- Smoking material loss fires (Ontario) or cigarette-ignited fires (Alberta) by cigarettes sold and by cigarettes sold (taxed) and by estimated total cigarettes sold (taxed and contraband)

Because of the nature of the New York data, the analyses and data review included:

- Discussion of trends in reported fires and deaths and estimates of smoking material fires and deaths
- Discussion of the average number of smoking material fires before and after RIP cigarettes were implemented
- Discussion of fire deaths per smoking material fire
- Discussion of smoking material fires per smoking population and smoking material fires by cigarette cigarettes sold (taxed) and by estimated total cigarettes sold (taxed and contraband).

Survey and Review of Literature

A survey of materials relevant to reduced ignition propensity cigarettes was undertaken as part of the research. This survey was primarily internet-based and was augmented with articles and papers referenced in the downloaded documents. The two principle databases used for journals were PubMed Central and ScienceDirect. PubMed is an archive of online journals that is run by the U.S. National Institutes of Health (NIH), National Center for Biomedical Information (NCBI) in the National Library of Medicine (NLM). This search engine offers both free articles and articles for purchase. ScienceDirect is an electronic search engine that specializes in scientific journal articles and books.

Of interest were the following:

- Documents produced during the comment and review period prior to the inclusion of cigarettes in the Canadian Hazardous Materials Act
- Documents produced by the Technical Study Group of the Cigarette Safety Act of 1984 and by the Technical Advisory Group of Fire Safe Cigarette Act of 1990
- Reports relating to cigarette or smoking material fires
- Evaluations of the effectiveness of reduced ignition propensity cigarettes
- Evaluations of other regulations pertaining to consumer products that have a connection to fire (e.g. mattresses, upholstered furniture, lighters, and the like)
- Other evaluations of the effective of regulations
- Sales and regulation of tobacco and tobacco products.

FINDINGS

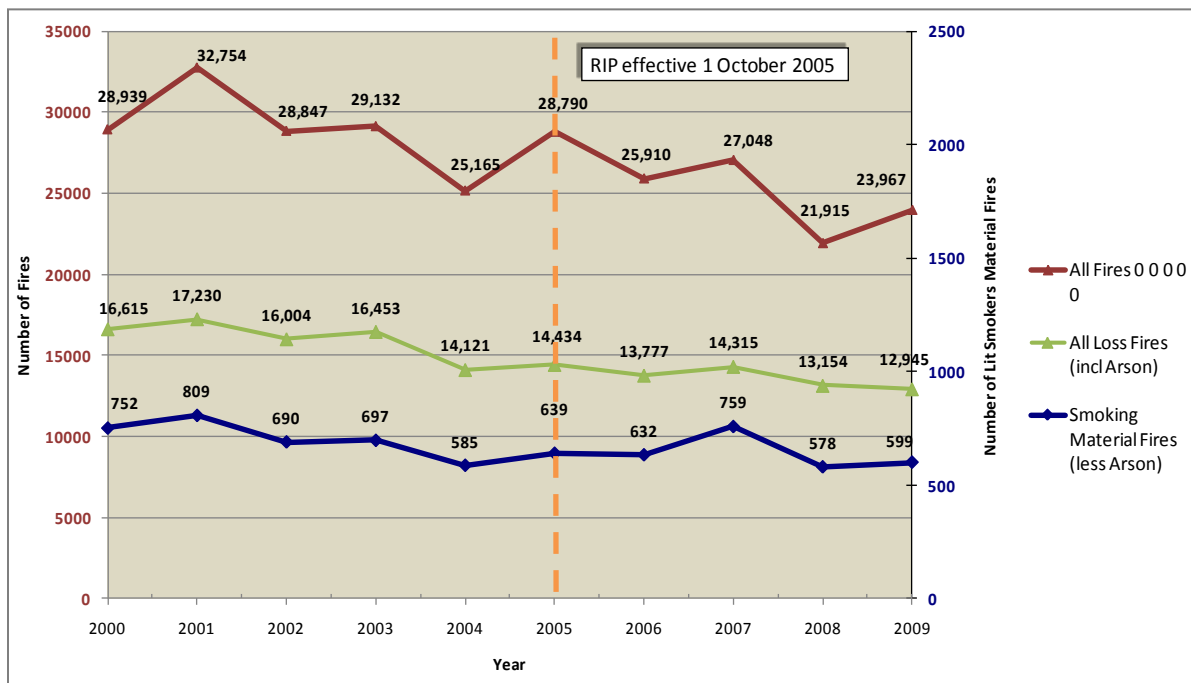
Evaluation of Effectiveness of the RIP Cigarettes in Ontario

The data provided by the Ontario Fire Marshal Office on smoking material fires included only fires with a loss (death, injury, or monetary). These are the fires of most concern to regulators. Excluded are minor fires (those with no losses associated with them) and arson or other deliberately caused fires. According to the Fire Marshal Office, this set of “loss fires” captures the intent of the law to reduce the deaths, injuries, and property damage from fires caused by cigarettes. Ontario does not distinguish between types of smoking material but does distinguish between lit and unlit material. Cigarette fires are included in the “lit material” category.

Trends in Ontario Lit Smoking Material Fires and Fire Casualties

Fires. Fires in Ontario, including smoking material fires, have been trending downward for some time (Figure 4), both before and after the implementation of RIP cigarettes. Total fires from all causes and ignition sources declined 24% in the 10 years between 2000 and 2009. Loss fires—generally larger fires and defined as those fires with dollar loss or casualties—declined 25%. Smoking material loss fires declined 20%. There is no visible break in the trend after the cigarettes are introduced.

Figure 4. Ontario Fires, 2000-2009



Sources:

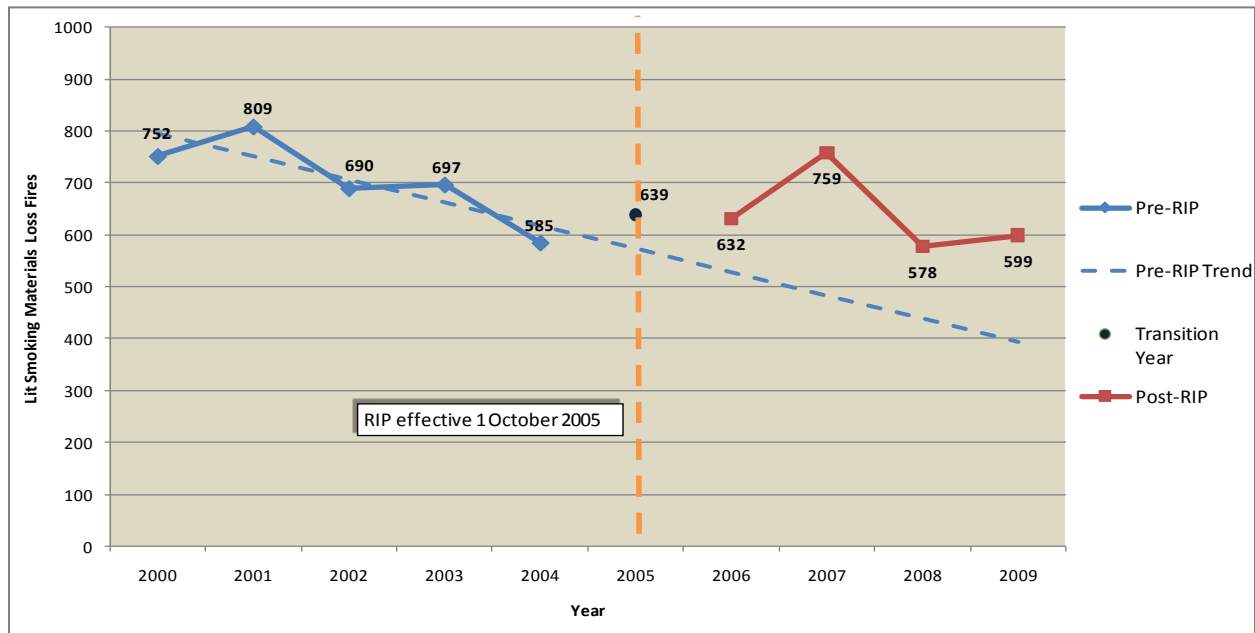
1) *Ontario Fire Incident Summary*, <http://www.ofm.gov.on.ca/en/Media%20Relations%20and%20Resources/Statistics/All%20Fire%20Incidents.asp> (accessed January 14, 2011).

2) Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

More specifically, prior to the introduction of RIP cigarettes, Ontario smoking material fires trended downward 17% between 2000 and 2004 (Figure 5). Immediately after implementation of RIP cigarettes (2006), the data show little change in smoking material fires (639 to 632). The 2007 data show a sharp increase in smoking material fires followed by a settling to approximately pre-RIP 2004 levels. Fire incidence is stochastic, and the 2007 increase is not outside the norm. Between 2006 and 2009, after RIP cigarettes were standard, smoking material loss fires declined 12%, a slower decline than the earlier trend and much less than predicted. The average number of smoking material loss fires was 642, on par with the average for the 2 years immediately preceding the legislation (641 loss fires). The trend of the 2000-2004 data suggest that, had that trend continued, the expected number of lit smoking material fires would have resulted in lower numbers than those seen in the 2006-2009 data.

No evidence of an additional decrease in smoking material fires as a result of the implementation of RIP cigarettes is seen in this trend data.

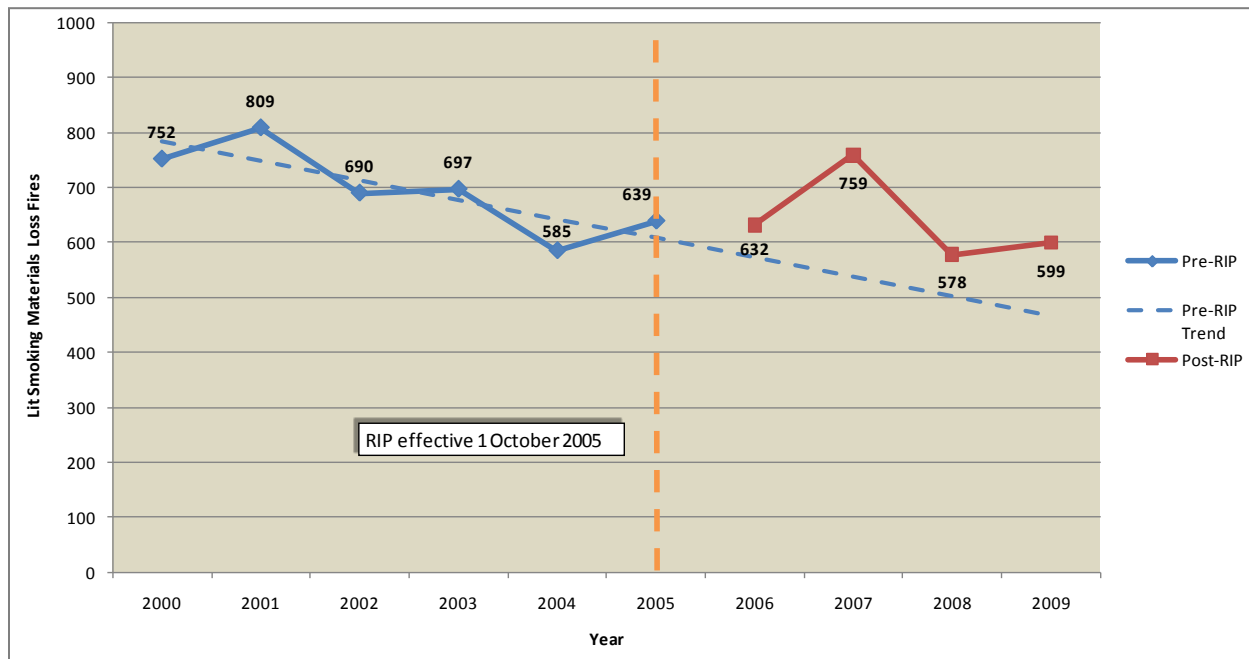
Figure 5. Ontario Loss Fires: Lit Smoking Material Pre- RIP (2000-2004) and Post-RIP (2006-2009) (Excluding 2005, effective year)



Source: Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

The 2005 data can be interpreted as primarily pre-RIP data as it reflects 9 months of non-RIP cigarette sales and 3 months where existing non-RIP cigarette stock was allowed to be sold. When the 2005 data are included as pre-RIP lit smoking material fires (Figure 6), the trend of the 2000-2005 data also suggest that the expected number of lit smoking material fires could have resulted in lower numbers than those seen in the post-RIP data.

Figure 6. Ontario Loss Fires: Lit Smoking Material Pre- RIP (2000-2005) and Post-RIP (2006-2009) (2005 included)

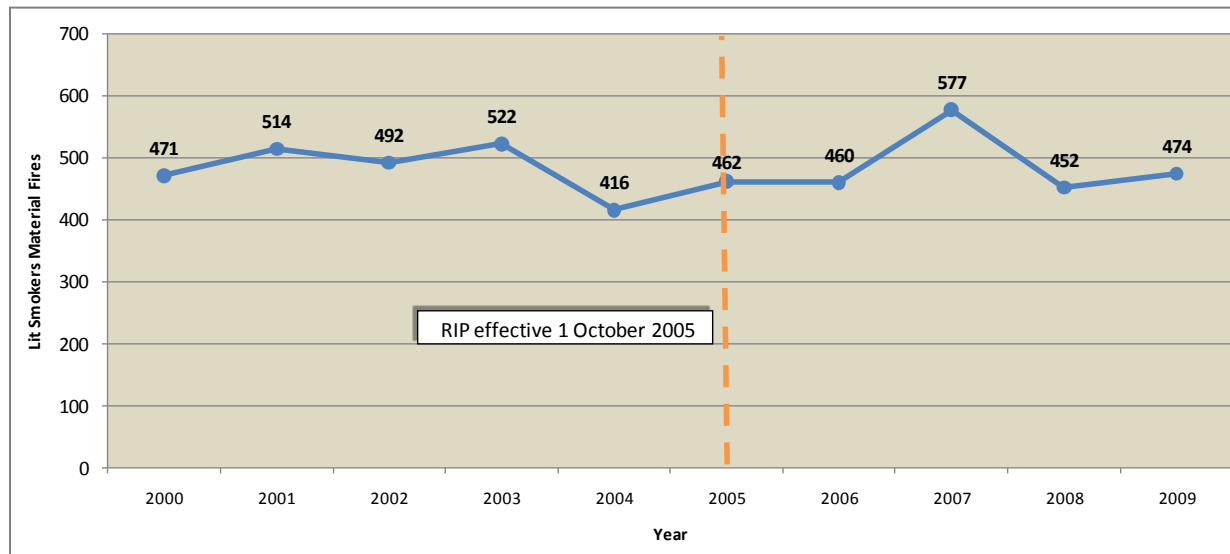


Source: Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

Residential Structure Fires. Fires in residential structures and the resulting losses were a major impetus for the introduction of RIP cigarettes. Little evidence of the effect of RIP cigarettes can be seen in the data presented in Figure 7. Ontario smoking material fires trended downward 8% during the 5 years between 2000 and 2004. Immediately after implementation of the RIP cigarettes (2006), the data show little change in the numbers of reported smoking material fires (462 to 460). The 2007 data show a sharp increase in smoking material loss fires followed by a settling to approximately pre-RIP 2004 levels. As noted above, the 2007 increase is not outside the norm.

Between 2006 and 2009, a period where RIP cigarettes were by regulation the standard, residential structure smoking material loss fires declined 5%, less than the earlier trend. The average number of smoking material loss fires was 491, similar to the average for the two years immediately preceding the legislation (469 loss fires). The 8% decreasing trend of the 2000-2004 data suggest that, had that trend continued, the expected number of lit smoking material fires would have resulted in lower numbers than those seen in the 2006-2009 data. No evidence is seen in this trend data of an additional decrease in residential structure smoking material fires.

Figure 7. Ontario Loss Fires: Residential Structure Lit Smoking Material Fires, 2000-2009



Source: Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

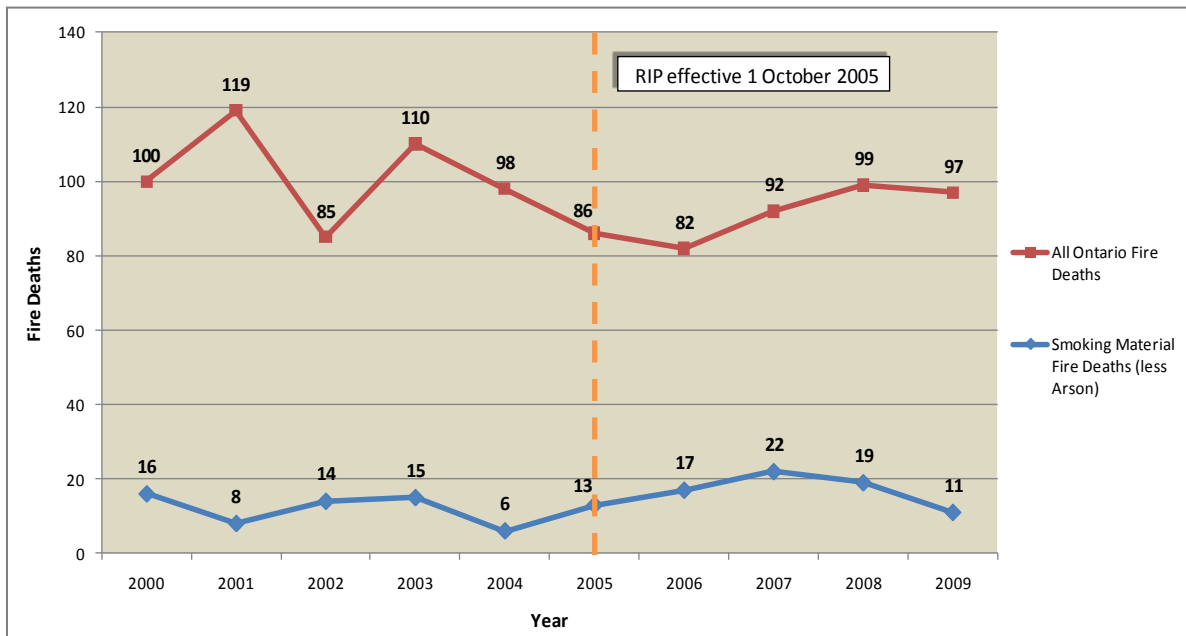
Fire Deaths. Fire deaths in Ontario have ranged between 119 and 82 in the 10 years between 2000 and 2009 (Figure 8). Because of two years in which the numbers of deaths were high, the overall trend indicates a decline in deaths. Considering 2001 and 2003 as outliers, the resulting trends without these two years is relatively flat—a 1% increase.

Fire deaths from lit smoking material fires range between 6 and 22 with no established trend over the years. While an overall increasing trend (39%) can be computed from the data, in part from two years of high numbers of deaths (which occur after the implementation of RIP cigarettes), without these two outliers, the overall trend would show a decrease in lit smoking material fire deaths of 5%.

Fatal fires are relatively rare occurrences. As noted by the Ontario Fire Marshal's Office, "with the small number of fatal fire incidents, a fire with multiple deaths can create variations that are not indicative of a trend".²⁷ Another way to phrase this observation is: RIP cigarettes are designed to prevent ignitions, not what happens after the ignition. For this reason, fatal fires are the preferred metric; data on fatal fires were not available at the time of the analysis.

Including the 2005 fire death data as pre-RIP lit smoking material fire deaths (Figure 9), the trend of the 2000-2005 data suggests that the expected number of fire deaths from lit smoking material fires would have resulted in lower numbers than those seen in the current post-RIP fire death data.

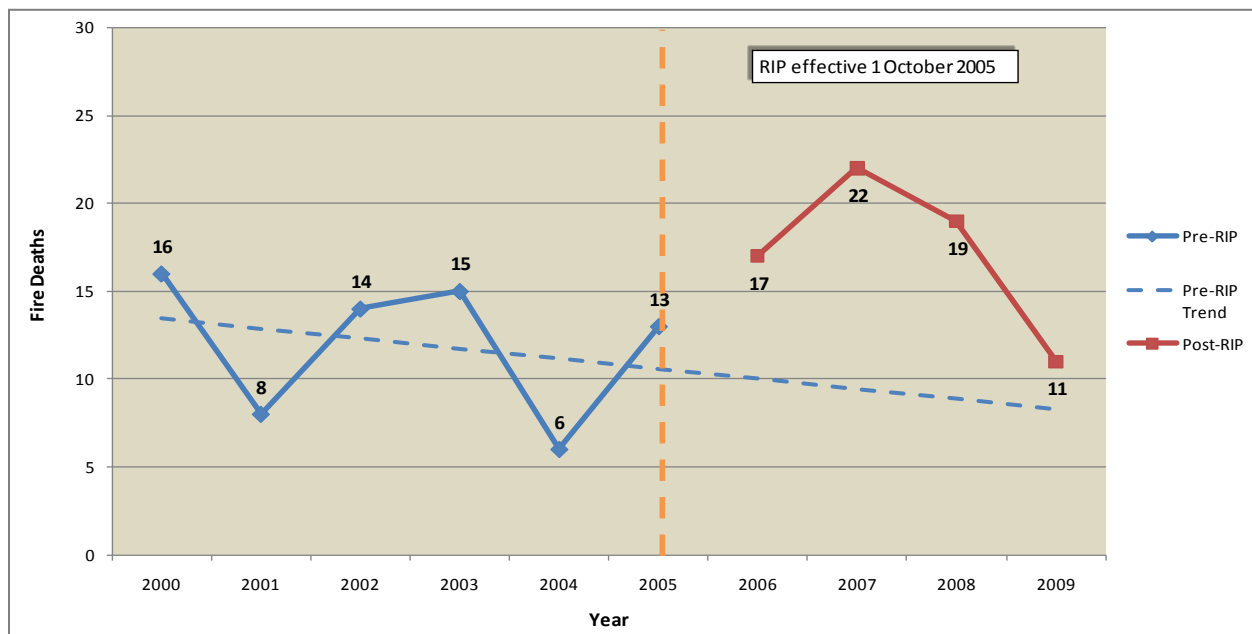
Figure 8. Ontario Fire Deaths, All Causes and Ignitions 2000-2009



Sources:

- 1) *Ontario Fire Incident Summary*, <http://www.ofm.gov.on.ca/en/Media%20Relations%20and%20Resources/Statistics/All%20Fire%20Incidents.asp> (accessed January 14, 2011).
- 2) Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

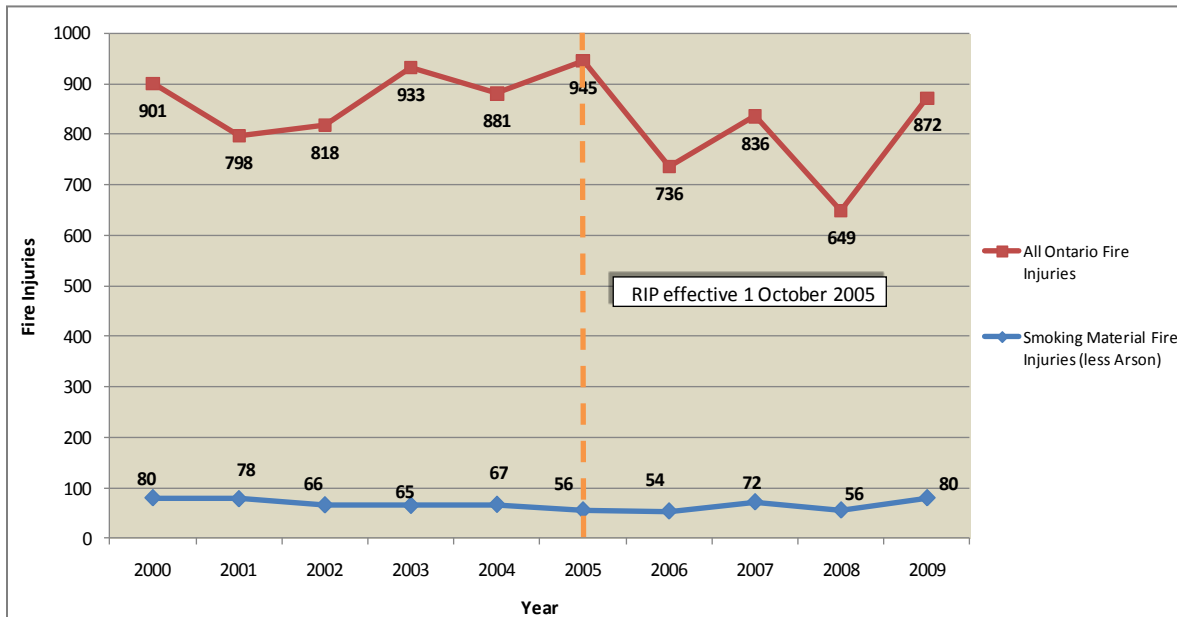
Figure 9. Ontario Loss Fire Deaths from Lit Smoking Material Fires Pre- RIP (2000-2005) and Post-RIP (2006-2009)



Source: Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

Fire Injuries. As with Ontario fire deaths, Ontario fire injuries exhibit great variation from year-to-year. The overall trend in fire injuries suggests an 11% decrease between 2000 and 2009, however, because the data are quite variable, this apparent trend must be viewed with caution. The number of injuries reported in fires ignited by smoking material ranged between 54 and 80. The computed trend in injuries from smoking material fires is a 13% decline (Figure 10). Again, because of the variability in the numbers of injuries, this trend must be viewed with caution and no substantive trend is evident.

Figure 10. Ontario Fire Injuries, 2000-2009

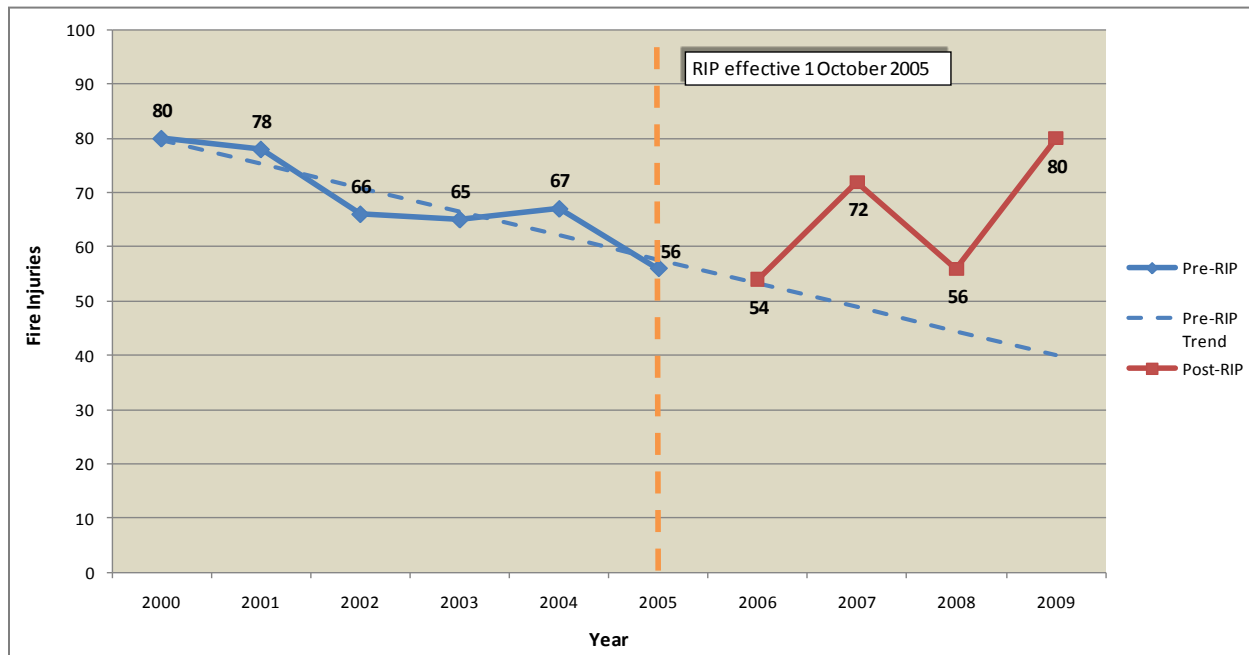


Sources:

- 1) *Ontario Fire Incident Summary*, <http://www.ofm.gov.on.ca/en/Media%20Relations%20and%20Resources/Statistics/All%20Fire%20Incidents.asp> (accessed January 14, 2011).
- 2) Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

Including the 2005 fire injury data as pre-RIP lit smoking material fire injuries (Figure 11), the trend of the 2000-2005 data suggest that the expected number of fire injuries from lit smoking material fires could have resulted in lower numbers than those seen in the current post-RIP fire injury data. A higher degree of variability is seen in the post-RIP injury data, with the lowest number of lit smoking material fire injuries since 2000 coupled with the highest number of injuries. No decrease is evident.

Figure 11. Ontario Loss Fire Injuries: Lit Smoking Material Pre- RIP (2000-2005) and Post-RIP (2006-2009)



Source: Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

Average Number of Fires Pre- and Post-RIP

Because of the variable nature of fire incidence and the resulting losses, several years’ data are often combined to compare the overall averages of fires and fire losses before and after a specific time. This method can attribute a change to the implementation of RIP cigarettes when an underlying trend already exists. That is if, as in the case of fires and fire losses, the current trends suggest an existing decrease, the average of the data “before” will necessarily be larger than the average of the data “after”.

For Ontario lit smoking material fires, the pre-RIP averages of fires are slightly larger (653 vs. 643). Lit smoking material fire deaths and injuries are larger post-RIP (Table 5). No substantive effect of the implementation of RIP cigarettes is seen.²⁸ As well, the predicted reductions from the implementation of RIP-compliant cigarettes are not seen in the data.

Table 5. Three-Year Average, Ontario Lit Smoking Material Fires, Pre- and Post-RIP

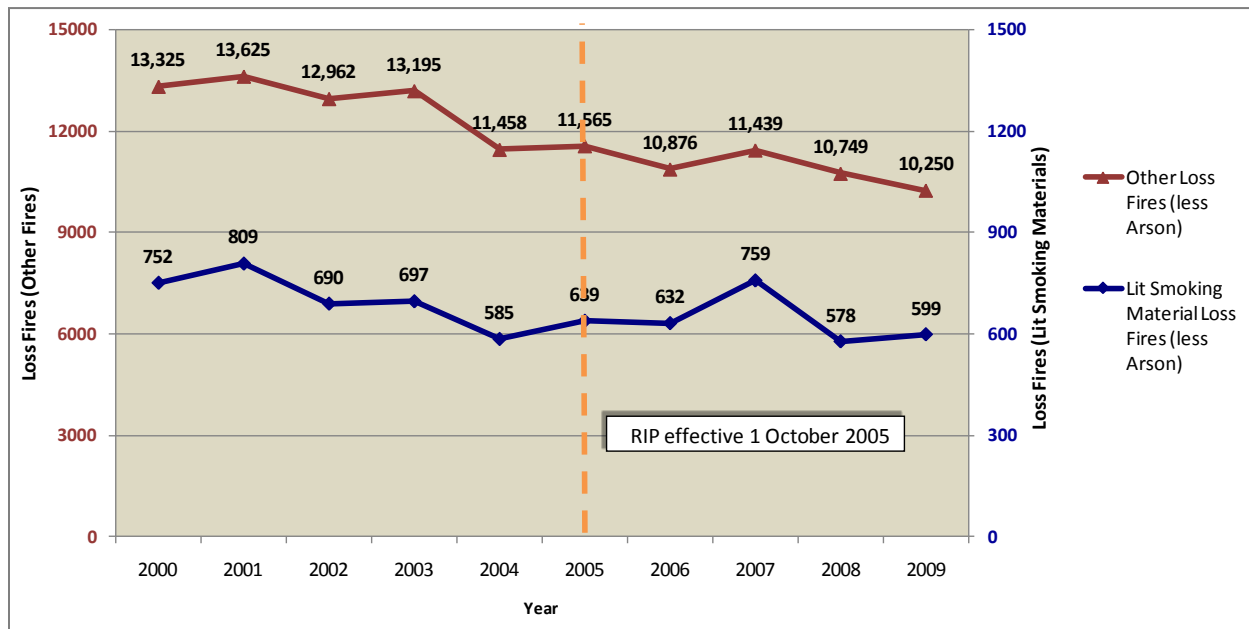
Evaluation Metric	Pre-RIP 2002-2005*	Post-RIP 2006-2009
Fires	653	642
Fire Deaths	12	17
Fire Injuries	64	66

* 2005 data is included in the pre-RIP totals

Smoking Material Loss Fires vs. Other Unintentional Loss Fires

Other unintentional loss fires (those that were not the result of smoking material or arson) declined approximately 22% over the 10-year period (Figure 12). Smoking material loss fires (less arson) declined 20%. As shown in Table 6 below, smoking material fires did not experience the same level of decline in incidence as other unintentional fires post-RIP.

Figure 12. Ontario Loss Fires: Lit Smoking Material vs. Other Non Intentional Fires (All Property Types), 2000-2009



Source: Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

Table 6. Ontario Loss Fires, Ignition Source Fires 2001-2009: Lit Smoking Material vs. All Other (Non Intentional) Fires In All Property Types

Time Period	Dates	Lit Smoking Material	Other Fires (non-intentional)
Prior to RIP introduction	2001-04	Decrease (809 to 585, -28%)	Decrease (13,625 to 11,458, -16%)
Oct 2005 RIP introduction	2005-06	Increase (to 632, +8%)	Decrease (to 10,876, -5%)
Period after RIP introduction	2007	Increase (to 759, +20%)	Increase (to 11,439, +5%)
	2008	Decrease (to 578, -24%)	Decrease (to 10,749, -6%)
	2009	Increase (to 599, +4%)	Decrease (to 10,250, -5%)

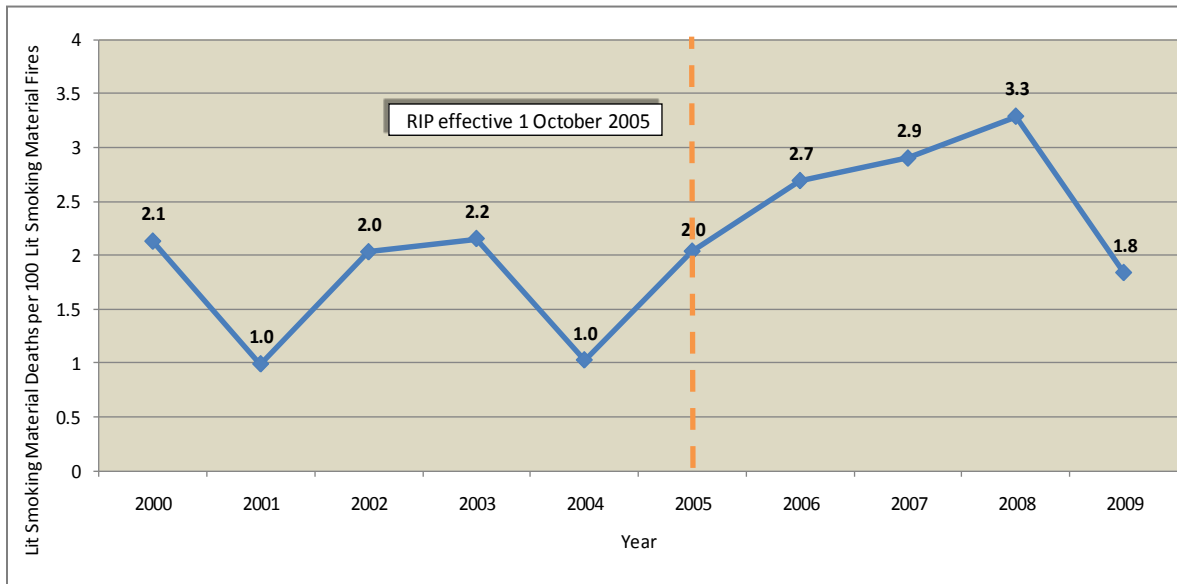
Source: Analysis of lit smoking material data by the Office of the Fire Marshal, Ontario, December 2010.

Fire Deaths per Smoking Material Fire

Figure 13 presents the fire deaths per 100 smoking material fires. This statistic is one measure of the severity of a fire. Pre-RIP, smoking material fire deaths per 100 smoking material fires fluctuated between 1.0 and 2.2 deaths per 100 fires with no trend and an average of 1.7 deaths per 100 fires. Post-RIP, smoking material fire deaths per 100 smoking material fires increased to the highest levels in the decade before returning to pre-RIP levels. While this

statistic is not an indication of the effectiveness of RIP cigarettes per se, it nonetheless shows an unexpected change upwards in the fire severity.

Figure 13. Ontario Smoking Material Fire Deaths per 100 Lit Smoking Material Fires, 2000-2009

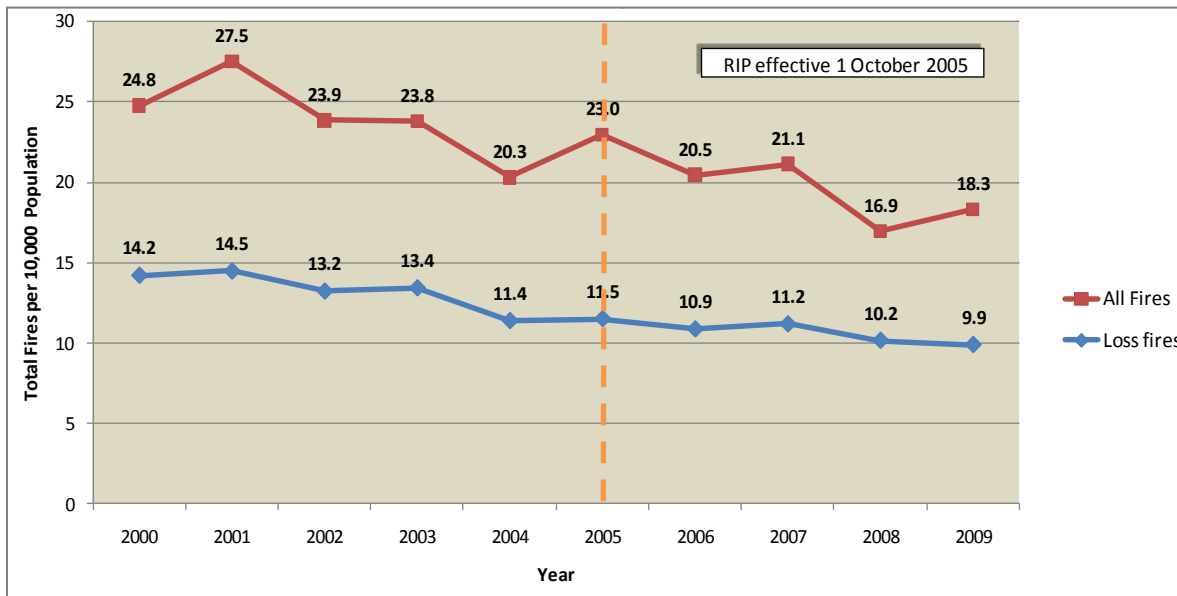


Source: Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

Fires per Capita

A key measure of the change in fire incidence over a period of time is the number of fires per unit population. The underlying assumption is that there exists a positive relationship between people and fires—that is, more people, more fires and conversely, fewer people, fewer fires. Fewer fires (or more fires) do not necessarily indicate a positive (or negative) change in the relative incidence of fires; it may merely be an indication of a population shift. Changes in fire per unit population, however, are an indication of actual change in risk. In Ontario, the decline in fire incidence seen in Figure 4, is underscored by the decline in fires per 10,000 population for both fires overall (32%) and for the more significant fires—loss fires (51%) (Figure 14). In both cases, the combination of declining fire incidence and increasing population result in substantial decreases in per capita fire incidence.

Figure 14. Ontario Fires per 10,000 Population, 2000-2009

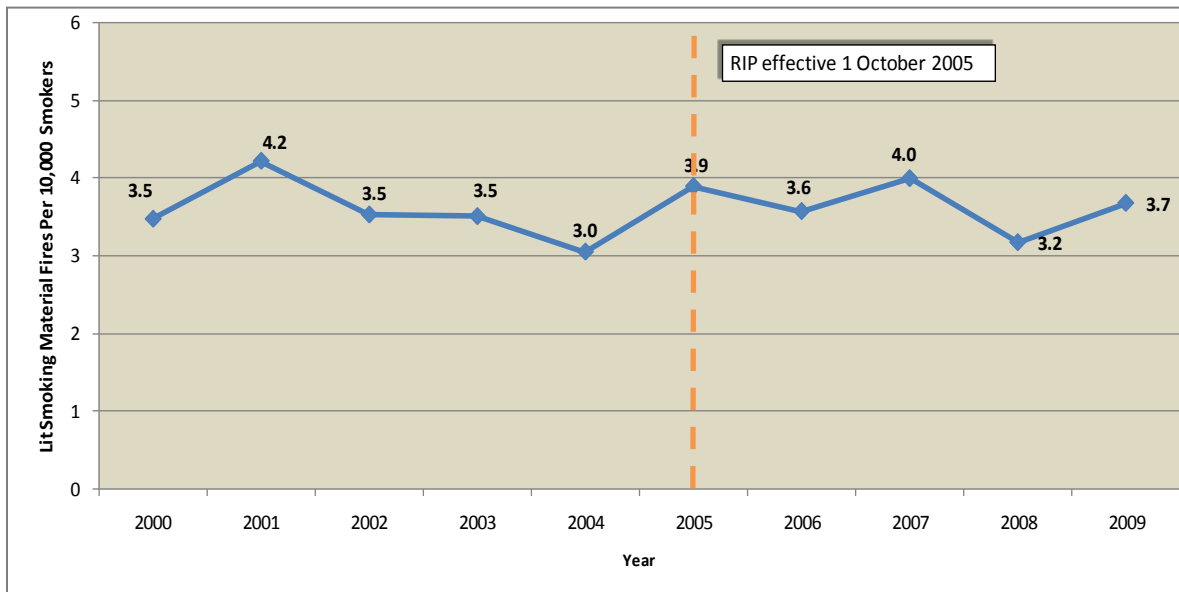


Sources:

- 1) Ontario Fire Incident Summary, <http://www.ofm.gov.on.ca/en/Media%20Relations%20and%20Resources/Statistics/All%20Fire%20Incidents.asp> (accessed January 14, 2011).
- 2) Ontario population and selected characteristics, 2001-2036, <http://www.fin.gov.on.ca/en/economy/demographics/projections/table3.html> (accessed February 1, 2011).
- 3) Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

Fires involving lit smoking material, however, should not be evaluated on a general population basis. The proper population basis for these fires is smokers, a subset of the population. Were there no smokers, one would expect essentially no smoking material fires. The combination of estimated decrease in smoking prevalence in Ontario with the estimated increase in the population of those 15 years and older (the general target smoking population) has resulted in an estimated decrease in the smoking population of approximately 17% to 18%.^{29, 30} Lit smoking material fires have decreased by 20% (Figure 4); the net reduction in lit smoking material fires per 10,000 smokers is 3% (Figure 15). No substantive effect of the implementation of RIP cigarettes is seen in terms of fire incidence per 10,000 smokers.

Figure 15. Ontario Lit Smoking Material Fires per 10,000 Smokers Age 15 and Over, 2000-2009



Sources:

- 1) Percentage of current smokers, by province and age group, age 15+ years, Canada 1999 to 2009, http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/ctums-esutc_2009/ann-histo-eng.php (accessed February 1, 2011).
- 2) Ontario population and selected characteristics, 2001-2036, <http://www.fin.gov.on.ca/en/economy/demographics/projections/table3.html> (accessed February 1, 2011).
- 3) Lit Smoking Material Fire Data from the Ontario Fire Marshal's Office, December 2010.

Smoking Material Fires by Cigarettes Sold

By 2008, 2 of every 5 cigarettes consumed in Ontario were estimated to have been purchased outside of Ontario's taxing and reporting system (i.e., were contraband).³¹ Studies by both the tobacco industry and health advocates identify the eastern provinces of Quebec and Ontario as having the most serious contraband cigarette sales problem in Canada.^{32, 33} Despite Health Canada data for 2009 that indicates a small increase in legitimate cigarettes sales for the first time since 1998, contraband tobacco sales continue to be a significant issue (Table 7).^{34, 35} The percent contraband increased very sharply in the years following the introduction of the RIP cigarettes; it is not clear, however, what caused the increase. It is possible that contraband cigarettes mask the effect of the RIP-compliant cigarettes.

Table 7. Estimated Percentage of Contraband Cigarette, Ontario 2003-2008

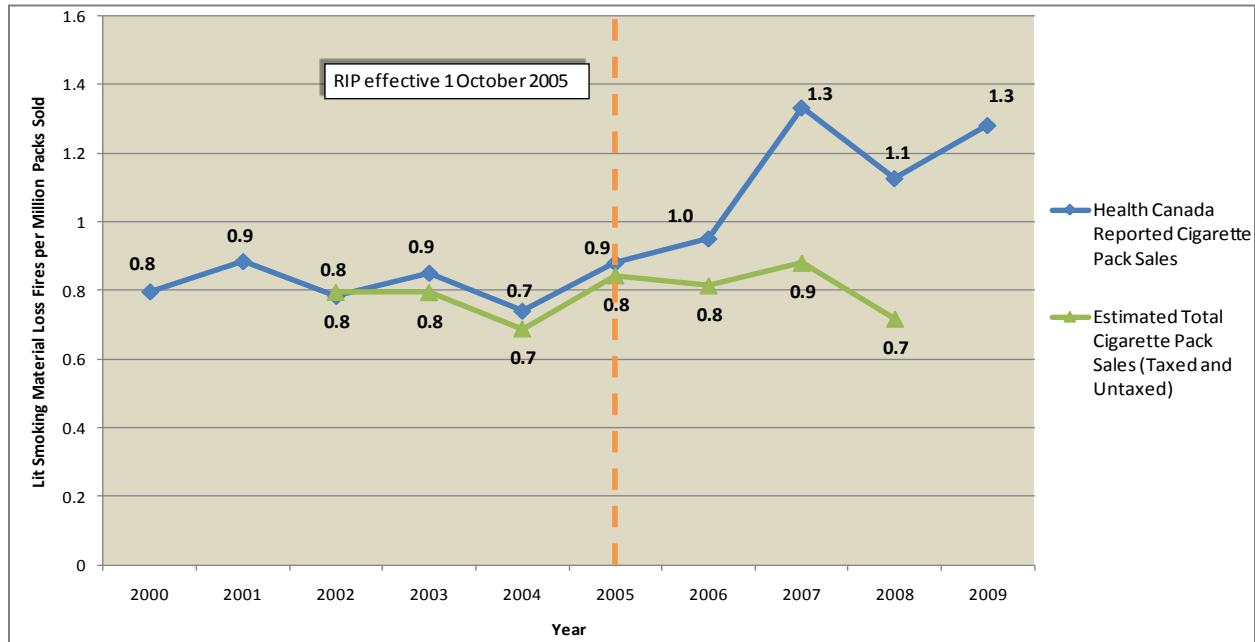
Year	2003	2004	2005	2006	2007	2008
Contraband Sales as % Total Sales	-2%	3%	1%	18%	33%	42%

Source: The Canadian Tobacco Market Place. *Estimating the Volume of Contraband Sales of Tobacco in Canada*. Ontario, Canada: Physicians for a Smoke-Free Canada. April 2010.

Figure 16 presents smoking material fires per million cigarette packs sold for both legal sales and for estimated total cigarette sales (which includes contraband cigarette sales). Driven by declining numbers of legal, RIP cigarette sales, the smoking material fires per million legal cigarette packs sold (upper curve) exhibits a substantial increase post-RIP. The lower curve, smoking material fires per estimated million cigarette packs sold (both legal and illicit), shows a

consistent level of fires per million cigarette packs with an overall increase of 2%. The year with the lowest smoking material fires per million cigarette packs sold since RIP implementation, 2008, is also the year with the potentially the highest proportion of contraband cigarettes in the marketplace, an unexpected outcome.

Figure 16. Ontario Lit Smoking Material Fires per Million Cigarette Packs Sold, 2000-2009



Sources:

- 1) *Cigarette Sales in Ontario, 1980-2009*, <http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/indust/sales-ventes/eng.php> (accessed February 1, 2011). Converted to packs (20 cigarettes per pack).
- 2) Smoking material loss fire data from Ontario Fire Marshal's Office, December 2010.
- 3) The Canadian Tobacco Market Place. *Estimating the Volume of Contraband Sales of Tobacco in Canada*. Ontario, Canada: Physicians for a Smoke-Free Canada. April 2010. 2002 total sales estimates were separately derived from data presented in the report.

As estimates of the percentages of compliance (RIP) and noncompliance (non-RIP) among contraband cigarettes were not available, three scenarios were postulated for purposes of evaluating the effect of contraband sales on the evaluation of RIP cigarettes:

- All contraband cigarettes in Ontario were RIP, making RIP cigarettes universally available in Ontario,
- All contraband cigarettes in Ontario were not RIP, creating a mix of RIP and non-RIP cigarettes, the relative proportion of non-RIP cigarettes equivalent to the estimated level of contraband sales, or
- Some portion of contraband cigarettes are RIP, creating a mix of RIP and non-RIP cigarettes but at a higher RIP consumption level.

Previously, the analytic case was proposed to include 2005, the year the RIP standard was effective, as wholly pre-standard data. For ease of analysis in this instance a conservative approach is taken: 2006 cigarette consumption is left aside as remaining inventory of pre-RIP

cigarettes was permissible and no estimates of the sales RIP and non-RIP cigarettes are available.³⁶

If one assumes that as of January 2007, 15 months after the effective date of the standard, all inventories of pre-RIP cigarettes are depleted then all 2007 legally purchased cigarettes are RIP-compliant. If the maximum estimate of the proportion of cigarettes that are contraband is 33% in 2007 and 42% 2008, the period during which only RIP cigarettes could be legally sold and for which estimates of contraband sales are available, this implies that at least 58% of cigarettes in Ontario post-RIP (the minimum of 2007 and 2008 estimates) were RIP cigarettes (Table 8). Further, this implies that while the full effect of RIP cigarettes may not be seen, a significant reduction would have been expected as over half the available cigarette market was RIP-compliant. This reduction is not seen.

To rephrase the earlier observation then: 2008, the year with the lowest number of smoking material fires per million cigarette packs sold since RIP implementation, is also the year with the potentially the lowest proportion of compliant (RIP) cigarettes in the marketplace.

From this analysis, still no substantive effect of the implementation of RIP cigarettes is seen.

Table 8. Estimated Percentage of Contraband Cigarette Sales and Resulting RIP Cigarette Saturation, Ontario 2003-2008

Year	2003	2004	2005	2006	2007	2008
Contraband Sales as % Total Sales (Table 7 above)	-2	3	1	18	33	42
Implied minimum % RIP Cigarettes	--	--	--	--*	67	58

*Some non-RIP cigarette sales are still permissible in 2006 as stock depleted; 2006 data is not used.

Source: The Canadian Tobacco Market Place. *Estimating the Volume of Contraband Sales of Tobacco in Canada*. Ontario, Canada: Physicians for a Smoke-Free Canada. April 2010.

Summary

In Ontario, the implementation of RIP cigarettes had no substantive effect in decreasing smoking material related fires, deaths and fire injuries. Trend analyses of overall smoking material fires, deaths, and injuries demonstrated that existing trends were continued or, as in the case of injuries, the post-RIP trends were mild increases. In particular, the trend analysis of residential smoking material fires, the primary focus of smoking material fire improvement, did not show the predicted decrease of smoking material related fires—rather, the data show no effect. Overall, the large predicted decreases in fires and deaths were not realized; moreover, the data show no additional decreases after the implementation of RIP cigarettes.

In addition, smoking material fires showed no increased reduction in comparison to other non-smoking fires. On the contrary, fires from other heat sources decreased faster than smoking material fires, regardless of the implementation of RIP cigarettes. An unexpected result was an increase in smoking material fire deaths per smoking material fire.

Analyses controlling for smoking population changes and for changes in cigarette consumption confirm that the implementation of RIP cigarettes did not result in the predicted decrease of smoking material related fires. Again, the data show no effect.

Based on these analyses with existing data from Ontario, the implementation of RIP cigarettes did not produce decreases in smoking material fires and fire losses above pre-RIP established trends and did not produce the magnitude of predicted reductions.

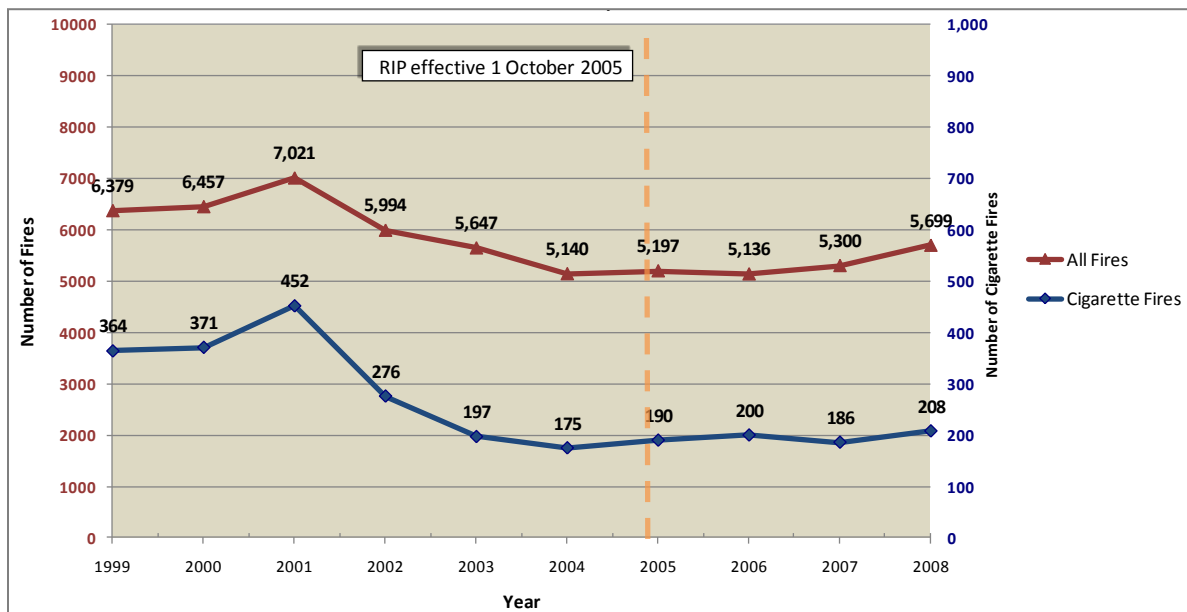
Evaluation of Effectiveness of RIP Cigarettes in Alberta

Alberta is the only Canadian province that tracks cigarettes as a separate ignition source. The data provided by the Alberta Emergency Management Agency from their Fire Statistics Information System are for fires caused by cigarettes (not the broader category of smoking material). Included in the data set are all fires from all causes and ignition sources.

Trends in Cigarette Fires and Fire Casualties

Fires. Fires from all causes and ignition sources in Alberta, including cigarette-ignited fires, trended downward between 1999 and 2008, the most recent period for which fire data were available (Figure 17). Overall fires declined 22% in the 10 years between 1999 and 2008. Cigarette fires declined 56% to 61% depending on the inclusion of the 2001 data (a potential outlier; discussions in the subsequent analyses of the Alberta fire data present a range to account for the 2001 data peak). Much of the decline in fires in general and in cigarette-ignited fires occurred prior to 2003. Since 2003, the incidence of both fires in general and in cigarette-ignited fires has been relatively level, with a mild upturn in recent years.

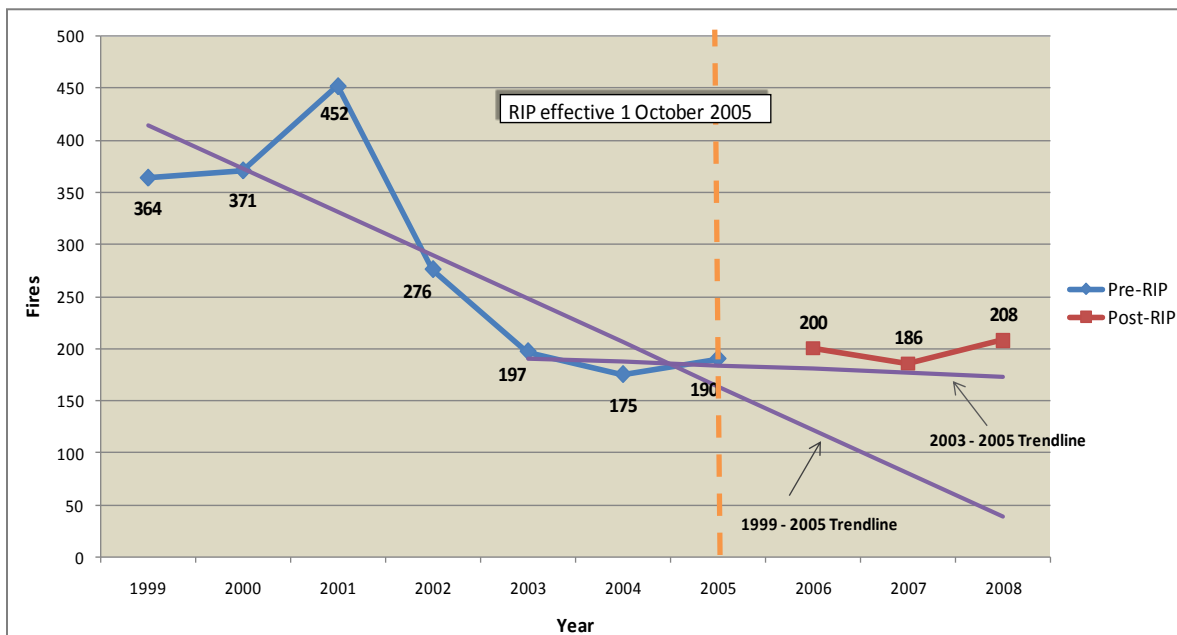
Figure 17. Alberta Fires, 1999-2008



Source: Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.

As with the Ontario fire data, for ease of analysis the 2005 data can be interpreted as primarily pre-RIP data. When the 2005 data are included as pre-RIP cigarette-ignited fires (Figure 18), Alberta cigarette-ignited fires trended downward 58%-60% during the 6 years between 1999 and 2005 (Figure 18). After implementation of RIP cigarettes (2006), the data show the typical variability in fire incident data with increases and decreases in the numbers of reported cigarette-ignited fires; reported fires range from 186 to 208. Between 2006 and 2008, a 3-year period where RIP-compliant cigarettes were by regulation the standard, cigarette-ignited fires trended upward, increasing 4%. The average number of cigarette-ignited fires was 198, higher than the average for the 3 years immediately preceding the legislation (187 fires). While the 1999-2005 trend would have been unlikely to sustain, the data suggest that had the more modest 2003-2005 trend data continued, the expected number of cigarette-ignited fires would have resulted in lower numbers than those seen in the subsequent 2006-2008 data. No evidence of an additional decrease in cigarette-ignited fires as a result of the implementation of RIP cigarettes is seen in this trend data.

Figure 18. Alberta Cigarette Fires: Pre-RIP (1999-2005) and Post-RIP (2006-2008)



Source: Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.

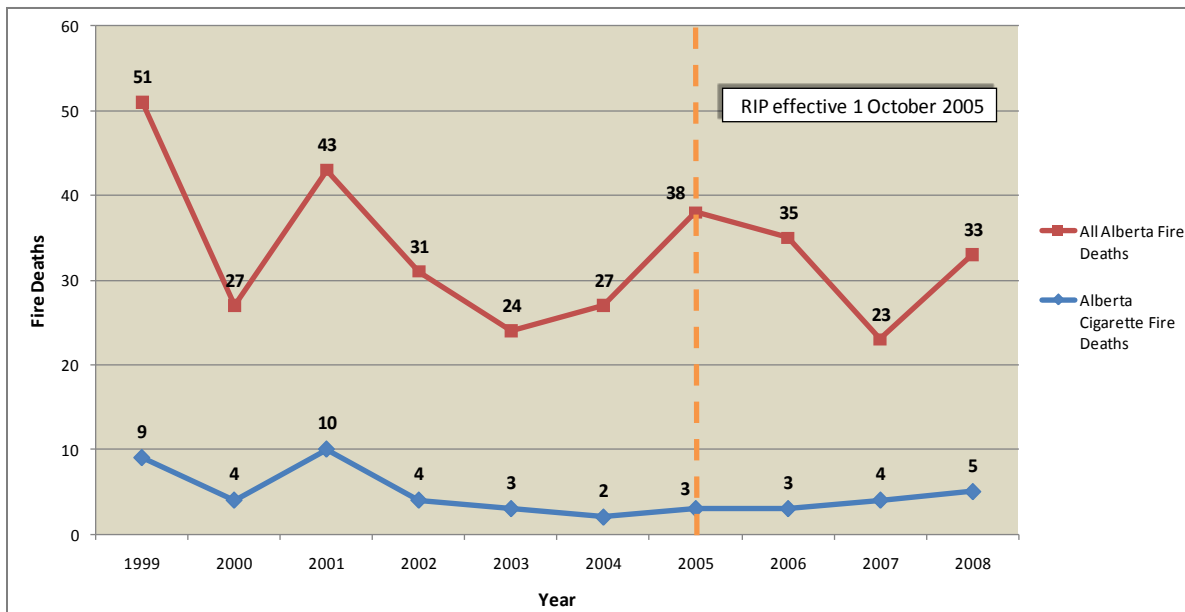
Fire Deaths. Fire deaths in Alberta ranged between 51 and 23 in the 10 years between 1999 and 2008 (Figure 19). As with Ontario (and any small set of fire casualty data), a fire with multiple deaths can create variations that are not indicative of a trend. No trend is clear; the data show much year to year fluctuation.

Fire deaths from cigarette-ignited fires ranged between 2 and 10 during the same period. No trend is clear. The numbers of deaths are consistently below 10 since 2002.

Including the 2005 fire death data as pre-RIP cigarette-ignited fire deaths (Figure 20), the post-RIP fire death data (2006-2008) do not suggest an improvement in the number of fire

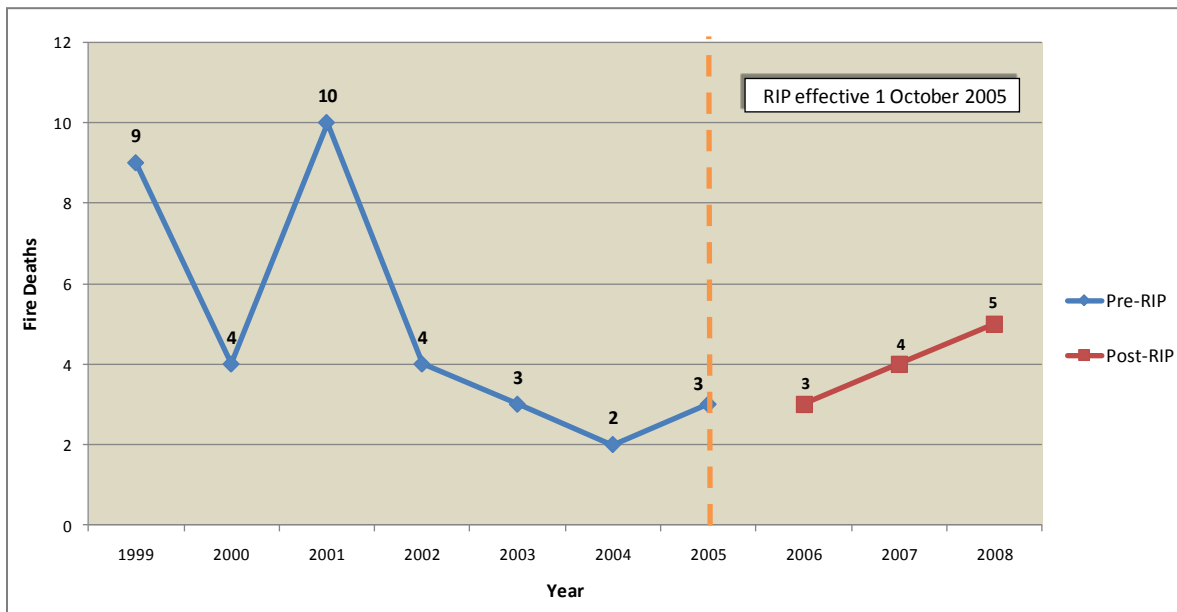
deaths from cigarette-ignited fires. Fire deaths from cigarette-ignited fires had already been reduced very low levels prior to the implementation of RIP cigarettes. The effectiveness of RIP cigarettes in reducing deaths from cigarette-ignited fires cannot be concluded from the data. Nonetheless, the predicted reductions in cigarette-ignited fire deaths are not demonstrated in the data.

Figure 19. Alberta Fire Deaths, 1999-2008



Source: Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.

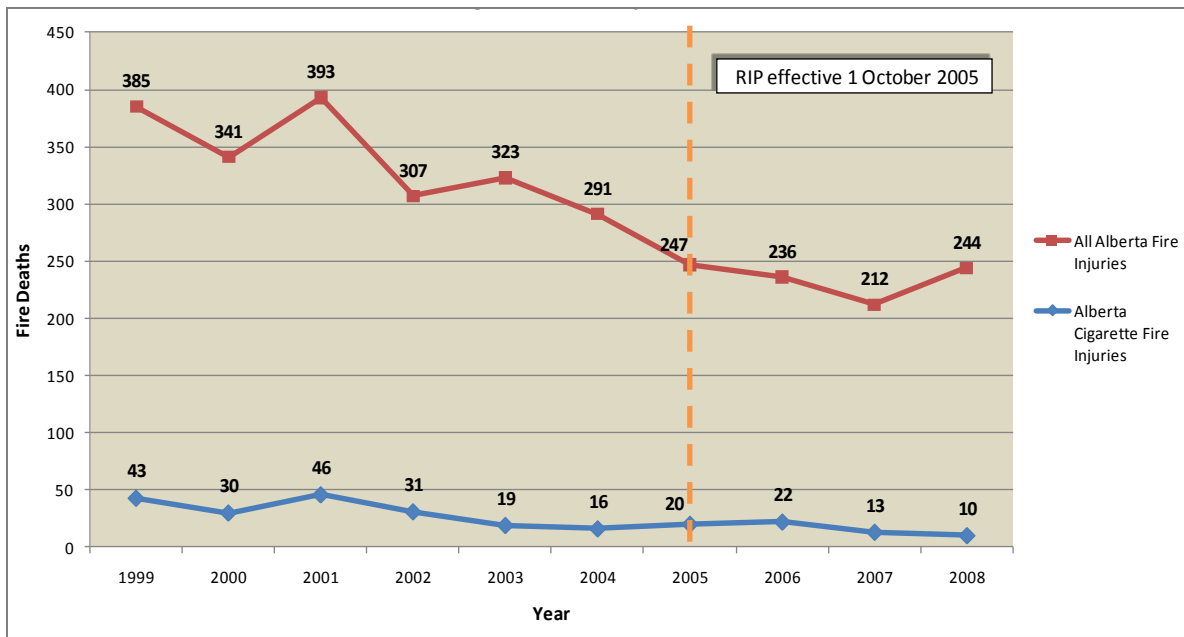
Figure 20. Alberta Cigarette Fire Deaths: Pre- RIP (1999-2005) and Post-RIP (2006-2008)



Source: Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.

Fire Injuries. Alberta fire injuries trended downward 45% between 1999 and 2008. The number of injuries reported in fires ignited by smoking material ranged between 10 and 46. The trend in injuries from cigarette-ignited fires declined 65% to 77%, depending on the inclusion of the possible outlier in 2001 (Figure 21).

Figure 21. Alberta Cigarette Fire Injuries, 1999-2008

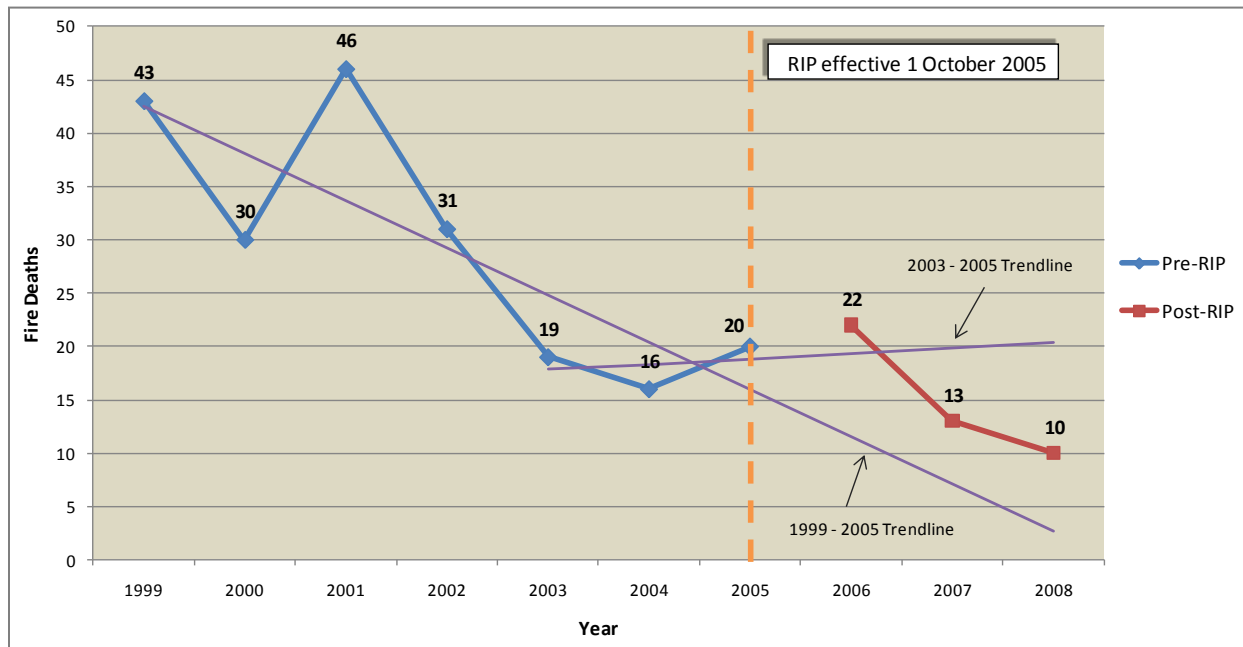


Source: Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.

The 2005 cigarette-ignited fire injury data are included as pre-RIP cigarette-ignited fire injuries in Figure 22. The 2006 post-RIP cigarette-ignited fire injuries (22) were higher than the injuries from 3 previous pre-RIP years. (As a caution, with a relatively small number of fire incidents with casualties, any fire with multiple injuries can create variations that do not reflect a trend or a significant change.) The 2007 and 2008 post-RIP fire injuries are below any reported pre-RIP cigarette ignited fire injuries.

As with cigarette-ignited fires, the 1999-2005 trend in pre-RIP cigarette-ignited fire injuries (50% to 62%) would have been unlikely to sustain. The last 3 years of pre-RIP fire injuries have little fluctuation and suggest an increasing trend (6%). It would be reasonable to expect that, without RIP, continued decreases in the number of cigarette-ignited fire injuries would fall between the two trendlines. As well, it is reasonable to observe that the 2007 and 2008 post-RIP cigarette-ignited fire injuries are the lowest in the 10-year period and reverse the development of an increasing trend. The caution noted above concerning the relatively small number of fire incidents with casualties must be reiterated. As a result, the effectiveness of RIP cigarettes in reducing injuries from cigarette-ignited fires cannot be sufficiently concluded from the data.

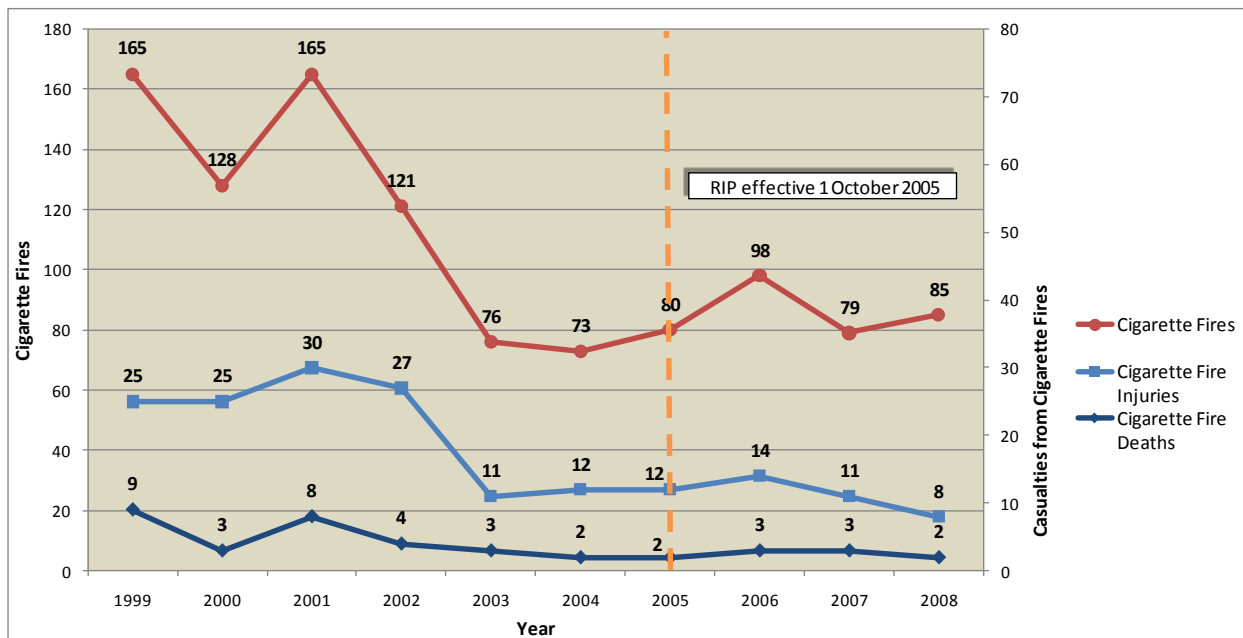
Figure 22. Alberta Loss Fire Injuries: Cigarette-ignited Pre-RIP (1999-2005) and Post-RIP (2006-2008)



Source: Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.

Ignition Scenarios. Figure 23 further restricts the analysis to only those cigarette fires in a selected set of scenarios—those wholly unintentional situations where a fire involves upholstered furniture, mattresses, bedding, and other flammable materials; in short, scenarios RIP cigarettes were designed to address.³⁷ Under these tight conditions, fires are unaffected and increase slightly. Fire deaths from cigarette ignited fires improve somewhat, however, the numbers of deaths are too small to discount expected variations. Injuries also improve in 2007 and 2008 after an increase in 2006, indicating that expected fluctuations may actually be the driving force behind the trend. Based on the available data, the anticipated reductions from the implementation of RIP cigarettes are not evident in these data.

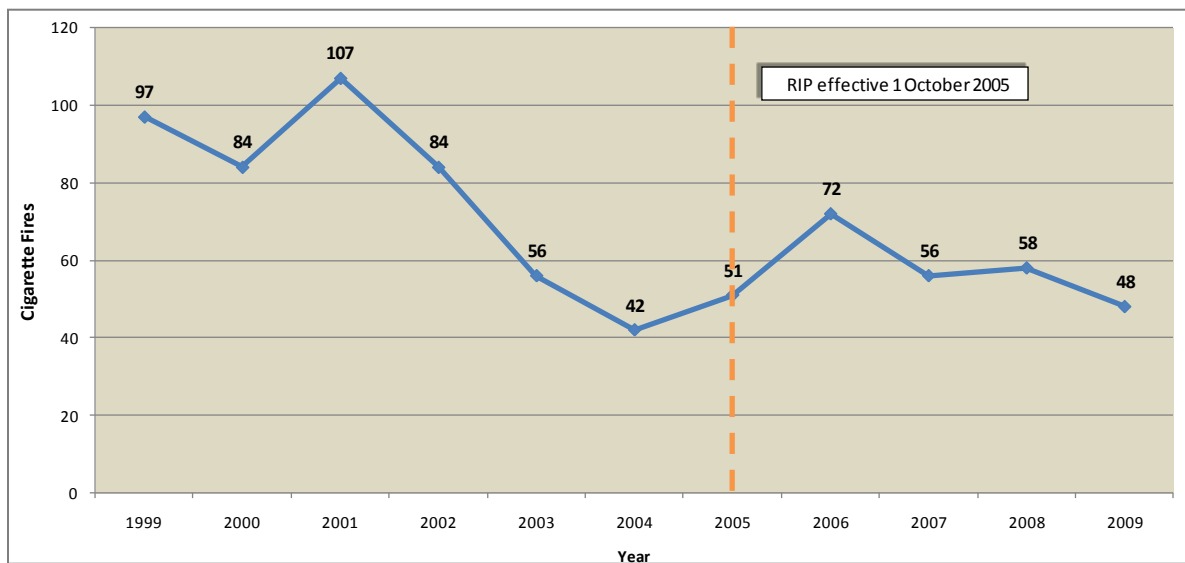
Figure 23. Alberta Cigarette Fires and Losses: Selected Scenario & Materials, 1999-2008



Source: Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.

Calgary and Edmonton have good fire investigation units and more confidence can be placed on their data. When these ignition scenarios are evaluated using only fire data from Calgary and Edmonton the expected reductions are not seen; cigarette fires increase post-RIP and not return to pre-RIP levels until 2009 (Figure 24).

Figure 24. Calgary and Edmonton Cigarette Fires: Selected Scenario & Materials, 1999-2009

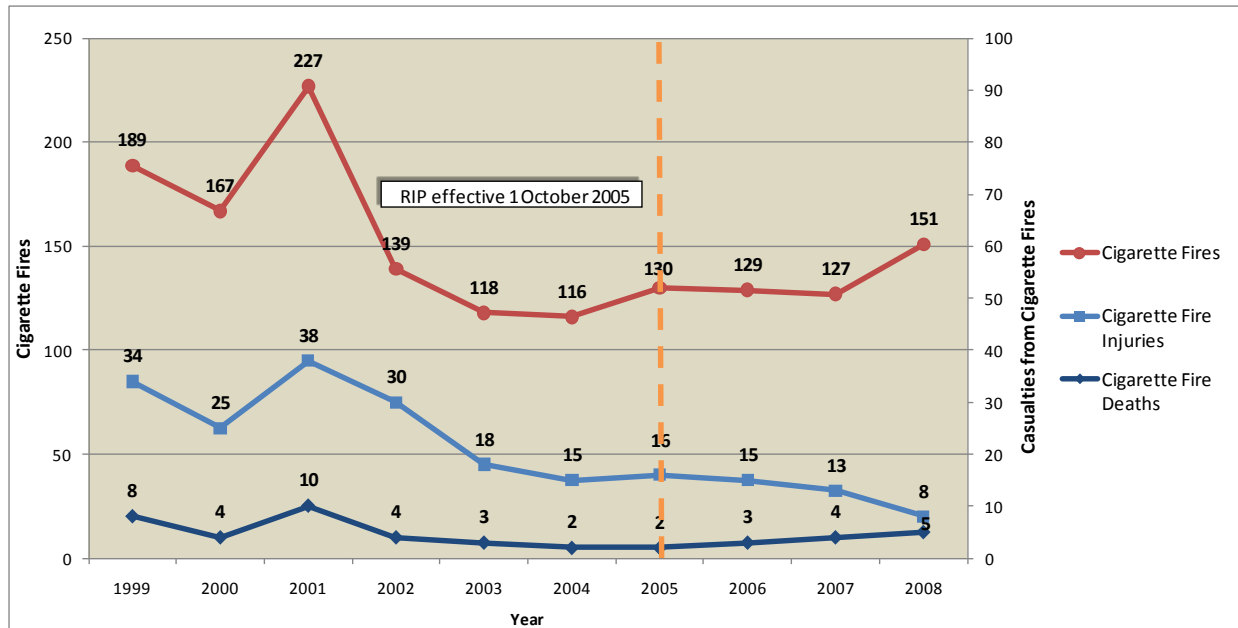


Residential Properties

Figure 25 presents data on unintentional cigarette fires and fire losses in residential properties (that is, arson fires are not included). Cigarette fires and fire deaths increase, slightly, post RIP implementation. Deaths occur in small numbers and drawing conclusions from the

death data is not possible. Injuries from cigarette-ignited fires, however, decrease consistently. In 2008, they reach the lowest level in the 10-year period. While injuries decreased, the effect of the regulation is not evident with respect to residential cigarette fires.

Figure 25. Alberta Cigarette Fires and Losses: Non-Incendiary Residential Property Fires, 1999-2008



Source: Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.

Average Number of Fires Pre- and Post-RIP

Because of the variable nature of fire incidence and the resulting losses, several years’ data are often combined to compare the overall averages of fires and fire losses before and after a specific time. As noted previously, this method may attribute a change to the implementation of RIP cigarettes when an underlying trend already existed.

For Alberta cigarette-ignited fires, the average number of fires is higher post-RIP (198 vs. 187). The average number of fire deaths is also higher post-RIP; this increase, however, may not be indicative of a sustained change for reasons discussed previously. The average number of injuries is smaller post-RIP (Table 9). The implementation of RIP cigarettes shows no substantive effect in decreasing cigarette-ignited fires and fires losses.

Table 9. Three-Year Average, Alberta Cigarette-ignited fires, Pre- and Post-RIP

Evaluation Metric	Pre-RIP 2002-2005*	Post-RIP 2006-2009
Fires	187	198
Fire Deaths	3	4
Fire Injuries	18	15

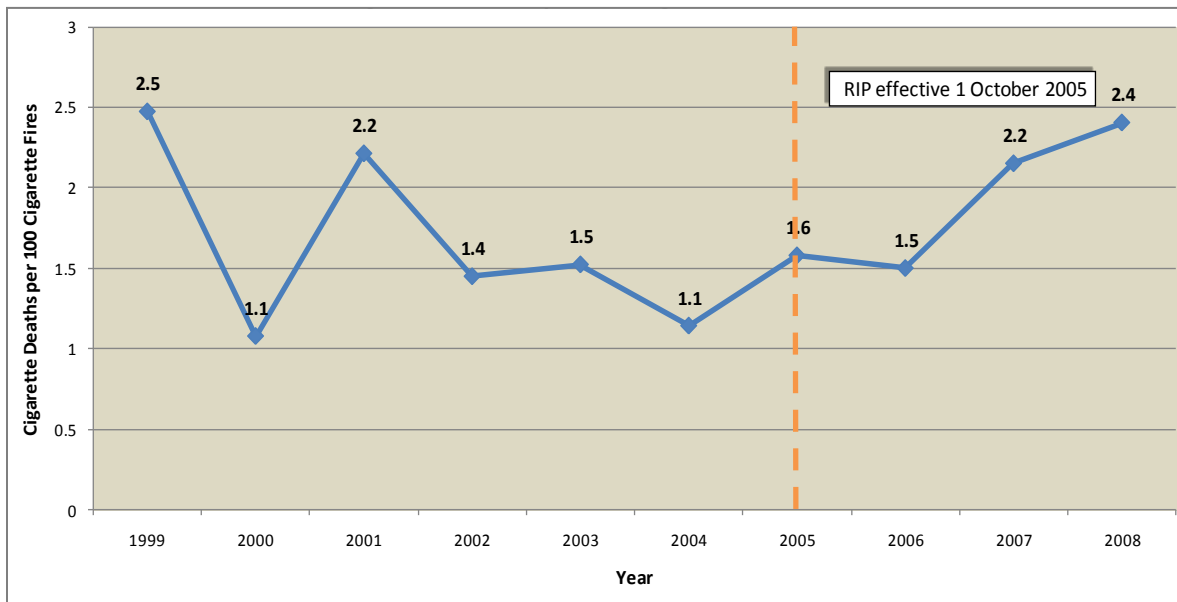
* 2005 data is included in the pre-RIP totals

Source: Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.

Fire Deaths per Cigarette-Ignited Fire

Figure 26 presents the fire deaths per 100 cigarette-ignited fires, a statistic used to measure the severity of a fire. Pre-RIP, cigarette-ignited fire deaths per 100 cigarette-ignited fires fluctuated between 1.1 and 2.5 deaths per 100 fires with no trend and an average of 1.6 deaths per 100 fires. Post-RIP, cigarette-ignited fire deaths per 100 cigarette-ignited fires increased each year, beginning at 1.5 deaths per 100 fires in 2006 rising to 2.4 deaths per 100 fires. While this statistic is not an indication of the effectiveness of the RIP cigarettes per se, as in the Ontario data, it shows an unexpected change in the fire severity.

Figure 26. Alberta Cigarette Fire Deaths per 100 Cigarette Fires, 1999-2008



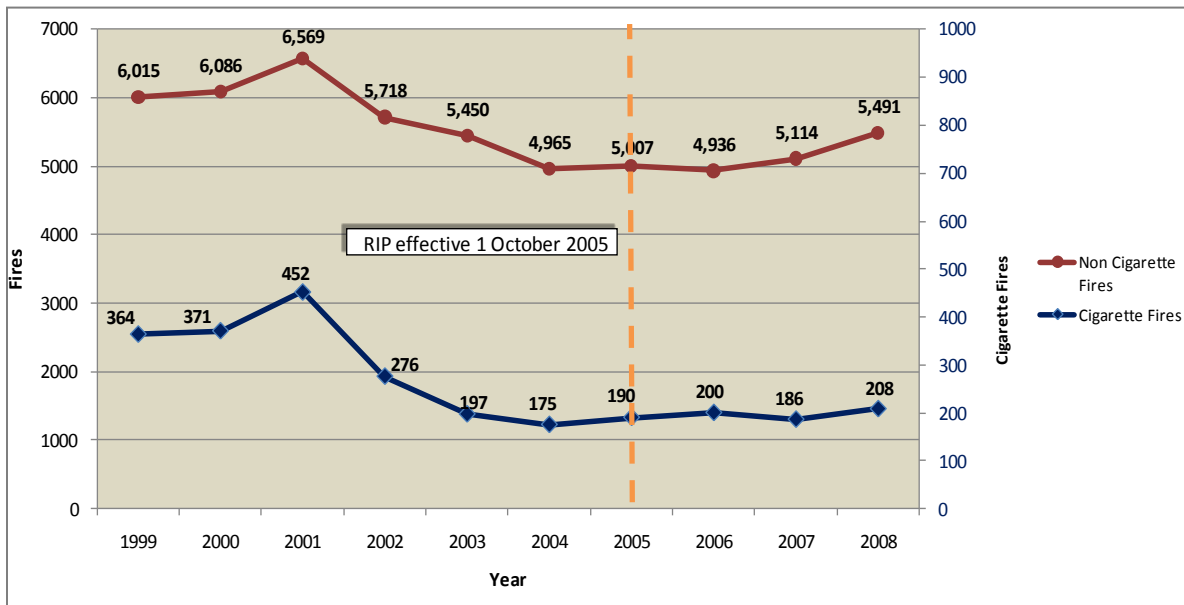
Source: Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.

Cigarette-Ignited Fires vs. Non-Cigarette-Ignited Fires

Non-cigarette-ignited fires (that is, fires caused by heat sources other than cigarettes) declined 17% to 20% between 1999 and 2008, depending on the inclusion of the 2001 data (a potential outlier) (Figure 27). The fires ranged from a high of 6,589 (2001) to a low of 4,965 (2004). Fires from non-cigarette heat sources show an increasing trend (11%) between 2006 and 2008.

Cigarette-ignited fires declined 56% to 61% between 1999 and 2008. Post-RIP, cigarette-ignited fires slightly increased (4%) but did not experience the same level of increase in incidence as other unintentional fires.

Figure 27. Alberta Cigarette Fires vs. Other Fires (Non-Cigarette Fires), 1999-2008

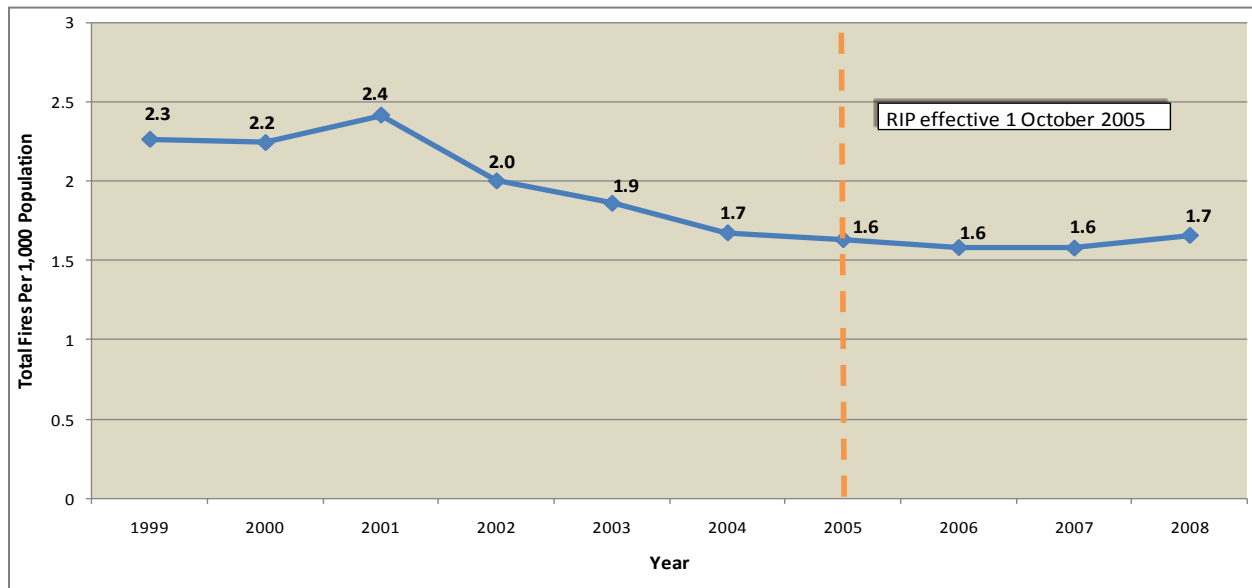


Source: Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.

Fires per Capita

A key measure of the change in fire incidence over a period of time is the number of fires per unit population. As noted earlier, changes in the number of fires may reflect population shifts rather than actual fire incidence change. Changes in fire per unit population are an indication of actual change. In Alberta, as in Ontario, the combination of declining fire incidence and increasing population result in substantial decreases in per capita fire incidence. The decline in fire incidence seen in Figure 17 is underscored by the 37% decline in all fires per 10,000 population (Figure 28).

Figure 28. Alberta Fires per 1,000 Population, 2000-2008



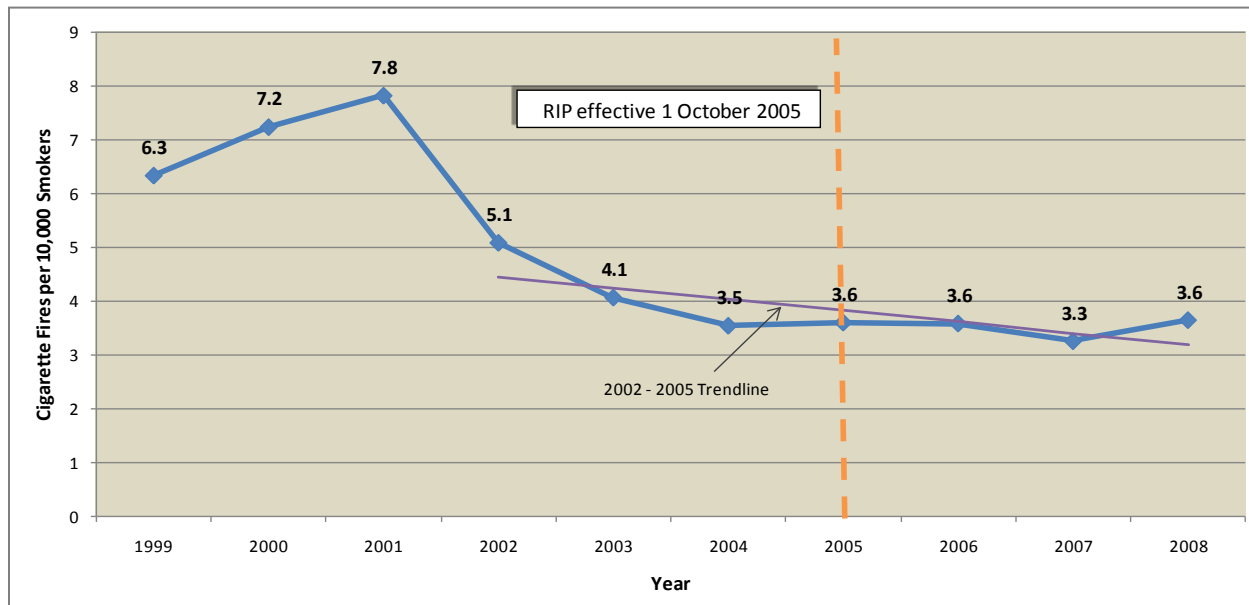
Sources:

- 1) Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.
- 2) *Alberta's Official Population*, http://municipalaffairs.gov.ab.ca/documents/LGS/Alberta_Official_Pop_History.pdf (accessed February 1, 2011).

Fires involving cigarettes, however, are evaluated on the subset of the general population—smokers. The estimated decrease in smoking prevalence in Alberta has been offset by the estimated increase in the population of individuals 15 years and older (the general target smoking population).³⁸ After a 3-year increase in cigarette fires per 10,000 smokers between 1999 and 2001, cigarette-ignited fires per 10,000 smokers decreased by approximately 28% between 2002 and 2008 (Figure 29). The decrease between 2002 and 2005 was 31%; between 2006 and 2008, there was an increase of 2%.

While the lowest number of cigarette fires per 10,000 was seen in 2007, the year with the largest estimated RIP cigarette saturation post-RIP (Table 10), the post-RIP data fit well with the trend established from the 2002-2005 pre-RIP data. The lack of sustained decrease, and one more pronounced than the established trend, indicates that no substantive effect of RIP cigarettes is seen.

Figure 29. Alberta Cigarette Fires per 10,000 Smokers Age 15 and Over, 1999-2008



Sources:

- 1) Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.
- 2) *Alberta's Official Population*, http://municipalaffairs.gov.ab.ca/documents/LGS/Alberta_Official_Pop_History.pdf (accessed February 1, 2011).
- 3) Statistics Canada, *Table 2 Percentage of the population aged less than 15 years in the last 50 years, Canada, provinces and territories*, <http://www12.statcan.gc.ca/census-recensement/2006/as-sa/97-551/table/t2-eng.cfm> (accessed January 31, 2011). The 15+ population was estimated by multiplying the overall population with the extrapolated 1996, 2001, and 2006 census estimated percentage of the population over age 15.
- 4) *Table 2.1: Smoking prevalence by province, 1999-2009*, Tobacco Use in Canada, 2011, Propel Centre for Population Health Impact (Data Source: CTUMS, 1999-2009). The estimate of the number of current smokers age 15+ was derived from the percentage of current smokers and the estimate of the 15+ population derived above.

Cigarette-Ignited Fires by Cigarettes Sold

Estimated sales of illegal or contraband tobacco sales for Alberta alone are not readily available. The available estimates include all western Canadian provinces. Contraband cigarette sales in the western Canadian provinces, while growing, has not reached the level of contraband cigarette sales currently experienced by Ontario. Until 2008, the flow of contraband cigarettes into the western provinces (or in some years, out of the provinces), was 6% or less. In 2008, the estimated percent of contraband cigarette sales in the western provinces had increased to 15%.³⁹

Note that the percentages of RIP and non-RIP contraband cigarettes were not determined during the research and no published estimates are available. As in the analysis for Ontario, for purposes of evaluating the effect of contraband cigarettes on cigarette-ignited fires in Alberta, three scenarios are postulated:

- All contraband cigarettes in Alberta were RIP, making RIP cigarettes universally available in Alberta,
- All contraband cigarettes in Alberta were not RIP, creating a mix of RIP and non-RIP cigarettes, the relative proportion of non-RIP cigarettes equivalent to the estimated level of contraband, or

- Some portion of contraband cigarettes are RIP, creating a mix of RIP and non-RIP cigarettes but at a higher RIP consumption level.

As in the analysis for Ontario, 2006 cigarette consumption is left aside as sales of remaining inventory of pre-RIP cigarettes were permissible. By 2007 then, all legally purchased cigarettes were RIP-compliant. As seen in Table 10, cigarette consumption in Alberta would have been virtually RIP-compliant and the effects of RIP should be seen. It is possible that the RIP effect may be somewhat reduced in 2008 as the level of RIP compliance in the contraband sales may have had some effect. However, no reduction is seen in these near wholly compliant years (Figure 30).

Table 10. Estimated Percentage of Contraband Cigarette Sales and Resulting RIP Cigarette Saturation, Alberta 2003-2008

Year	2003	2004	2005	2006	2007	2008
Contraband Sales as % Total Sales	3%	-3%	-1%	6%	4%	15%
Implied minimum % RIP Cigarettes	--	--	--	--*	96%	85%

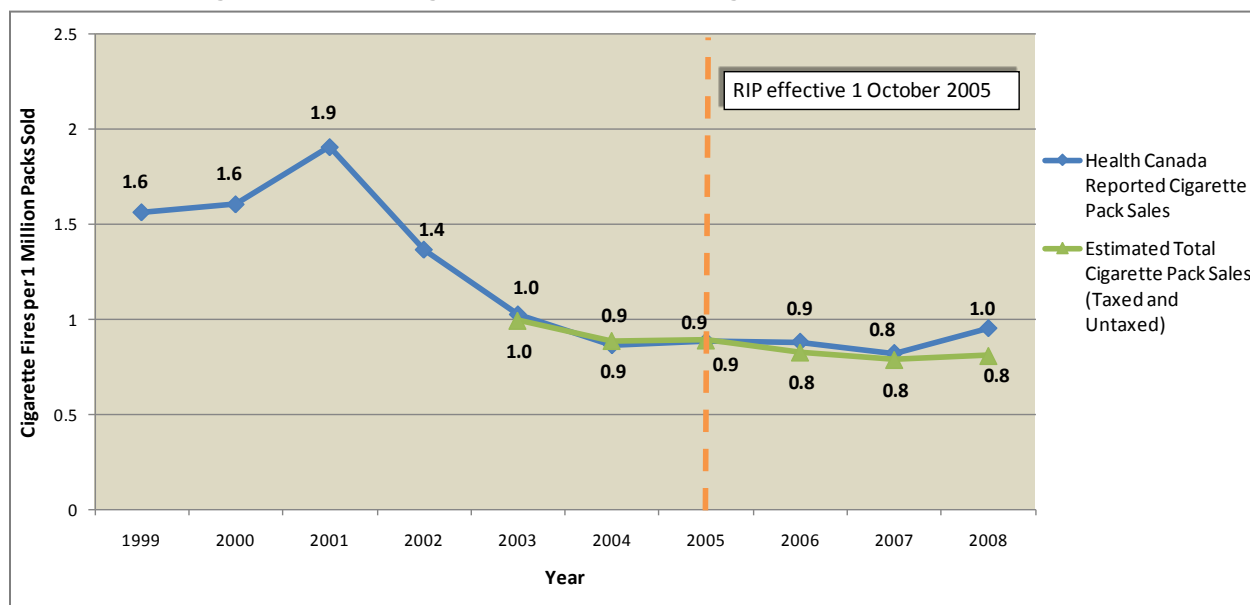
*Some non-RIP cigarette sales are still permissible in 2006 as stock depleted; 2006 data is not used.

Source: The Canadian Tobacco Market Place. *Estimating the Volume of Contraband Sales of Tobacco in Canada*. Ontario, Canada: Physicians for a Smoke-Free Canada. April 2010. Estimates of contraband cigarette sales were derived from estimated percentages of contraband cigarettes in all western Canadian Provinces.

Figure 30 presents cigarette-ignited fires per million cigarette packs sold for both legal (taxed) sales and for estimated total cigarette sales (total sales, taxed and untaxed). As contraband cigarettes have not yet been a serious issue in Alberta, the two curves are very similar. The curves diverge in 2008 when estimated contraband sales reached 15%.

The decline in cigarette fires per total cigarettes sold (including contraband) in the period immediately preceding the implementation of RIP cigarettes (11% between 2003 and 2005) is continued post-RIP but without the additional decline expected from RIP cigarettes. No substantive effect of the implementation of RIP cigarettes is seen.

Figure 30. Alberta Cigarette Fires per Million Cigarette Packs Sold, 1999-2008



Sources:

- 1) Fire Statistics Information System, Alberta Emergency Management Agency, January 2011.
- 2) *Cigarette Sales in Alberta, 1980-2009*, <http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/indust/sales-ventes/ab-eng.php#cig> (accessed February 1, 2011). Converted to packs (20 cigarettes per pack).
- 3) The Canadian Tobacco Market Place. *Estimating the Volume of Contraband Sales of Tobacco in Canada*. Ontario, Canada: Physicians for a Smoke-Free Canada. April 2010. Estimates of contraband cigarette sales were derived from estimated percentages of contraband cigarettes in all western Canadian Provinces.

Summary

As in Ontario, the implementation of RIP cigarettes had no substantive effect in decreasing smoking material related fires, deaths and fire injuries in Alberta. With the exception of injuries, trend analyses of overall smoking material fires, deaths, and injuries demonstrated that the implementation of RIP cigarettes did not result in predicted reductions. Injuries from cigarette-ignited fires showed some improvement, however, the numbers of both deaths and injuries from cigarette-ignited are very small and changes in trends may be more indicative of expected fluctuations rather than actual trend changes.

As well, trend analyses of cigarette-ignited fires in a selected set of scenarios and in residential properties—both situations RIP cigarettes were designed to address—do not show the anticipated reductions from the implementation of RIP cigarettes.

As with Ontario, an unexpected result was an increase in smoking material fire deaths per smoking material fire.

Analyses controlling for smoking population changes and for changes in cigarette consumption confirm that the implementation of RIP cigarettes did not result in the predicted decrease of smoking material related fires. Again, as with Ontario, the data show no effect.

Based on these analyses with existing data from Alberta, the implementation of RIP cigarettes did not produce substantive decreases in smoking material fires and fire losses and did not produce the magnitude of predicted reductions.

Analyses of cigarette fire data by the Alberta Fire Commissioner staff similarly concluded that a reduction in cigarette fires could not be seen from the numbers of fires, deaths, or injuries from the 1999-2008 fire data.

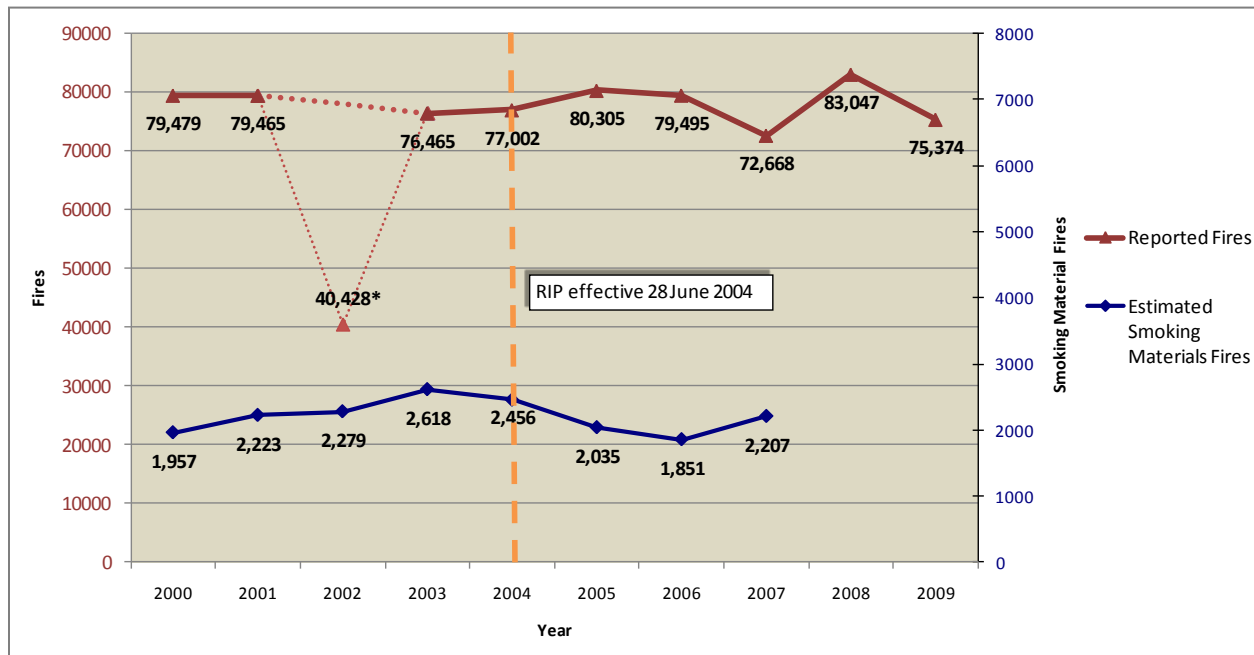
Discussion of Effectiveness of RIP Cigarettes in New York State

While most fire departments now participate in the New York State Fire Reporting System, fire reporting is not required in New York State and no published data on the estimated total number cigarette fires is available from the New York State Fire Marshal Office. Available estimates on smoking material fires are available from the Coalition for Fire Safe Cigarettes. Because the method used to create these cigarette fire estimates relies on how one treats the sources of heat reported as unknown⁴⁰, estimates may be over or under actuals. These estimates are nonetheless the best information available.

Trends in Estimated New York Smoking Material Fires and Fire Deaths

Fires. Fires reported to the New York State Fire Reporting System increased in number between 2000 and 2005, then dropped sharply between 2006 and 2007. In 2008, reported fires were at the highest level in the 10-year period between 2000 and 2009. Fires then sharply fell in 2009 (Figure 31). It is important to note that this fire incidence reflects the fires reported to the state data system and may not be all fires in New York. The state does not extrapolate the data it receives to a statewide estimate. Thus the changes in numbers of fires reported from year to year may be due to changes in reporting to the state or changes in the fire problem—one does not know which. Between 2003 and 2009, fire department participation in the New York State Fire Reporting System rose from 71% to 93%.⁴¹ Estimates of smoking material fires do not follow the increases in fire reporting during this period.

Figure 31. New York State Fires, 2000-2009



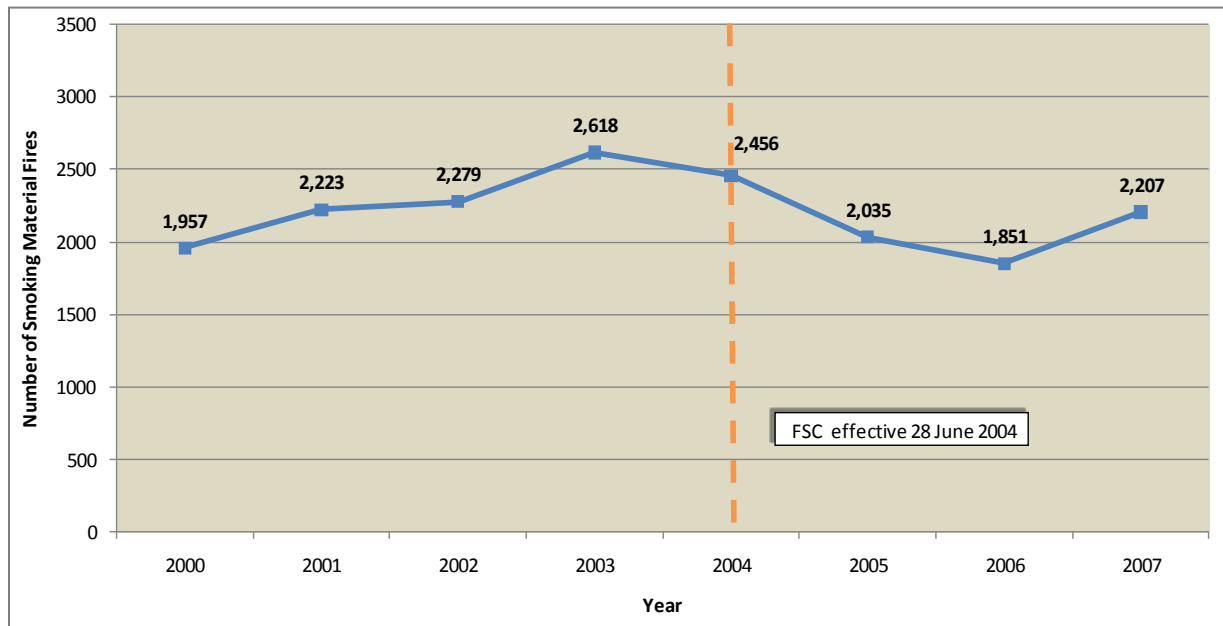
* New York City did not fully report in 2002; New York City accounts for approximately half of fires reported to the state Fire Marshal.

Sources:

- 1) *Fire in New York*, <http://www.dhSES.ny.gov/ofpc/fire-incident-reporting-system/statistical-information.cfm>, for 1999-2001, and each year from 2003 to 2007. *Fire in New York* was not published for 2002 (accessed December 28, 2010).
- 2) 2002 New York State data from New York Office of Fire Prevention and Control, March 11, 2011.
- 3) Coalition for Fire-Safe Cigarettes, *In the News*, “The New York Experience”, <http://www.firesafecigarettes.org/itemDetail.asp?categoryID=107&itemID=1512&URL=In%20the%20news/The%20New%20York%20Experience> (accessed October 27, 2011 and February 6, 2011).

Unlike the U.S. as a whole (where estimates of the number of smoking material fires have been declining but the percentage of smoking fires is remaining fairly constant), the number of estimated smoking material fires in New York rose between 2000 and 2003, then declined between 2004 and 2006, reaching the lowest level of estimated smoking material fires since 2000, and then rose in 2007 to a level consistent with that of the early part of the decade. The overall trend is slightly downward (4%). Taken as whole, the 8 years of estimates show fluctuation around a mean of 2,200 fires with an overall 4% decline. Estimates of smoking material fires have not been published for 2008 and 2009 (Figure 32).

Figure 32. New York Smoking Material Fires, 2000-2007

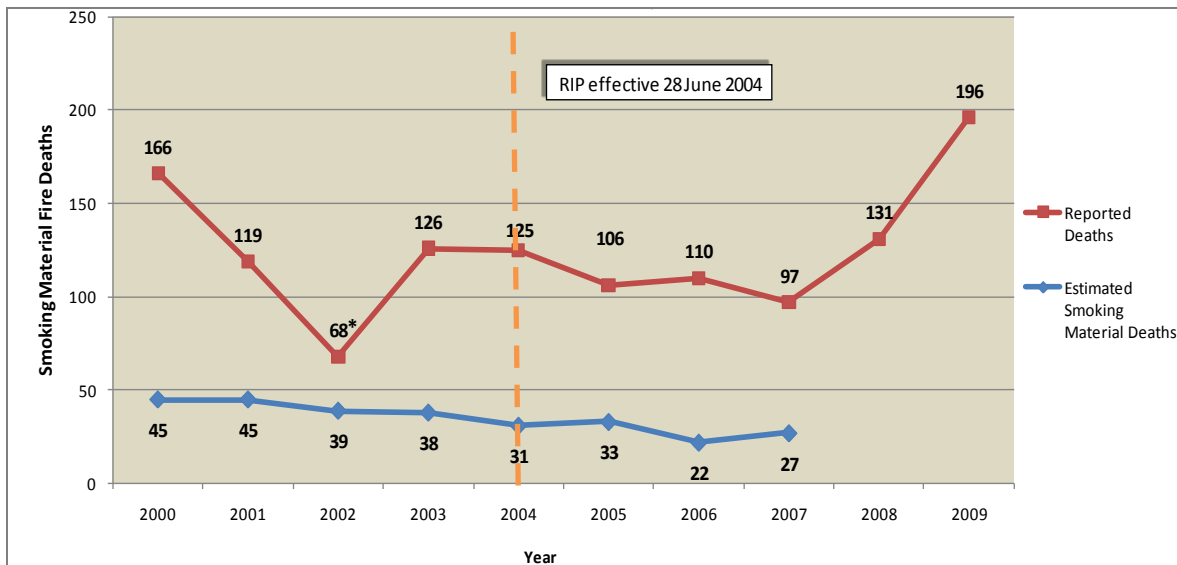


Source: Coalition for Fire-Safe Cigarettes, *In the News*, “The New York Experience”, <http://www.firesafecigarettes.org/itemDetail.asp?categoryID=107&itemID=1512&URL=In%20the%20news/The%20New%20York%20Experience> (accessed October 27, 2011 and February 6, 2011).

As the reporting of fires is not required, the estimates are based on a subset, albeit a large subset, of all fires. Unlike statistically derived estimates of the total number of U.S. fires and fire losses, no such estimates exist for individual states. Because the method used to create these estimates relies on the distribution of unknown heat source⁴² (which can be quite large), estimates may be over- or understated and may include (or miss) a sizable number of fires that may (or may not) be smoking material fires. As a result, the estimates of the magnitude of New York smoking material fires may not be reliable for year-to-year comparisons such as comparisons before and after the 2004 legislation.⁴³ While definitive conclusions on the effect of New York RIP cigarettes on reducing fires and fire losses cannot be readily drawn from the available data, the predicted reductions are not demonstrated.

Fire Deaths. Reported fire deaths in New York have ranged from a low of 68 fire deaths in 2007 to a high of 196 deaths in 2009 (Figure 33). Despite wide fluctuations in the number of reported fire deaths, the estimated deaths resulting from smoking material fires show a steady decline.

Figure 33. New York State Fire Deaths, 2000-2009



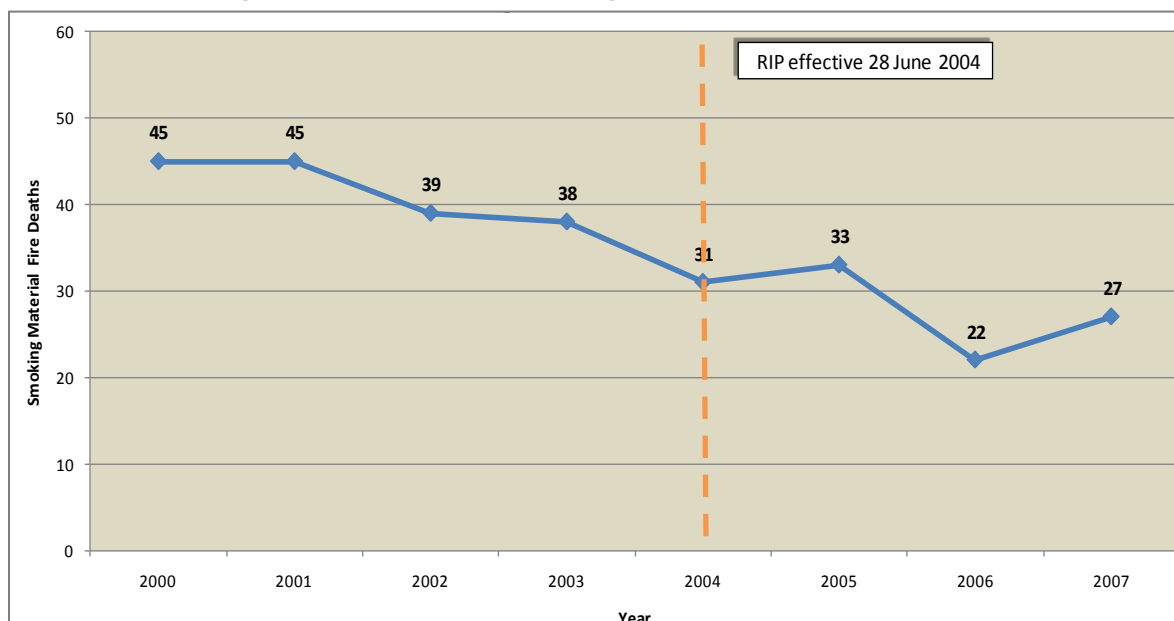
* New York City did not fully report in 2002.

Sources:

- 1) *Fire in New York*, <http://www.dhSES.ny.gov/ofpc/fire-incident-reporting-system/statistical-information.cfm>, for 1999-2001, and each year from 2003 to 2007 (accessed December 28, 2010). *Fire in New York* was not published for 2002.
- 2) 2002 New York State data from New York Office of Fire Prevention and Control, March 11, 2011.
- 3) Coalition for Fire-Safe Cigarettes, *In the News*, “The New York Experience”, <http://www.firesafecigarettes.org/itemDetail.asp?categoryID=107&itemID=1512&URL=In%20the%20news/The%20New%20York%20Experience> (accessed October 27, 2011 and February 6, 2011).

The estimates of fire deaths from smoking material fires ranged between 22 and 45 with a downward trend of 48% over the 8 years—the best fit linear trend is very strong (Figure 34). The decline evident pre-RIP is continued post-RIP. While the data is the best available, the cautions discussed above apply. Nevertheless, with these estimates, no additional reduction in smoking material fire deaths is seen after the implementation of RIP cigarettes. The implementation of RIP cigarettes did not have a substantive effect on New York smoking material fire deaths.

Figure 34. New York State Smoking Material Fire Deaths, 2000-2007



Source: Coalition for Fire-Safe Cigarettes, *In the News*, “The New York Experience”, <http://www.firesafecigarettes.org/itemDetail.asp?categoryID=107&itemID=1512&URL=In%20the%20news/The%20New%20York%20Experience> (accessed October 27, 2011 and February 6, 2011).

Average Number of Fires and Fire Deaths Pre- and Post-RIP

As with Ontario and Alberta, because of the variable nature of fire incidence and the resulting losses, several years’ data are often combined to compare the overall averages of fires and fire losses before and after a specific time. This method can attribute a change when an underlying trend already exists. This is the case with deaths here: because of the strong downward trend in deaths (48% as noted above) it is expected that pre-RIP deaths will be larger than those post-RIP (Table 11).

For New York smoking material fires, the average number of fires for the 3-year period prior to RIP is larger (2,373 vs. 2,031). Because of the fluctuations in the number of estimated smoking material fires, it is not evident that this 14% difference is due to RIP cigarettes. If the reduction was the result of the implementation of RIP cigarettes, it is substantially less than predicted reduction.

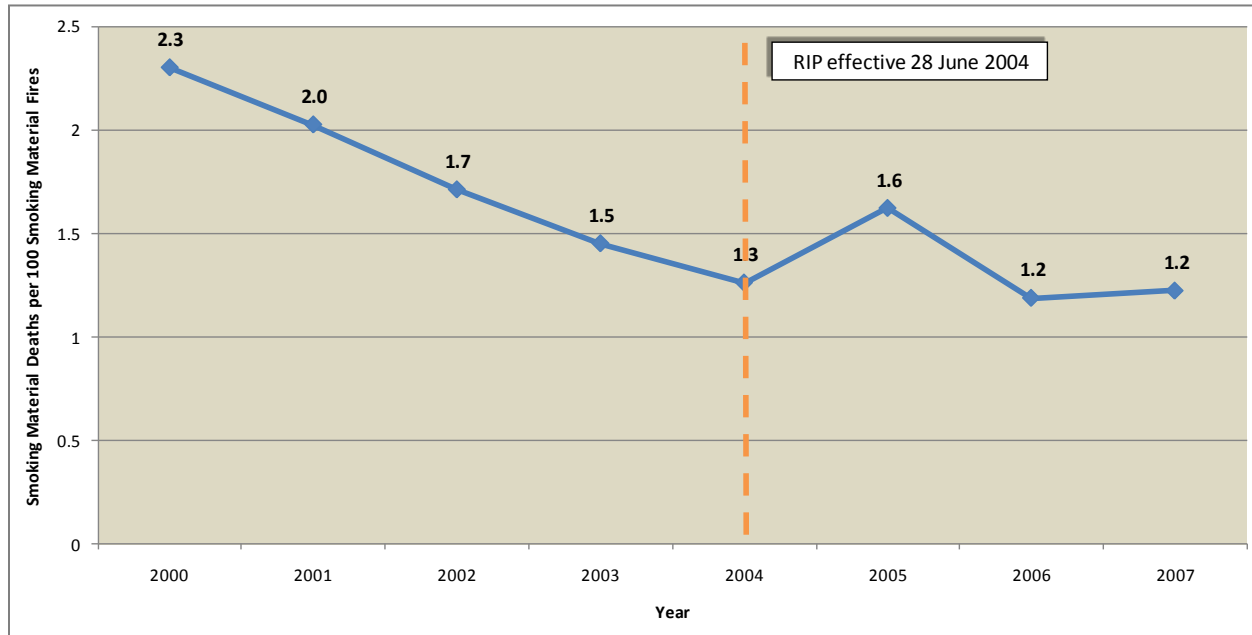
Table 11. Three-Year Average, New York State Smoking Material Fires, Pre- and Post-RIP

Evaluation Metric	Pre-RIP 2001-2003	Post-RIP 2005-2007
Fires	2,373	2,031
Fire Deaths	41	27

Fire Deaths per Smoking Material Fire

Figure 35 presents the fire deaths per 100 smoking material fires. While this statistic is not an indication of the effectiveness of the New York RIP cigarettes per se, as with the data from Ontario and Alberta, it nonetheless shows an unexpected change in the fire severity after the implementation of RIP cigarettes.

Figure 35. New York State Smoking Material Fire Deaths per 100 Smoking Material Fires, 2000-2007

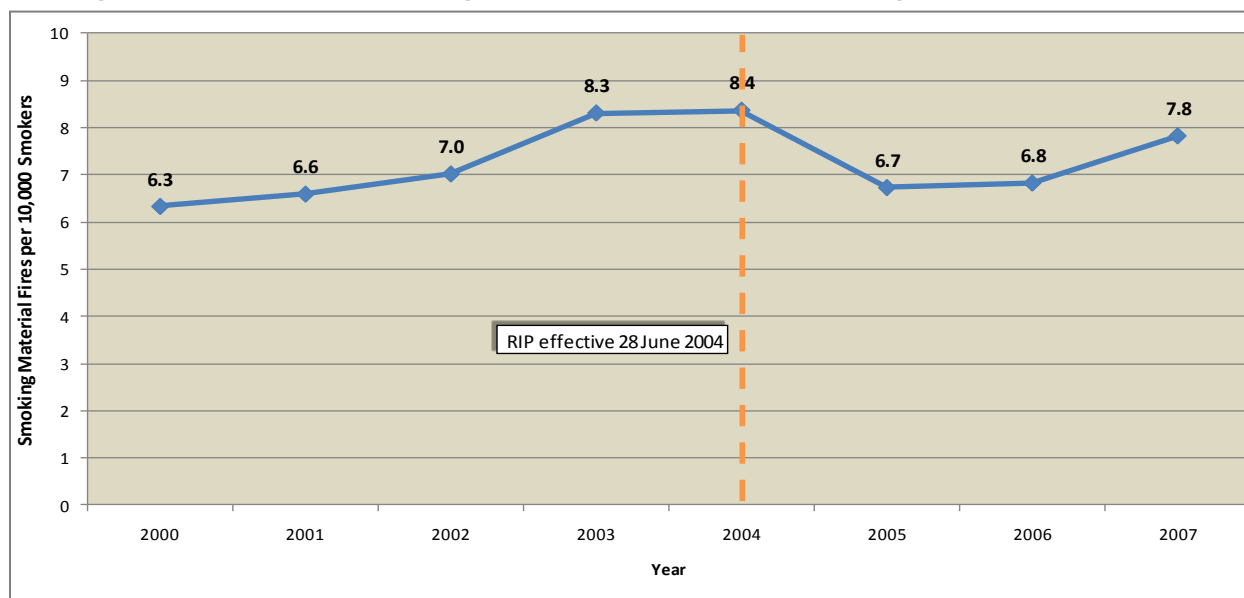


Source: Coalition for Fire-Safe Cigarettes, *In the News*, “The New York Experience”, <http://www.firesafecigarettes.org/itemDetail.asp?categoryID=107&itemID=1512&URL=In%20the%20news/The%20New%20York%20Experience> (accessed October 27, 2011 and February 6, 2011).

Fires per Smoking Population

After a 4-year increase in cigarette fires per 10,000 smokers between 2000 and 2003, cigarette-ignited fires per 10,000 smokers leveled off in 2004. In 2005, after implementation of RIP cigarettes, smoking material fires per 10,000 smokers decreased 20% to a level roughly that of pre-RIP 2001-2002. The next two years show an increase of 16%, to a level par with that pre-RIP (Figure 36). The lack of sustained decrease in cigarette fires per 10,000 smokers post-RIP cigarette implementation indicates that no substantive effect of the implementation of RIP cigarettes is seen.

Figure 36. New York State Smoking Material Fires per 10,000 Smokers Age 18 and over, 2000-2007



Sources:

- 1) Centers for Disease Control and Prevention, State Tobacco Activities Tracking and Evaluation (STATE) System, <http://apps.nccd.cdc.gov/statesystem/TrendReport/TrendReports.aspx> (accessed January 10, 2011).
- 2) U.S. Census Bureau, *Population Estimates*, <http://www.census.gov/popest/states/asrh/SC-EST2009-02.html> (accessed January 10, 2011).
- 3) Coalition for Fire-Safe Cigarettes, *In the News*, “The New York Experience”, <http://www.firesafecigarettes.org/itemDetail.asp?categoryID=107&itemID=1512&URL=In%20the%20news/The%20New%20York%20Experience> (accessed October 27, 2011 and February 6, 2011).

Smoking Material Fires by Cigarettes Sold

As in Ontario and Alberta, New York faces a substantial challenge with the control of cigarettes purchased outside of its taxing and reporting system. Sources of untaxed cigarettes are: unregulated Native American sources, other states (that may or may not have enacted legislation yet), internet sales, and other contraband avenues. Until 2009, when New York’s last neighboring state became RIP-compliant, New York was surrounded by access to non-compliant sources of cigarettes. A 2008 study estimated that 40% or more of the New York cigarette market was untaxed.⁴⁴ It is unknown what portion of the untaxed cigarette sales was non RIP-compliant cigarettes.⁴⁵

As for Ontario and Alberta, the results of analyses which control for changes in tobacco consumption show no substantive effect of RIP cigarette as well.

If one assumes that as of January 2005, 6 months after the effective date of the standard, all inventories of pre-RIP cigarettes are depleted then all 2007 legally purchased cigarettes are RIP-compliant. If the maximum estimate of the proportion of cigarettes that are contraband is 45% in 2005 and 44% 2006-2007, the period during which only RIP cigarettes could be legally sold and for which estimates of contraband sales are available, the implication is that at least 55% of cigarettes consumed in New York post-RIP cigarette implementation (the minimum of the 2005 to 2007 estimates) were RIP cigarettes (Table 12). Further, this implies that while the full effect of RIP cigarettes may not be seen, a significant reduction would have been expected as over

half the available cigarette market was RIP-compliant. Smoking material fires per pack, either tax paid (top curve) or total estimated sales (taxed plus illicit, bottom curve), do not show the expected, sustained decrease post-RIP implementation (Figure 37).

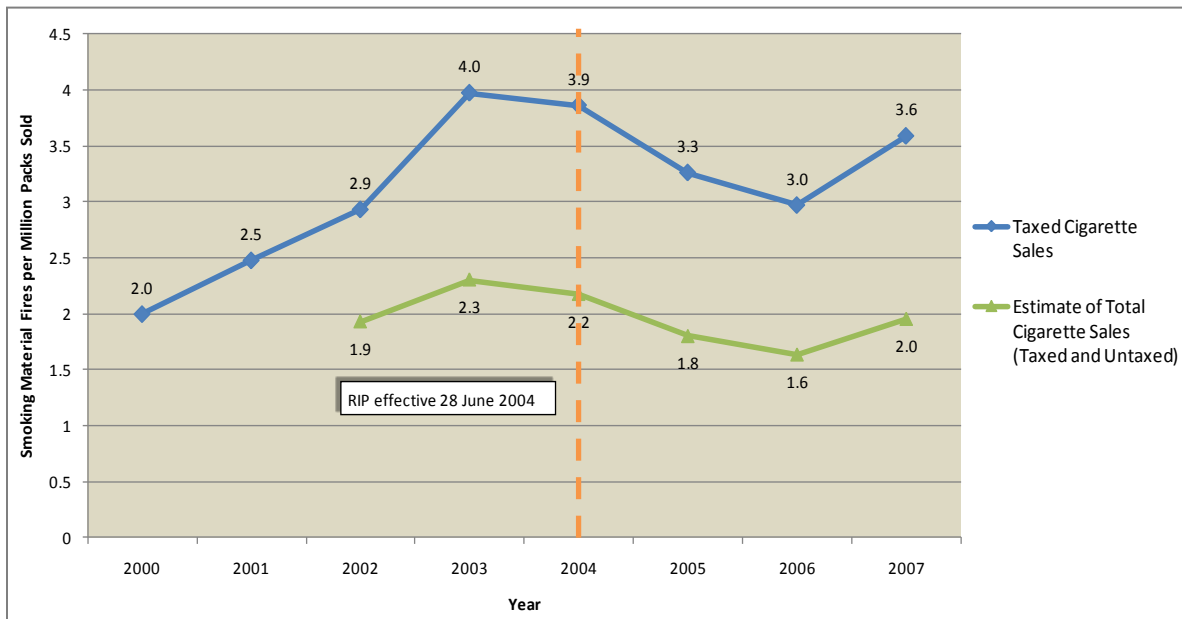
Table 12. Estimated Percentage of Untaxed (Contraband) Cigarette Sales and Resulting RIP Cigarette Saturation, New York 2002-2007

Year	2002	2003	2004	2005	2006	2007
Untaxed (Contraband) Sales as % Total Sales	36%	41%	44%	45%	44%	44%
Implied minimum % RIP Cigarettes	--	--	--*	55%	56%	56%

*Some non-RIP cigarette sales are still permissible in 2004 as stock depleted; 2004 data is not used.

Source: Analysis of estimates of total cigarette demand with taxed and untaxed sales from O'Connor, B.J., *An Update - Additional Cigarette Tax Revenue Sources for New York State, 2008*.

Figure 37. New York Smoking Material Fires per Million Cigarette Packs, 2000-2007



Sources:

- 1) *Tax Burden on Tobacco Historical Compilation Volume 45*, Orzechowski and Walker, 2010. Note: Does not include non-revenue based cigarette sales.
- 2) O'Connor, B.J., *An Update - Additional Cigarette Tax Revenue Sources for New York State, 2008*. Includes estimates on tribal, internet, bootleg, and cross-border sales; represents New State cigarette demand.
- 3) Coalition for Fire-Safe Cigarettes, *In the News*, "The New York Experience", <http://www.firesafecigarettes.org/itemDetail.asp?categoryID=107&itemID=1512&URL=In%20the%20news/The%20New%20York%20Experience> (accessed October 27, 2011 and February 6, 2011).

Summary

As in Ontario and Alberta, the implementation of RIP cigarettes in New York had no substantive effect in decreasing smoking material fires or deaths. The decline in smoking material deaths has been ongoing; post RIP cigarette declines follow the trend set prior to RIP implementation. Trend analyses of smoking material fires and deaths demonstrate that the implementation of RIP cigarettes in New York did not result in additional reductions of smoking material related fire deaths.

As with Ontario and Alberta, an unexpected result was an increase in smoking material fire deaths per smoking material fire.

Analyses controlling for smoking population changes and for changes in cigarette consumption confirm that the implementation of RIP cigarettes did not result in the predicted decrease of smoking material related fires. Again, as with Ontario and Alberta, the data show no overall effect.

Based on these analyses with the available data for New York, the implementation of RIP cigarettes did not produce substantive decreases in smoking material fires and fire losses and did not produce the magnitude of predicted reductions.

CONCLUSION AND DISCUSSION

Based on the analyses in this initial evaluation, there is no discernable effect of the implementation of RIP cigarettes on the increased reduction of cigarette-ignited fires and fire losses in Alberta or on the increased reduction of lit smoking material fires and fire losses in Ontario and New York. When reductions in cigarette or smoking material fires and fire losses were seen, they were most often limited to pre-existing trends. Predicted levels of additional reductions, ranging from approximate 15% to 75% depending on the loss measure, were not seen in the data.

The available data from the three case studies were analyzed under multiple methods: trend analyses, changes in cigarette fire incidence in comparison to non-cigarette fires, controlling for changes in smoking prevalence (smoker population) and tobacco consumption, losses per fires, and analyses of specific subsets of the data where RIP cigarettes were designed to be effective. None of these approaches supported the overall predicted reductions in fires resulting from the implementation of RIP cigarettes or the loss resulting from these fires. In most analyses, not only were no additional reductions seen, the RIP cigarettes appeared to have no effect in fire incidence and fire losses.

Analyses of cigarette fire data by the Alberta Fire Commissioner staff similarly concluded that a reduction in cigarette fires could not be seen from the numbers of fires, deaths, or injuries from the 1999-2008 fire data.⁴⁶ Staff from Office of the Fire Marshal, Ontario noted that there was no trend evident between 2000-2009 in lit smoking material fire deaths or injuries and that lit smoking material fires showed variability from year to year.⁴⁷ Ontario preferred to see additional years' data of lit smoking material fires before rendering an opinion on the effect of the RIP cigarettes.⁴⁸

Factors Affecting the Current Decline in Cigarette-Ignited Fire Incidence

Over the past decade, total fires and fires with losses have been decreasing in Ontario, as have total fires in Alberta. The U.S. has seen a steady decline in fires over the past several decades. When overall fires decrease, it is not uncommon that fires from the major heat sources and from major causes decrease as well. Such is the case with smoking material fires in Ontario and New York and cigarette-ignited fires in Alberta. There are many possible explanations for these declines.

First and foremost as an explanation to decreases in fire incidence may well be the overall increased public awareness of fire and its effects. One of the most successful methods to prevent fires and reduce losses from them is public fire education. While there are no national statistics tracking the relationship between public fire education and its effect on fire incidence, when used effectively and consistently by targeting the at-risk populations as well as keeping the general public aware of the need for fire safety vigilance, it has proven to be very effective.⁴⁹ Ontario, in particular among states and provinces, has invested significant resources into public fire education and fire safety.

As well, prior to the enactment of RIP standards, product changes in mattresses to resist cigarette and other open flame resistances had already produced declines in fire incidence.⁵⁰ Product changes to upholstered furniture, a common item ignited by cigarettes, also appear to have had an effect in reducing cigarette ignited fires and fire losses.⁵¹ Upholstered furniture fires in the home started by smoking materials fell 92% between 1980 and 2005; fire deaths resulting from these upholstered furniture fires started by smoking materials decreased 69%.⁵² As older upholstered furniture and mattresses are replaced, these reductions continue.

Reduced smoking prevalence plays a significant role in the reduction of cigarette fires. Leistikow⁵³ and Diekman⁵⁴ both cite reductions in smoking-related fires as linked to reductions in cigarette consumption.

Importantly, the prevalence of smoke alarms plays a very significant role in the reduction of fire losses. While smoke alarms do not prevent ignitions, they do provide early warning which in turn reduces or, in the case of deaths and injuries, prevents losses. Smoke alarms also may reduce the number of reported fires, as the early warning allows for more extinguishment by occupants instead of calling the fire service.

Achieving Further Reductions in Fires

Proven Engineered Measures

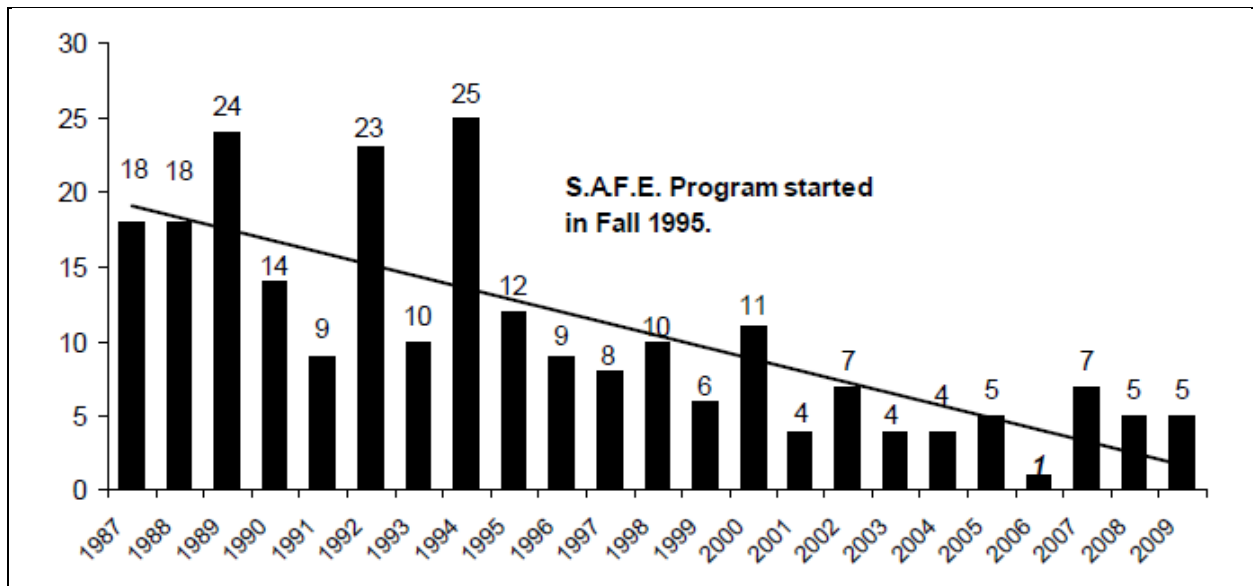
Smoke Alarms. Smoke alarms have been universally credited with the reduction in fire losses. Analyses of fatal fires demonstrate that most fatalities result from fires without working alarms.⁵⁵ With smoke alarms now in an estimated 94% of U.S. homes, the effort now is to both achieve complete saturation (that is, 100% of homes) as well as ensuring that installed alarms are in proper working order or replaced with newer, more effective models. Targeted programs that use demographic data to identify at-risk households are underway in many US cities. Smoke alarms are very effective in providing early warning for smoldering fires—such as the early stages of cigarette fires.

Sprinklers. Residential sprinklers are an even more powerful engineered measure for reducing deaths and losses from fires. Long known to be effective at reducing losses in nonresidential occupancies with high value inventory, sprinklers are installed in high rise buildings—office buildings and apartments—as required by code. Losses in residences are significantly less in apartments (also called multifamily buildings) as a direct result of sprinklers.⁵⁶ Vancouver, BC introduced a residential fire sprinkler program in 1990. After 10 years, the number of fire fatalities dropped from an average of 8.8 fire deaths per year to 3.3 fire deaths per year, well below the provincial average and half that of the Canadian national average. In 2000, Vancouver fire officials estimated that 26% of single family residences and 38% of multifamily residences were sprinklered.^{57,58} In the next 10 years, sprinklerization continued, and almost half of all households in Vancouver are now sprinklered.⁵⁹

Continuing the Role of Public Education and Prevention

Massachusetts' S.A.F.E. (Student Awareness of Fire Education) program is an example of the success of a well-designed and consistent public fire education program. In the 1980s and early 1990s, Massachusetts fire officials became increasingly concerned over the numbers of child fire deaths in the state that seemed impervious to reductions. Prior to the introduction of the S.A.F.E. program in 1995, the average number of child fire deaths was 18, ranging from a high of 25 to a low of 9. In the first year of the program, deaths dropped to 12, within the range of previous years. By the third year of the program, it was evident that a change had been effected. In the 14 years that the program has been in existence, the average number of child deaths has dropped to just above 6 deaths. Massachusetts states "The one thing that is happening in Massachusetts to improve fire safety exclusively for this age group, that is not also happening to all other age groups, is consistent, comprehensive, statewide, school-based fire safety education".⁶⁰

Figure 38. Massachusetts Child Fire Deaths, 1987-2009



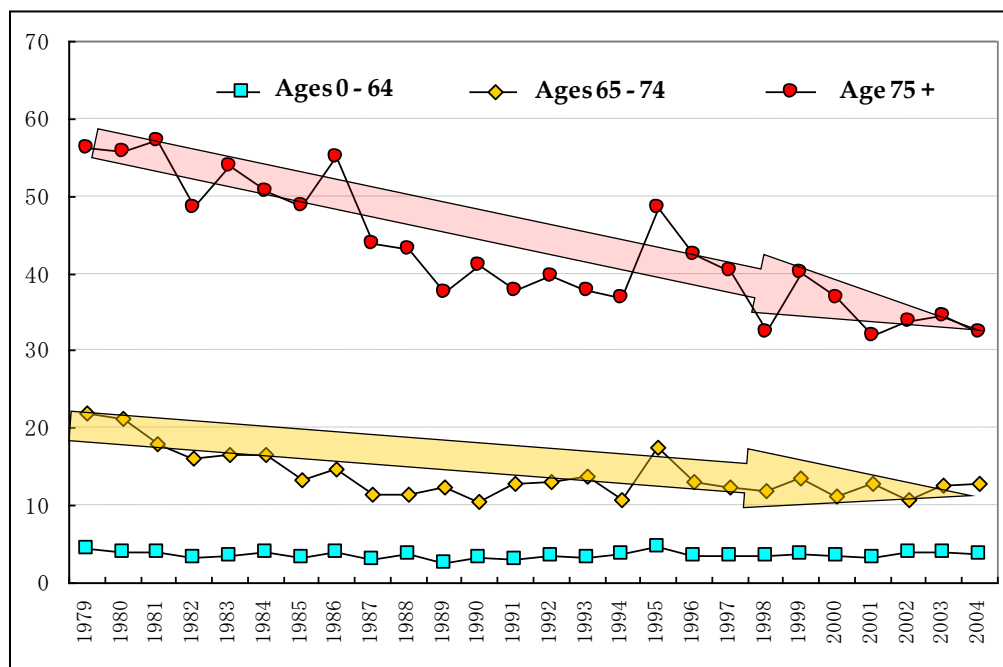
Source: State Fire Marshal, *The Massachusetts Fire Problem: Annual Report of the Massachusetts Fire Incident Reporting System 2009*. Massachusetts Department of Fire Services, p. 87. 2009.

Japan, long known for its keen attention to fire issues, provides an example of the effect of comprehensive and sustained public fire education and prevention. Fire death rates for older adults are typically the highest among all age subgroups. Japan, however, was able to reduce the fire death rate per capita for adults over 65 by 40% over the 25-year period 1979-2004. The drop is thought to be the result of a combination of both changes in housing arrangements and sustained public education. Many older Japanese now live in group homes or apartment buildings with modern fire protection features, instead of wooden two-story homes, though many still live in the latter.⁶¹

In concert with these changes in living arrangements, there are public fire education and outreach programs, both nationally and in many cities, which specifically target older adults. These programs include:

- Home Visits – A key strategy to reduce fire risk for the elderly is for the fire service to visit elderly at home to advise on home safety, especially the use of smoke alarms. Osaka and Nagasaki focus home visits on elderly living alone.
- Elderly Campaign – Each September Osaka has a week devoted to fire prevention for the elderly, in addition to two other national fire prevention weeks for the whole population.
- Specialized Alarm Systems – The fire service wants to make sure that all elderly have some version of a working smoke alarm. A related strategy is to promote smoke alarm systems with special features for the elderly. The goal is both to detect fires to warn household residents to escape and to automatically and more rapidly report fires and health emergencies to the fire service.
- Neighbor Dispatch – An even more novel approach, used for selected elderly and people with disabilities, is to identify a neighbor who is willing and able to assist in an emergency.⁶²

Figure 39. Japanese Trend in Residential Fire Death Rate Per Million Population by Age Group, 1979-2004



Source: Professor Ai Sekizawa, The University of Tokyo, slide presentation, April 2008.

Summary

While the evidence to support the effectiveness of the implementation of RIP cigarettes in reducing cigarette fires is not seen in the three case studies, there are other, proven and

effective measures that do reduce fires and fire losses. These measures include public fire education; installation, maintenance, and heeding of smoke alarms; product improvements to the ignitibility of upholstered furniture and mattresses; and the use of residential sprinklers.

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Office of Fire Prevention and Control

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ABOUT TRIDATA AND THE AUTHORS

The TriData Division of System Planning Corporation (SPC) has undertaken research on topics of interest to the fire service for over 29 years. Organized in 1981 under the premise that day-to-day decision-making, policy initiatives, and program evaluation must be grounded in well-articulated research and analyses of data, TriData has become known in the national and international fire world for technical excellence and objectivity.

From its work in the evaluation of over 250 fire departments in the US and Canada, and its analytic support to the U.S. Fire Administration, TriData is experienced in all aspects of the U.S. fire problem, fire and EMS department management issues, and the issues associated with fire. Internationally, TriData is recognized for its seminal work in fire prevention strategies, best practices, effectiveness of public fire education, and evaluation metrics.

In addition to fire departments and the U.S. Fire Administration, TriData's clients have included, among others:

- Centers for Disease Control and Prevention (CDC)
- Consumer Product Safety Commission (CPSC)
- National Institute for Occupational Safety and Health (NIOSH)
- United States Department of the Navy
- National Institute of Standards and Technology (NIST)
- National Academy of Sciences
- United States Forest Service
- Department of Defense, Force Health Protection & Readiness
- Canadian National Research Center
- Office of the Governor of the Commonwealth of Virginia
- The Urban Institute
- National League of Cities
- Firefighter unions
- Many industries, including those whose products ignite fires, are ignited by fires, or whose products reduced ignitions and losses

TriData's parent organization, SPC, was founded in 1970 by Dr. Ronald L. Easley to support defense, national security, and domestic preparedness programs. SPC's 40 years of success is rooted in its commitment to provide innovative solutions through research and advanced technology development.

Patricia Frazier is Director, Center for Data Analysis in the TriData division of System Planning Corporation (SPC). A mathematician by training, with a degree in Mathematics from Smith College, and graduate work in Mathematics and Operations Research from George Washington University, Ms. Frazier directs and participates in studies and analyses that focus on identifying the nation's fire-related problem areas. She is widely regarded as one of the leading analysts of fire data in the country.

For the past 20 years, Ms. Frazier has participated in and directed research and special study programs. These efforts have focused on the analysis of fire and fire-related issues and the development of performance indicators for the fire problem for federal, local government, and private sector clients. She is the manager of TriData's large-scale national fire databases and the lead author of the 8th through 15th editions of *Fire in the United States*, the U. S. Fire Administration's flagship report.

As TriData's principal fire data analyst, Ms. Frazier has conducted a wide range of research and data analyses and written numerous reports for USFA and other federal, local government, and private sector clients. She recently was the project manager and a co-author of *Assessing State Firefighter Cancer Presumption Laws and Current Firefighter Cancer Research* for the National League of Cities.

For the National Institute of Standards and Technology, Ms. Frazier was the project leader and primary author of *The Economic Consequences of Firefighter Injuries and Their Prevention*. For the National Institute for Occupational Health and Safety (NIOSH), Ms. Frazier led a research study team to investigate current and emerging technology solutions that improve, or hold promise to improve, firefighter radio communication systems (*Current Status, Knowledge Gaps, and Research Needs Pertaining to Firefighter Radio Communication Systems*). She is a contributing author to the Data Analysis chapter of the National Fire Protection Association's *Handbook*.

She was the project manager and lead author for the Congressionally-mandated Firefighter Safety Study and was responsible for the review of available response information for hazardous materials for first responders. She is a contributing author to National Fire Protection Association's *Handbook*. Prior to her career in fire-related research, Ms. Frazier was an intelligence analyst.

Philip Schaenman, MIFireE, founded TriData to perform three functions: fire and EMS studies, related public safety management research, and data analysis. Mr. Schaenman holds advanced engineering degrees from Stanford University and Columbia University. He is nationally and internationally known to the fire community for leading studies and research on first responder issues. He has more than 40 years experience working on management studies of fire organizations and 30 years in related research in fire protection, EMS, hazmat, and emergency management.

He served as Associate Administrator of the U.S. Fire Administration from 1976 to 1981, where, as a member of the Senior Executive Staff, he was responsible for the National Fire Data Center and the fire protection technology program.

Mr. Schaenman is acknowledged as leader in the fire community for his seminal work in international concepts in fire protection and in demonstrating that public fire education can be effective in reducing fires and fire losses. These efforts produced six highly regarded documents that are well known to both the U.S. and international fire communities.

Mr. Schaenman was an integral part of the Urban Institute/ICMA/NFPA team that defined appropriate performance measures for the fire service in the 1970s and again in the 1990s. Mr. Schaenman was the lead author of *Measuring Fire Protection Productivity in Local Government*, published in 1974 by the National Fire Protection Association and The Urban Institute. He also wrote the fire protection chapter in the 1976 and the updated 1992 edition of the performance measures book, *How Effective Are Your Community Services?*, published by the International City Management Association and The Urban Institute. Further, he wrote “Managing Information For The Fire Service” as a chapter in the ICMA “Green Book” on managing fire services, the chapter in the NFPA Fire Protection Handbook on evaluating public fire education programs, as well as numerous other articles and contributions to major fire publications.

He has conducted workshops for state and local government officials on how to undertake strategic planning for fire departments, and is an internationally known expert in fire management data analysis, fire prevention research, performance measurement, and management of complex fire protection studies.

Erin C. Jones provides analytical and project support for the U.S. Fire Administration. She specializes in fire data analysis and evaluating emergency medical services and preparedness including bioterrorism and public health response issues. Ms. Jones has a Masters of Forensic Science degree from Stevenson University. As a forensic science analyst in the TriData Division of System Planning Corporation, she has worked with the New York State Medical Examiner’s Office and Project WHO?, a program to match DNA evidence with missing persons.

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³⁸ Smoking prevalence from *Table 2.1: Smoking prevalence by province, 1999-2009*, Tobacco Use in Canada, 2011, Propel Centre for Population Health Impact (Data Source: CTUMS, 1999-2009) was applied to population estimates determined from *Alberta's Official Population*, http://municipalaffairs.gov.ab.ca/documents/LGS/Alberta_Official_Pop_History.pdf (accessed February 1, 2011). The 15+ population was estimated by multiplying the overall population with the extrapolated 1996, 2001, and 2006 census estimated percentage of the population over age 15. January 31, 2011. <http://www12.statcan.gc.ca/census-recensement/2006/as-sa/97-551/table/t2-eng.cfm>.

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⁴⁰ From telephone conversation with Marty Ahrens, National Fire Protection Association.

⁴¹ *Fire Department Participation History 2003 – 2009*. March 7, 2011. <http://www.dhSES.ny.gov/ofpc/fire-incident-reporting-system/documents/summaryparticipation2003-2009.pdf>.

⁴² John R. Hall and Beatrice Harwood, "The National Estimates Approach to U.S. Fire Statistics," *Fire Technology*, Volume 25, Number 2, May 1989, pages 99-113.

⁴³ Although the estimates of New York smoking material fires are not recommended for comparison use, they do provide, however, a reasonable and relative sizing of the problem.

⁴⁴ O'Connor, B.J., *An Update - Additional Cigarette Tax Revenue Sources for New York State, 2008*.

⁴⁵ In October 2009, the Assistant General Counsel of Altria Client Services, Inc., a division of Philip Morris USA, stated that approximately 95% of all Philip Morris cigarette brands were currently manufactured with the fire standard compliant paper, with full compliance expected by the end of 2009, <http://www.flickr.com/photos/32619856@N08/4058311470/in/set-72157622570482369/> (accessed January 14, 2011). Philip Morris USA has approximately a 50% market share in the U.S. cigarette market. In an October 2007 letter addressed to NFPA, ReynoldsAmerican also indicated that by the end of 2009, all its cigarettes would be converted to fire compliant paper. ReynoldsAmerican has approximately a 28% market share in the U.S. cigarette market. As the transition to compliant paper progressed, it may be that some portion of untaxed cigarettes consumed were RIP cigarettes.

⁴⁶ Email exchange January 6, 2011 with Mahendra Wijayasinghe, Alberta Emergency Management Agency, Alberta, CN.

⁴⁷ Written correspondence accompanying the Ontario fire data December 10, 2010 from Alison Wilson and Bev Gilbert, Office the Fire Marshal, Ontario, CN.

⁴⁸ Telephone conversation December 15, 2010 with Alison Wilson and Bev Gilbert, Office the Fire Marshal, Ontario, CN.

⁴⁹ Schaenman, P. et al, *Proving Public Fire Education Works*, TriData Corporation. September 1990 and Schaenman, P. et al, *Reaching the Hard to Reach*, TriData Corporation. October 1994.

⁵⁰ Tohamy, S.M. and Aiden, D.V., *Assessing Regulatory Effectiveness with Exogenously Declining Risk: A Case Study of the CPSC's 1973 Mattress Standard*. *Journal of Safety Research* 38(6), 661-668. 2007.

⁵¹ Hall, Jr., J.R. "Targeting upholstered furniture fires", *NFPA Journal*. Mar/Apr 2001.

⁵² Ahrens, Marty, *Home Fires That Began With Upholstered Furniture*, National Fire Protection Association, 2008.

⁵³ Leistikow, B. N., Martin, D. C., & Milano, C. E. (2000). Fire Injuries, Disasters, and Costs from Cigarettes and Cigarette Lights: A Global Overview. *Preventive Medicine*, 31, 91-99.

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- ⁵⁵ Frazier, P. (author), United States Fire Administration, *Fatal Fires in Residential Buildings*, Topical Fire Report Series, Volume 11, Issue 2. August 2010.
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- ⁵⁷ "Update on Sprinklered Dwellings", http://vancouver.ca/fire/fire_prev/sprinkler.html (accessed February 15, 2011).
- ⁵⁸ "Residential Fire Sprinklers: A Report on Vancouver's 10 Year Statistics on Residential Sprinklers", www.firesprinklers.org.uk/Services/Documents/Vancouver%20report.pdf (accessed February 15, 2011).
- ⁵⁹ Personal communication, Vancouver director of Fire Prevention to TriData Corporation, 2009.
- ⁶⁰ Massachusetts Department of Fire Services, *The Massachusetts Fire Problem: Annual Report of the Massachusetts Fire Incident Reporting System 2009*. Stow, MA: State Fire Marshal. p. 87. 2009.
- ⁶¹ Schaenman, P (author), *Global Concepts In Residential Fire Safety, Part 2 – Best Practices from Australia, New Zealand and Japan*, prepared by TriData Corporation for the U.S. Centers for Disease Control and Prevention and the Assistance to Firefighters Grant Program of the Department of Homeland Security, August 2008.
- ⁶² Schaenman, P (author), *Global Concepts In Residential Fire Safety, Part 2 – Best Practices from Australia, New Zealand and Japan*, prepared by TriData Corporation for the U.S. Centers for Disease Control and Prevention and the Assistance to Firefighters Grant Program of the Department of Homeland Security, August 2008.