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Analysis of Fire Statistics in Canada 1986-2000

Research Report No. 172

Date: October 26, 2004

Authors: Abderrazzaq Bounagui
Noureddine Bénichou
Ederne Victor

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Abstract

Fire is a challenge faced by all society and Canada is no exception. The consequences of fire in terms of human lives and material damages are an important tool to aid in identifying potential hazards in the built environment. The analysis of the fire data gathered for the period 1986-2000 reveals that the fire incidents sloped downward over the last few years. However, with an annual average of 63,622 fires occurring over the last 15 years, the number of fires in this country is still high. Ontario, Quebec, Alberta, British Columbia, Manitoba, and Saskatchewan are the provinces in which 90% of the fires occurred and over 92% of these fire costs were recorded. Residential houses are the properties most affected: 42% of the fires, and approximately 80% of the fire deaths took place in residential properties. Cooking equipment, heating equipment, electrical distribution equipment, and smoker's materials are the leading factors responsible for fire in Canada. They account for 42% of the fires across the country. Mechanical and electrical failures are also important circumstances leading to fire incidents.

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Analysis of Fire Statistics in Canada 1986-2000

1 INTRODUCTION

Fire has significant social and economic impacts on our society and it is one of the major problems which continues to challenge Canadian society. Each year, Canada sees a number of deaths occurring in different locations as a result of fires. These fires also result in injuries and losses of quality of life and property. In order to assess how life safety is being affected year after year, this report presents an analysis of fire statistics in Canada during the period 1986-2000 [1 to 15].

1.1 Number of fires per year (1986-2000)

This section summarizes the fire statistics in Canada and describes their consequences. Fire incidents are still high in Canada even though the overall number of fires is generally down over the period 1986-2000. An annual average of 63,622 fires occurred in Canada for a total of 954,331 declared fires over the same period under consideration. Over the first ten years, the average number of fires was above the period average and reached 68,083 and 66,199 respectively. The last five years averaged out to 56,584 fires and is by far less than the previous ones. These three averages actually vindicate that the fire frequency is slowing down over the period 1986-2000 and is still above 52,000 a year, which represents an average of more than 1,000 fires a week. Figure 1 shows the trends of the fires over this period.

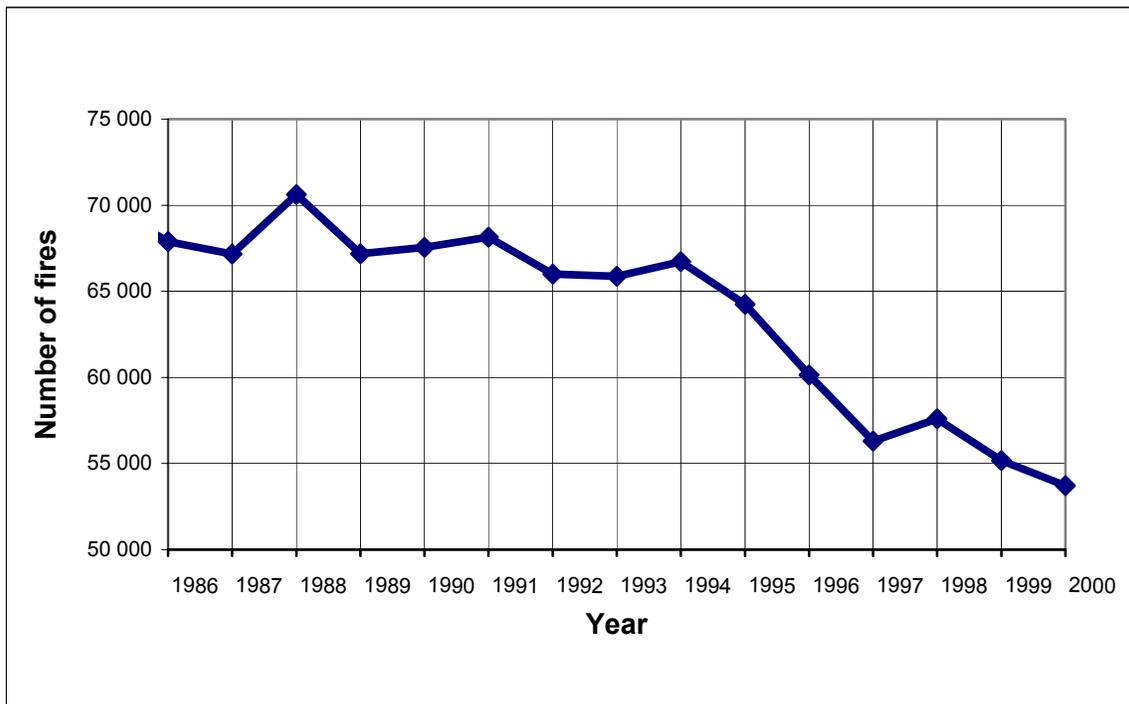


Figure 1: Number of fires per year (1986-2000)

1.2 Number of fire deaths per year (1986-2000)

One of the reasons why the number of fires is considered high in Canada is that it results in a significant loss of lives. From 1986 to 2000, 6,408 people died from fire across the nation. Most of these casualties, an average of 506 per year occurred during the first five years of the 15-year period. This average exceeds the period average of 427 deaths. Over the next ten years, the number of fire-related deaths is lower and remains stable despite the drastic decrease in the number of fires over the same time period. Figure 2 illustrates how fire-related deaths vary over the period 1986-2000.

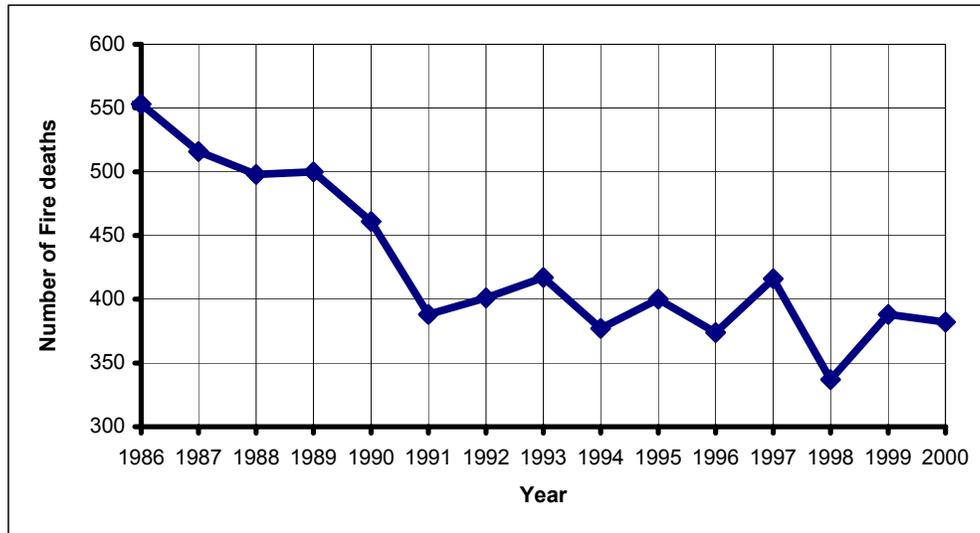


Figure 2: Number of fire deaths per year (1986-2000)

1.3 Number of fire injuries per year (1986-2000)

Fires account for 51,212 reported injuries over the period 1986-2000. Fire injuries display a similar trend to the number of fires occurring in the country. They remain high with respect to the period average (3,414) and practically constant throughout the first and second five years periods, namely 3,772 and 3,581 injuries respectively. During the last five years of the period, the number of fire injuries falls below the average at 2,890 except for the year 2000 where the number increased sharply. This similarity between the fire incidence and the fire injury trend shows that the number of fire injuries can be reduced if the fire incidents are somehow contained. Figure 3 represents the trend in fire injuries in Canada during the period.



Figure 3: Number of fire injuries per year (1986-2000)

1.4 Fire Losses in CDN dollars (1986-200)

The monetary losses are important in the sense that they represent a loss of resources in society as a whole. Unlike the number of fires in Canada, the monetary losses due to fire are roughly sloped upward over the period 1986-2000. Inflation is probably responsible for that unexpected variation. Over 17 billions dollars of damage were recorded in Canada from 1986 to 2000, which represents on average more than 1 billion dollars per year. The five years averages fluctuate about the period average but the largest one was observed from 1991 to 1995 (\$ 1,185 076 944 a year). Figure 4 shows the Zigzag trend of the monetary losses due to fire from 1986 to 2000.

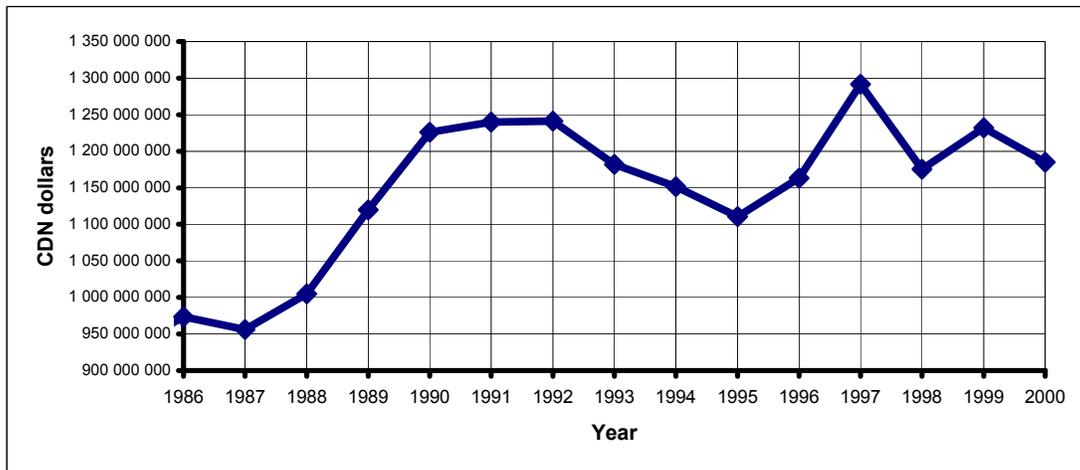


Figure 4: Fire losses in CDN dollars (1986-2000)

1.5 Fires by jurisdiction

The jurisdictions within Canada include the Provinces, the Territories as well as the National Defence, the Indian Reserves, and the Federal Properties. But only six of them, namely Ontario, Quebec, British Columbia, Alberta, Manitoba, and Saskatchewan, are of great statistical interest inasmuch as 90% of the total number of fires in the country took place there.

Fire incidents in the period 1986-2000 are not uniformly distributed among the different parts of the country. The overall trend of the fires is down in Ontario and Quebec where more than 50% of the incidents happened (Figure 5). The fires in the other 4 provinces oscillate slightly about constant values over the same period. Although the number of fires in Saskatchewan tailed up over the period, it does not influence the overall trend because of its relatively low weight (5% on average) with respect to fire incidents. Figures 6 and 7 show the trends by jurisdiction.

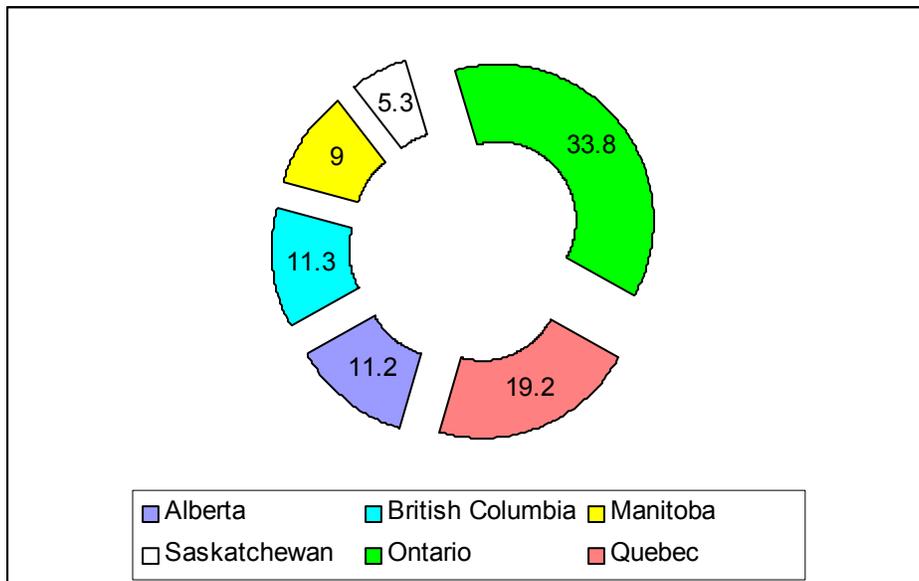


Figure 5: Average fire distribution by jurisdiction over the period 1986-2000

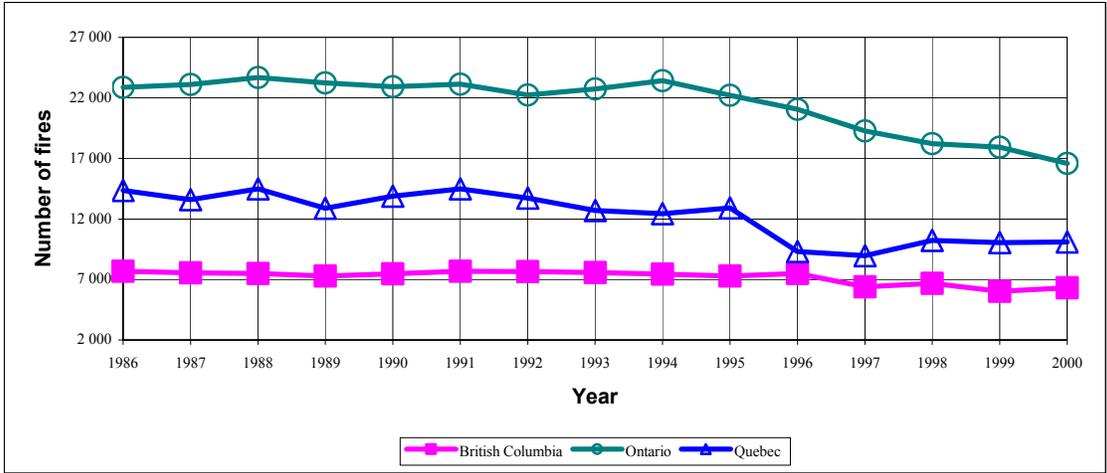


Figure 6: Number of fires by jurisdiction (1986-2000)

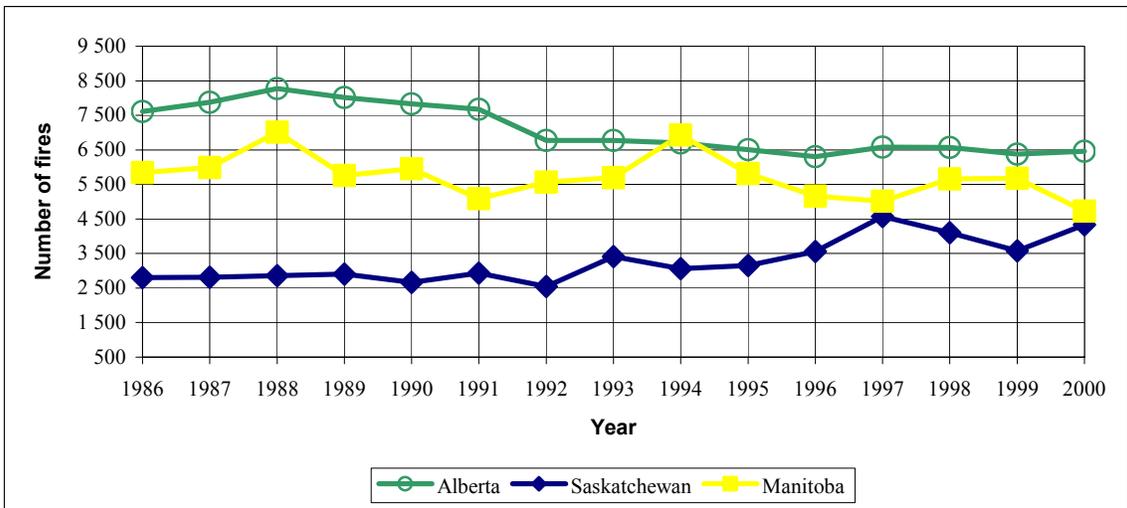


Figure 7: Number of fires by jurisdiction (1986-2000)

1.6 Fire losses by jurisdiction

It is not surprising that the same 6 provinces have the largest monetary fire losses given the fact that they are responsible for most of the fires. Indeed, over 92% of the total fire losses were recorded in these provinces (Figure 8). It is important to note that the fire losses are not proportionately distributed among the provinces according to the number of fires. Many more fires, for instance, occurred in Ontario than in Quebec (Figures 6 and 7), yet they are approximately subjected to the same monetary losses over the period. Figures 9 and 10 effectively illustrate this point.

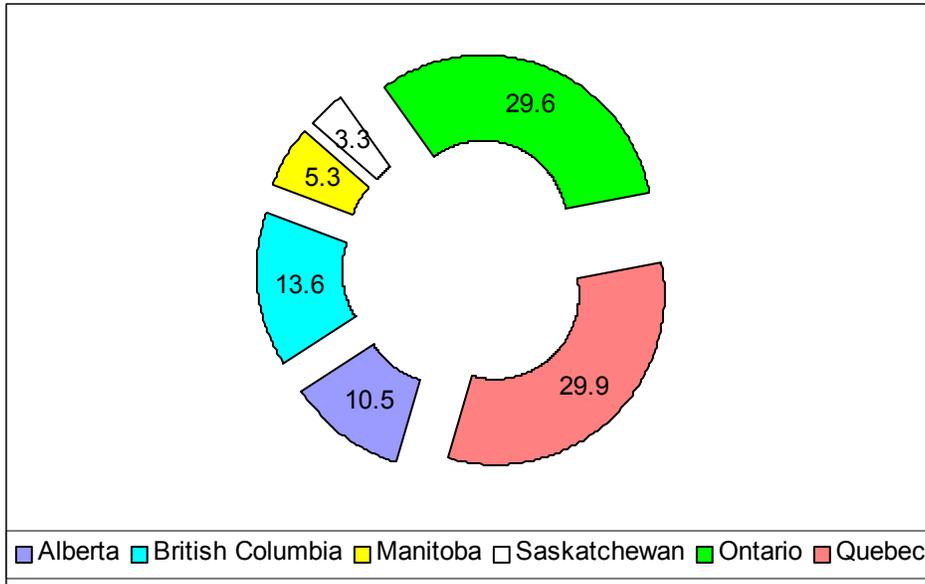


Figure 8: Average fire losses by jurisdiction for the period 1986-2000 in percentage

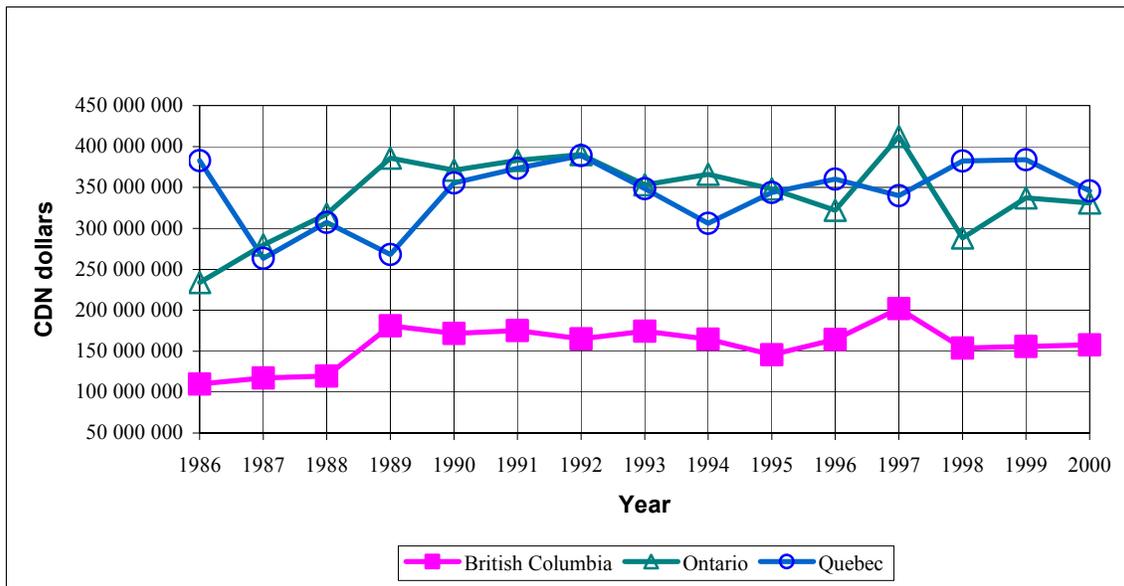


Figure 9: Fire losses in CDN dollars by jurisdiction (1986-2000)

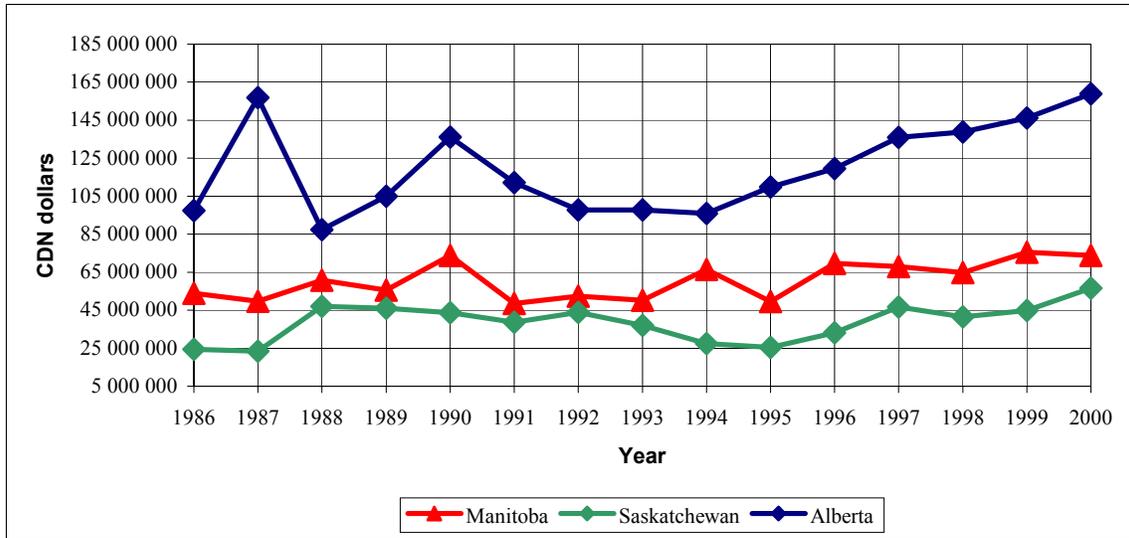


Figure 10: Fire losses in CDN dollars by jurisdiction (1986-2000)

2 FIRE IN CANADA BY PROPERTY CLASS

One of the key parameters used to analyze fire statistics is the type of property involved in the incidents. This classification will allow, among other things, to target specific areas of action if measures have to be taken. Table 1 shows the classification employed and also provides examples for every category so that any misinterpretation is avoided.

Property class	Examples
Residential	1&2 Family Dwellings; Apartment; Hotel, Inn, Lodge; Dormitory; Mobile Home; Camp/Retreats, ...
Assembly	Theatre, Studio, Auditorium; School, College, University; Church, Funeral Parlour; Library, Museum, Art Gallery; ...
Institutional	Penitentiary, Correctional Facility, Reformatory; Home for Aged; Community Care Facility; Medical Facilities; ...
Business and Personal Service	Office; Personal Service; Electronic Equipment; Miscellaneous, Business & Personal Service.
Mercantile	Food, Beverage Sale; Textile, Wearing Apparel Sale; Recreation, Hobby Supplies; Department, Variety; ...
Industrial Manufacturing Properties	Chemical, Petroleum, Paint, Plastic; Wood, Furniture, Paper, Printing; Food Processing; Textiles; ...
Storage Properties	Agriculture, Products Storage; Textiles, Fibres, Clothing Storage; Chemical, Plastics, Paints; Vehicle Storage; ...
Special Properties-Transportation Equipment	Outdoor Property; Watercraft; Rail, Transport Vehicle & Equipment; Ground Transport Vehicle; Aircraft; ...
Farm Properties	
Miscellaneous Properties	Laboratories; Farm Facilities; Utilities; Mining, Quarrying; Communications; Cement, Glass, Pottery Manufacturing; ...

Table 1: Description of property class terms

2.1 Fire by property classification

Residential and special properties are the main places where the majority of fires took place in Canada from 1986 to 2000. Of the declared fires, over 42% occurred in residential properties followed by the special properties with more than 36%. These two categories accounted for about 80% of the total fires over the period. Figure 11 is the distribution of the fire incidents from 1986 to 2000, while Figure 12 shows the trends of these two categories over the same period. It turns out that the gap between the two trends has shrunk at the end of the period.

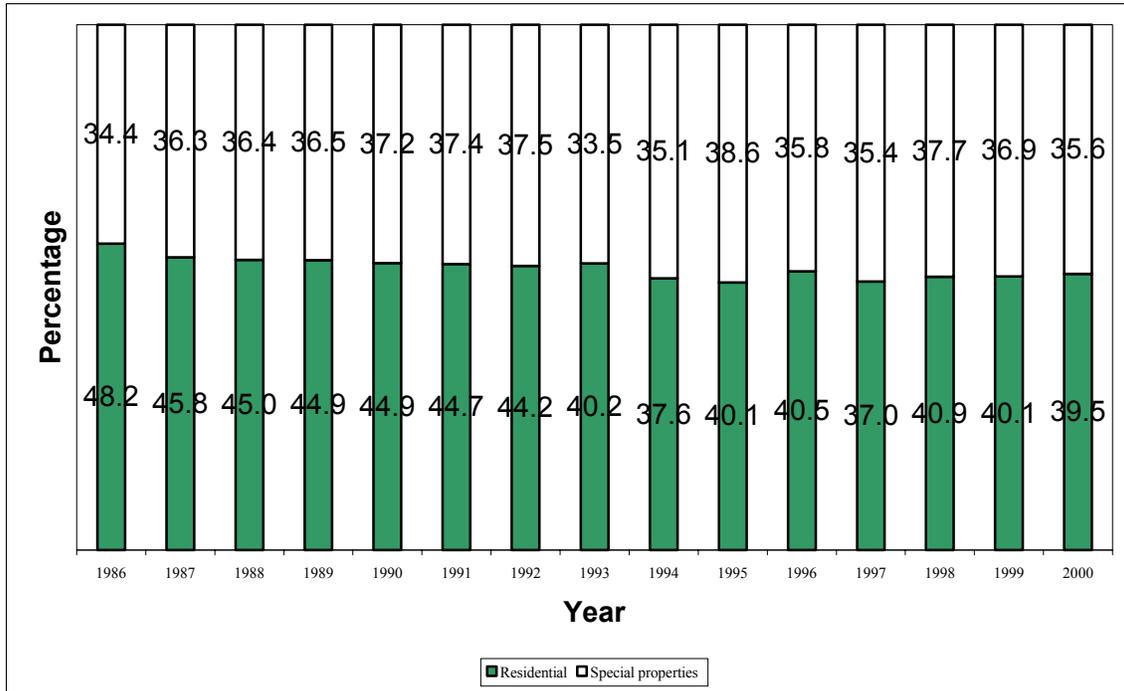


Figure 11: Fires by property classification (1986-2000) in percentage

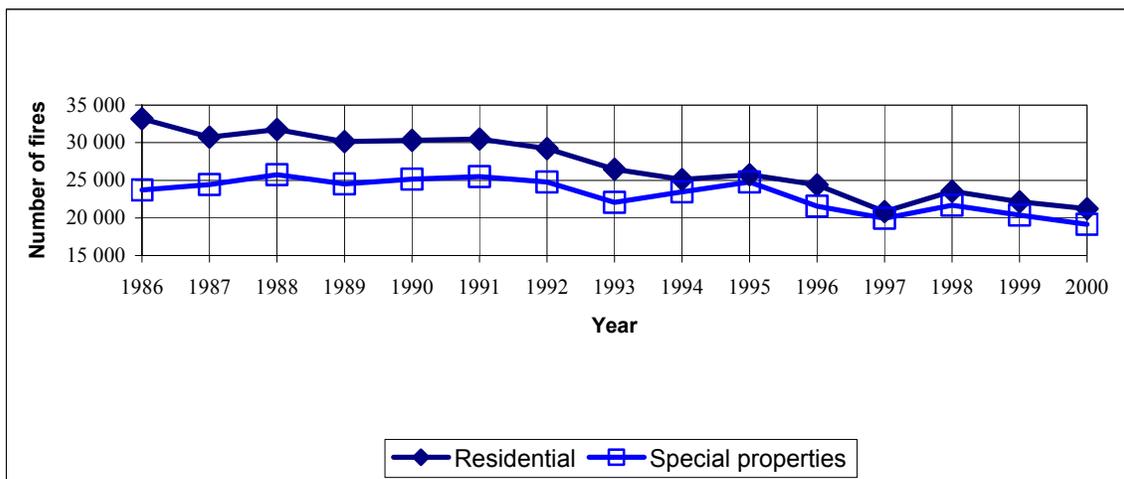


Figure 12: Number of fires by property classification (1986-2000)

2.2 Fire deaths by property classification

Fires are more often fatal in residential properties than in any other property group. Nearly 80% of the fire-related deaths came from residential, and 8% on average from special properties. These two categories totalled on average 87% of all the fatalities. The difference between the trends of these two categories becomes much more important when it comes to fire-related deaths. See Figures 13 and 14 for illustration.

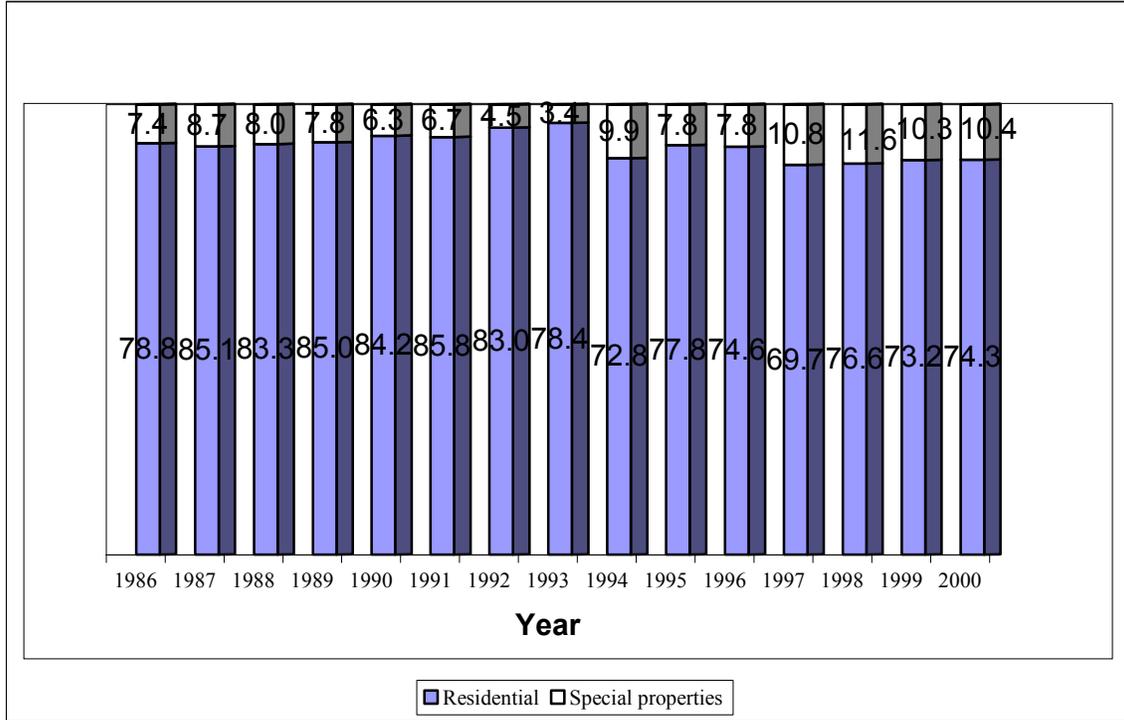


Figure 13: Fire deaths by property classification (1986-2000) in percentage

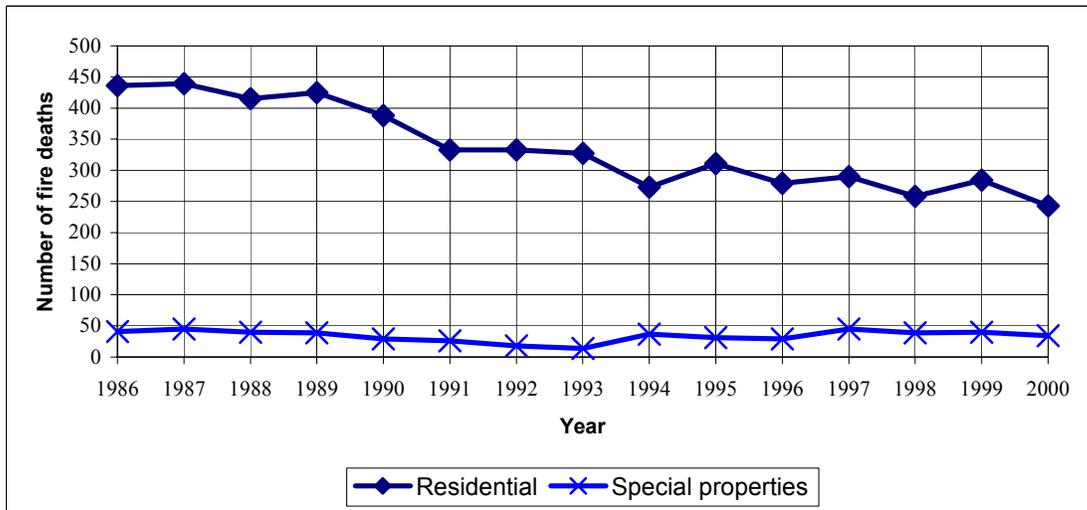


Figure 14: Number of fire deaths by property classification (1986-2000)

2.3 Fire losses by property classification

The cost of the fires is important in the residential category. In fact, 43% of the monetary losses fall into this group. Otherwise, the cost of the fires is fairly distributed over the other categories. The special property still comes second but at a much lower level in terms of cost (11% on average). Categories such as Assembly, Mercantile, and Industrial Manufacturing are not very likely to be involved in a fire but if they do the cost is fairly high, given the nature of the equipment involved. Whether it is the overall cost of fire or the losses by residential classification, the trends are still sloped upward over the period 1986-2000. Figures 15, 16 and 17 give the distribution and the variation of the monetary losses over the period.

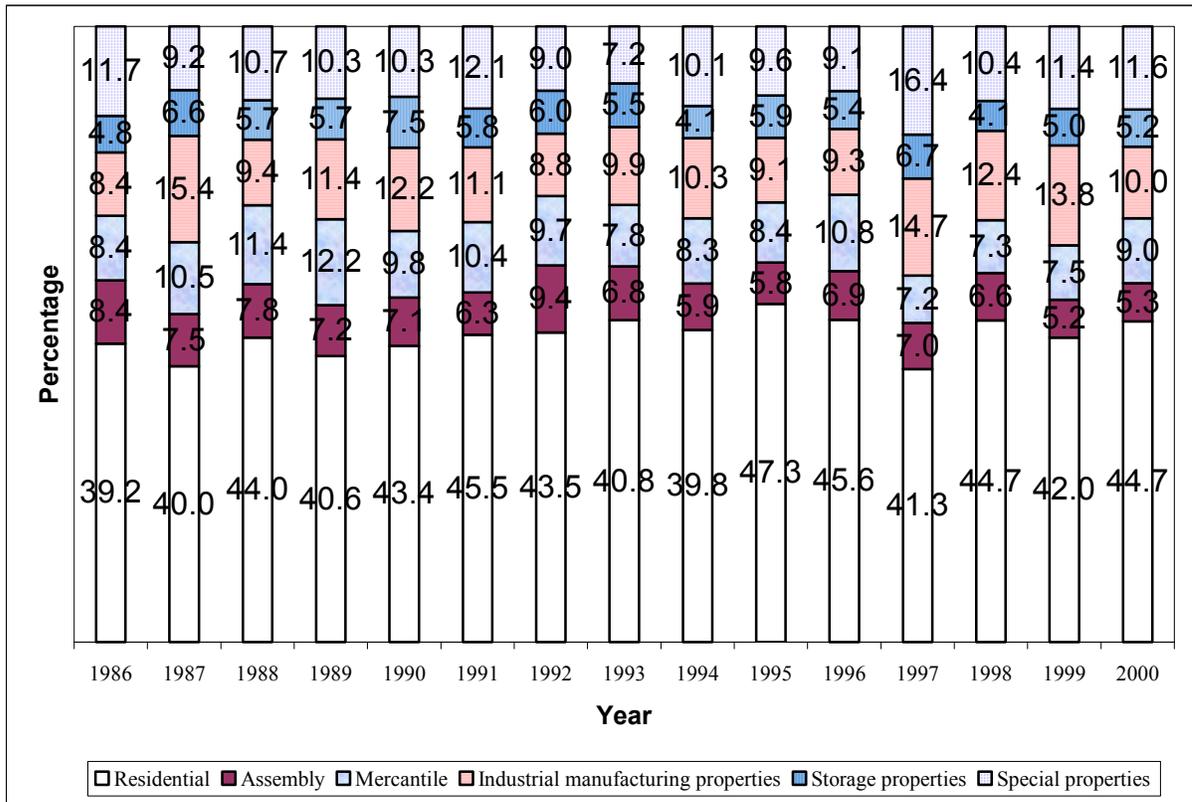


Figure 15: Fire losses by property classification (1986-2000) in percentage

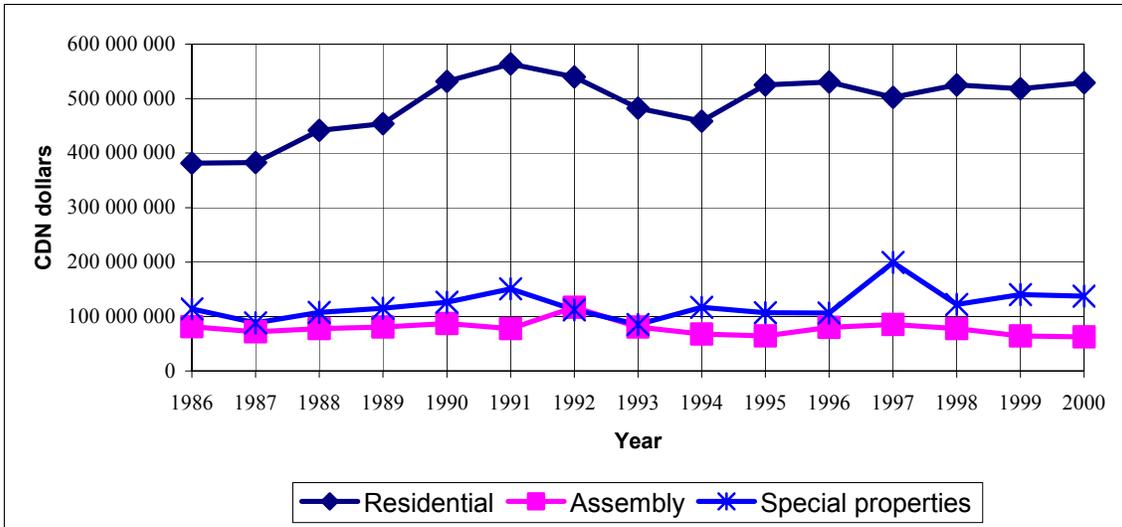


Figure 16: Fire losses in CDN dollars by property classification (1986-2000)

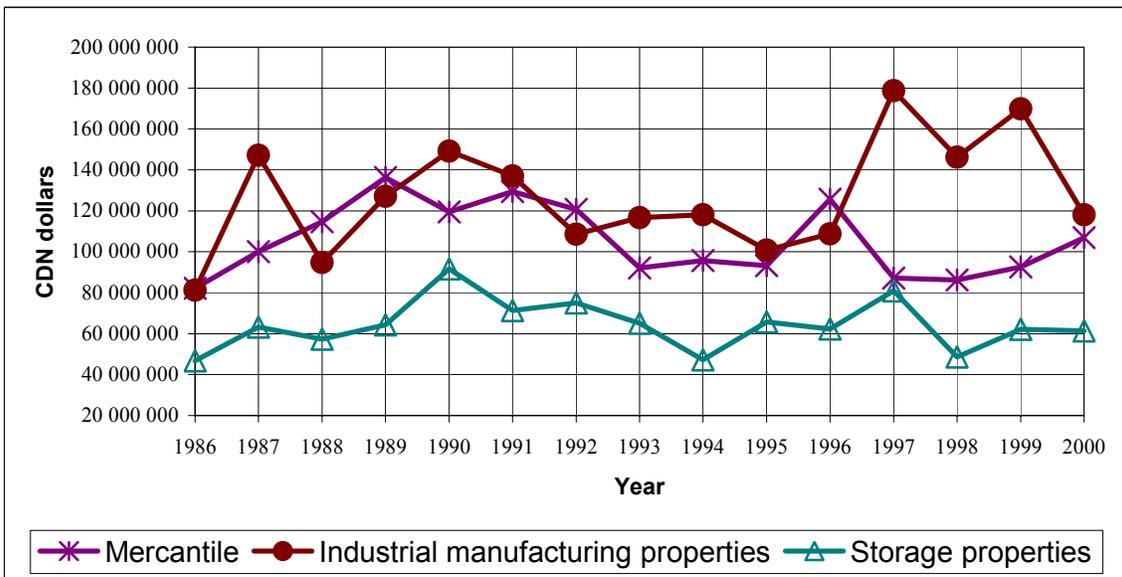


Figure 17: Fire losses in CDN dollars by property classification (1986-2000)

2.4 Residential properties

It was previously observed that most of the fires occurred in 6 provinces and particularly in Ontario and Quebec. As a result, those provinces incurred the majority of the fire consequences. The same reality prevails when the focus is shifted to the residential category of its own. The six provinces, Ontario, Quebec, British Columbia, Alberta, Manitoba, and now Nova Scotia are responsible for 90% of the fires recorded in this group (Figure 18). The weight of Ontario is now 36% while that of Quebec is on average 26%. Figures 19 and 20 present the trends of the group by jurisdiction over the period under consideration.

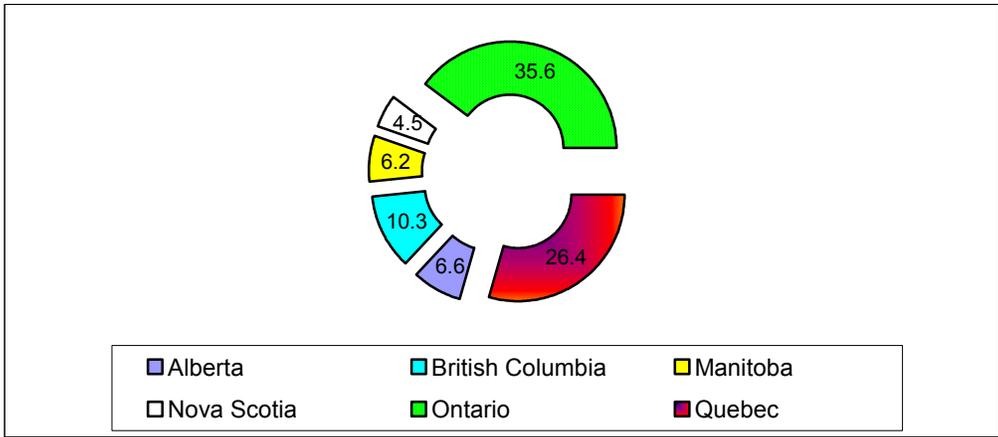


Figure 18: Fire distribution in residential property by jurisdiction over 1986-2000

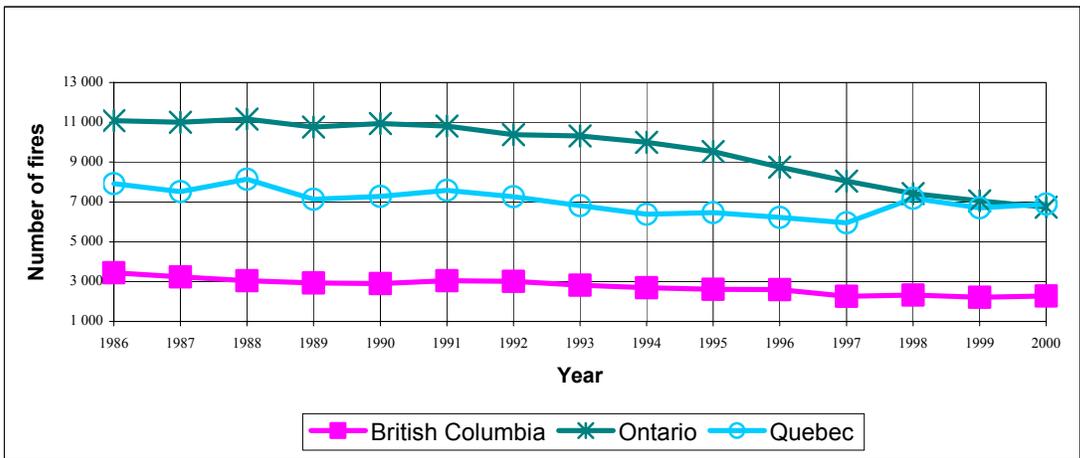


Figure 19: Number of fires in residential properties by jurisdiction (1986-2000)

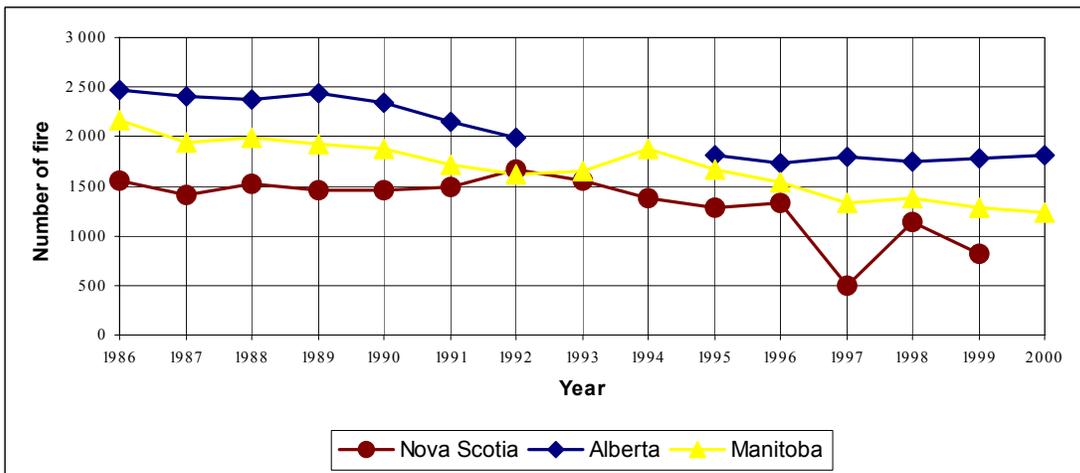


Figure 20: Number of fires in residential properties by jurisdiction (1986-2000)

2.4.1 Fires by residential occupancy

The importance of the residential category suggests breaking it down further so that the vulnerable elements can be identified. By doing so, it is revealed that 87% of the fires in the residential group occurred in the following three subcategories: “one and two family residence”, “apartment, tenement, flat”, and “mobile home, trailer”. It is also remarkable that over 83% of these fires took place in the first two subcategories, which actually represent the regular homes. Figures 21 and 22 clearly show the trends over the period 1986-2000.

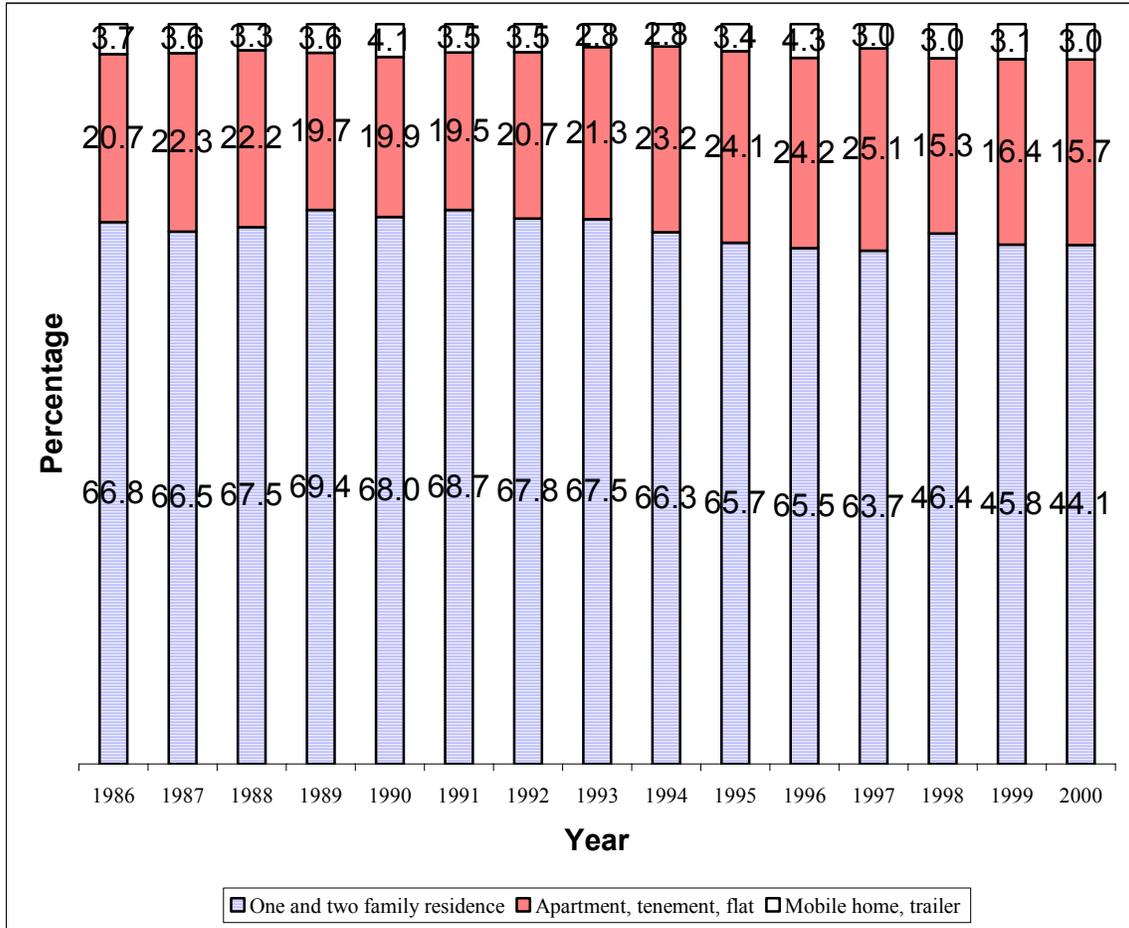


Figure 21: Fires by residential occupancy (1986-2000) in percentage

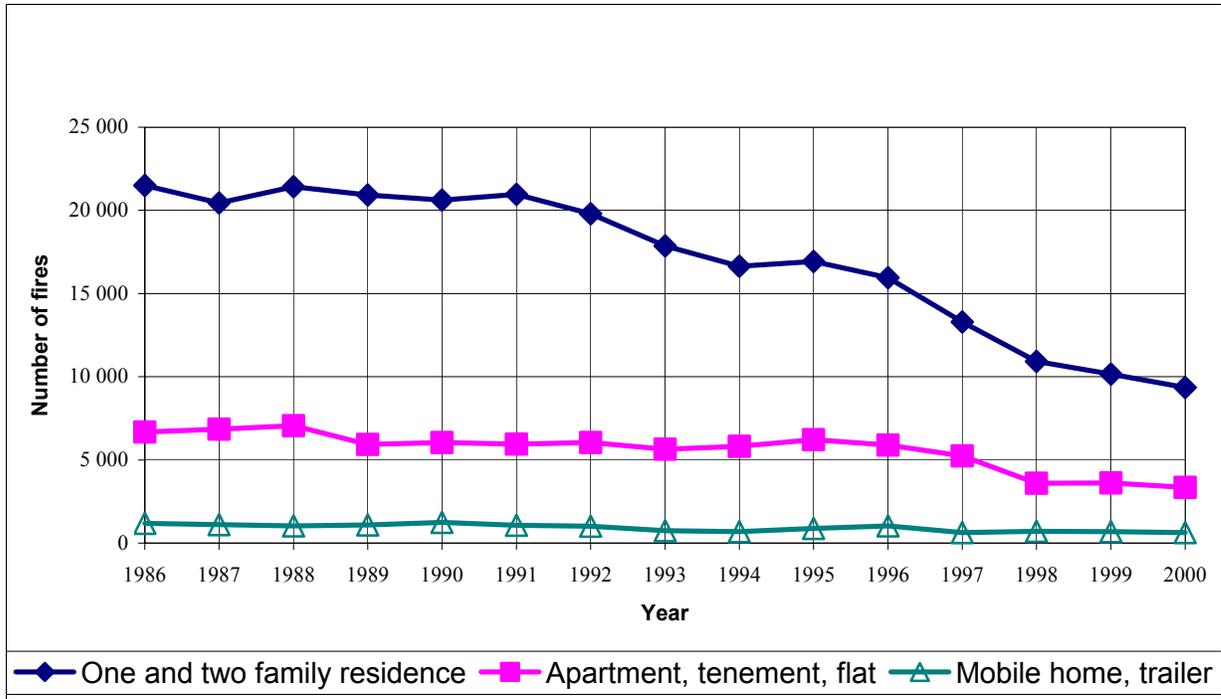


Figure 22: Number of fires by residential occupancy (1986-2000)

2.4.2 Fire losses by residential occupancy

The monetary losses are proportionately distributed among the three subcategories. Indeed, their cost reached over 85% of the total cost in the residential property. The same subgroups “One and two family residence”, “apartment, tenement, flat” have a weight of about 83% in terms of loss. It is evident that all the fire issues boil down to these two types of property where fires and their damages are more disastrous. Figures 23 and 24 illustrate the bar distribution and the trends of the residential properties by occupancy from 1986 to 2000.

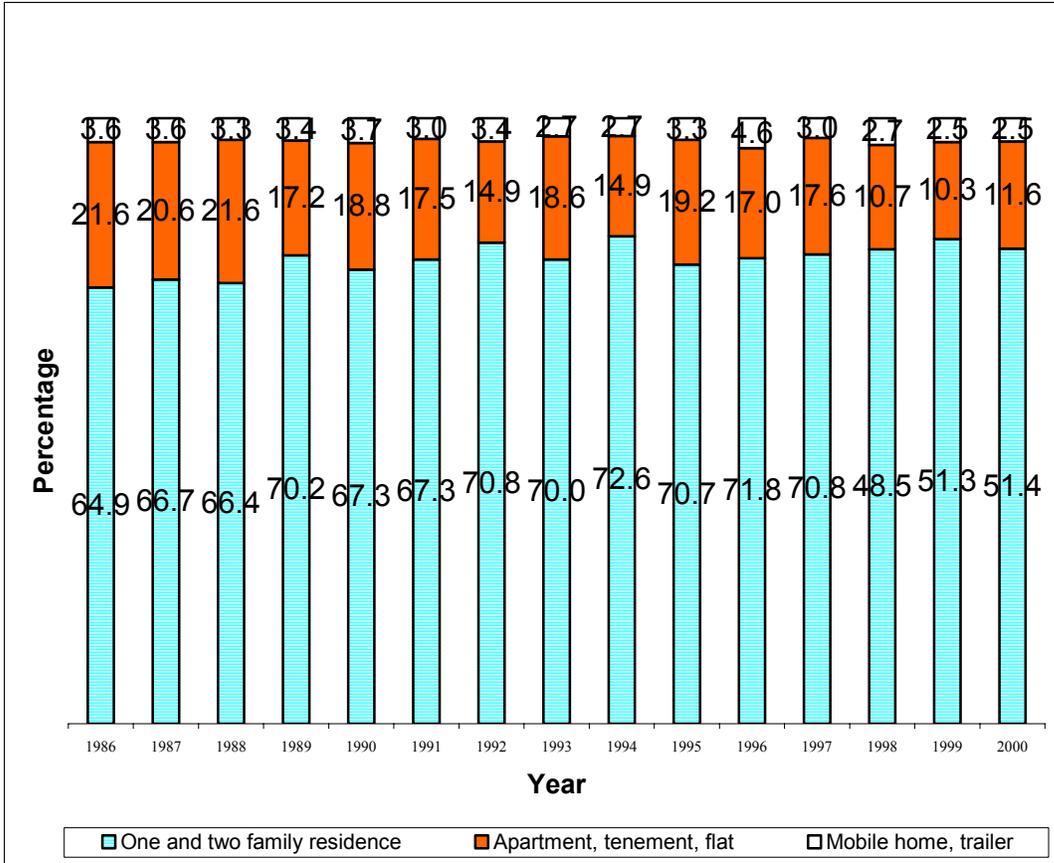


Figure 23: Fire losses by residential occupancy (1986-2000) in percentage

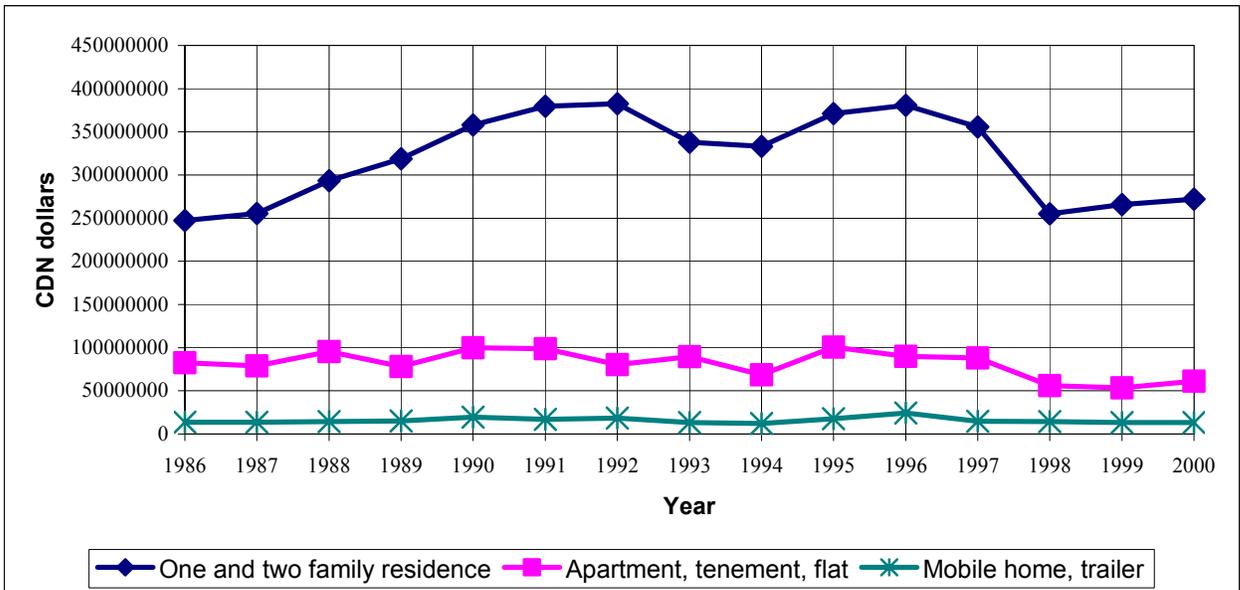


Figure 24: Fire losses in CDN dollars by residential occupancy (1986-2000)

2.5 Fire deaths by residential occupancy

As mentioned earlier, 80% of fire related deaths come from residential property. The fire deaths in residential property are proportionally distributed among three subcategories: “one and two family residence”, “Apartment, tenement, flat” and “mobile home, trailer”. These three subgroups have a weight of about 88% in terms of fire deaths in residential property. Figure 25 illustrates the bar distribution of fire residential fire deaths by occupancy from 1986 to 2000.

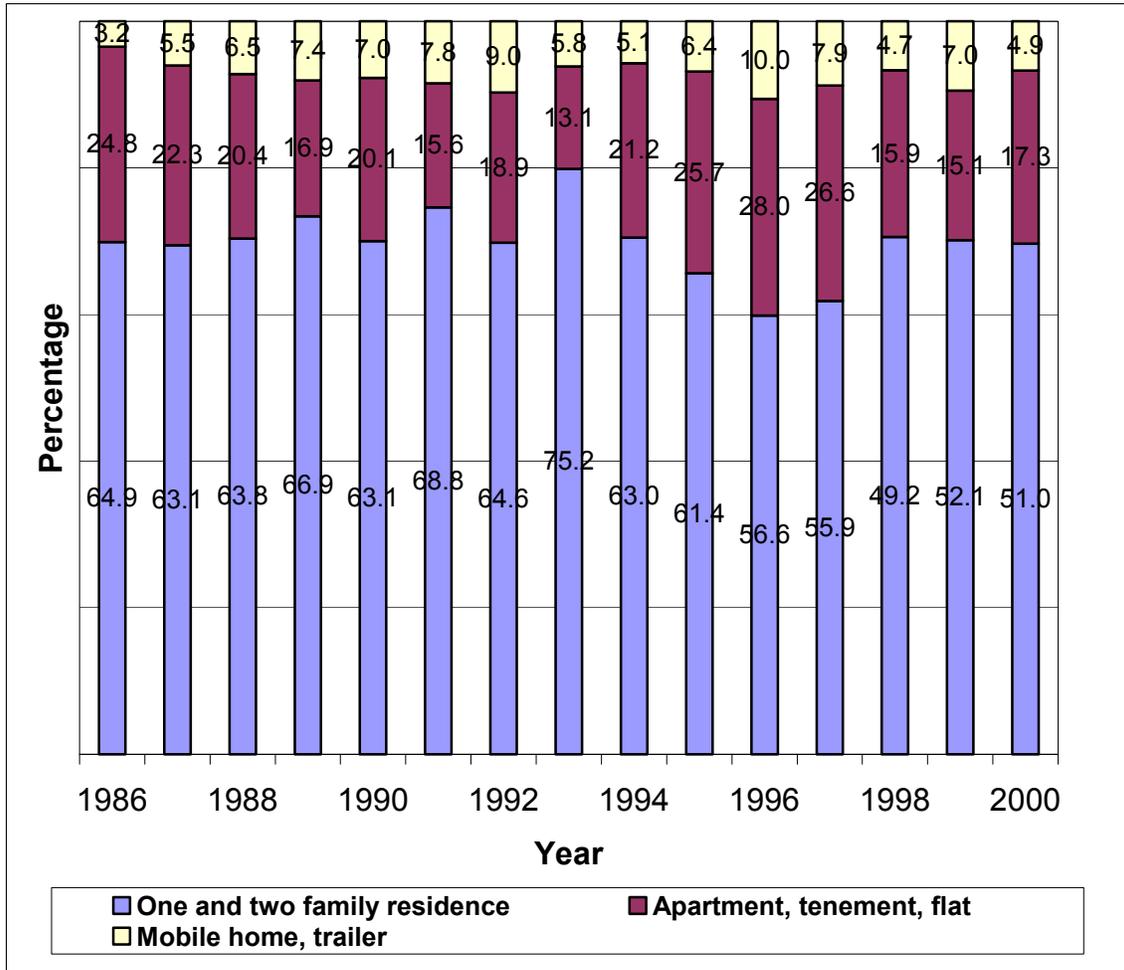


Figure 25: Fire deaths by residential occupancy (1986-2000) in percentage

2.6 Special property

In terms of fire occurrence and fire loss, the special property is the second most important of the property classifications. The distribution of the fires in the special property is similar to that in the residential group. Most fires in that group, 94% on average, happened in 6 jurisdictions: Ontario, British Columbia, Manitoba, Alberta, Quebec, and Saskatchewan. But in the special property category, Ontario and British Columbia record the highest weights of 33% and 14% respectively, while Quebec and Saskatchewan have the lowest percentages among the six provinces (Figure 25). Figures 27 and 28 clearly show the lead of Ontario and the overall down trend of the fires over the period 1986-2000.

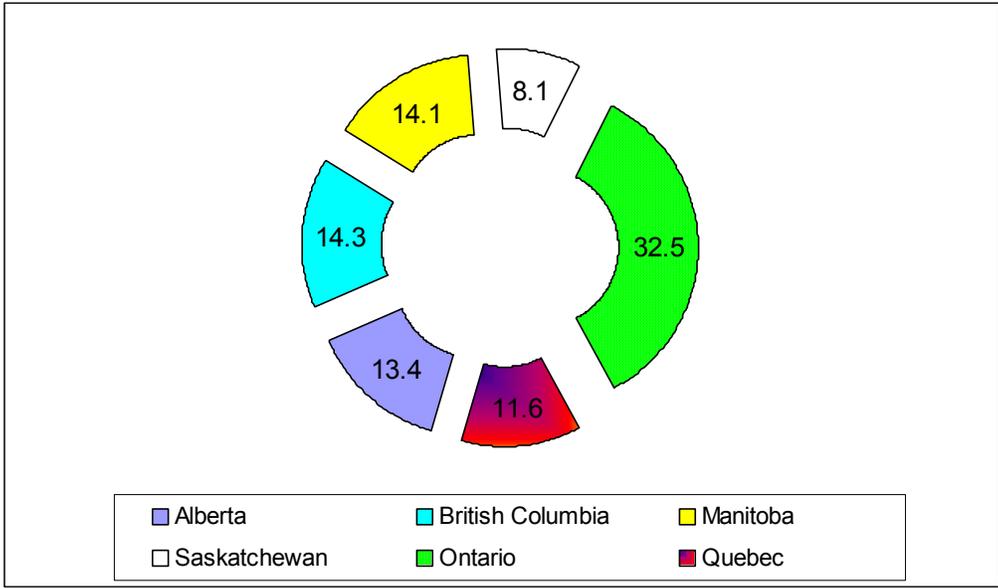


Figure 26: Fire distribution in special property by jurisdiction for the period 1986-2000

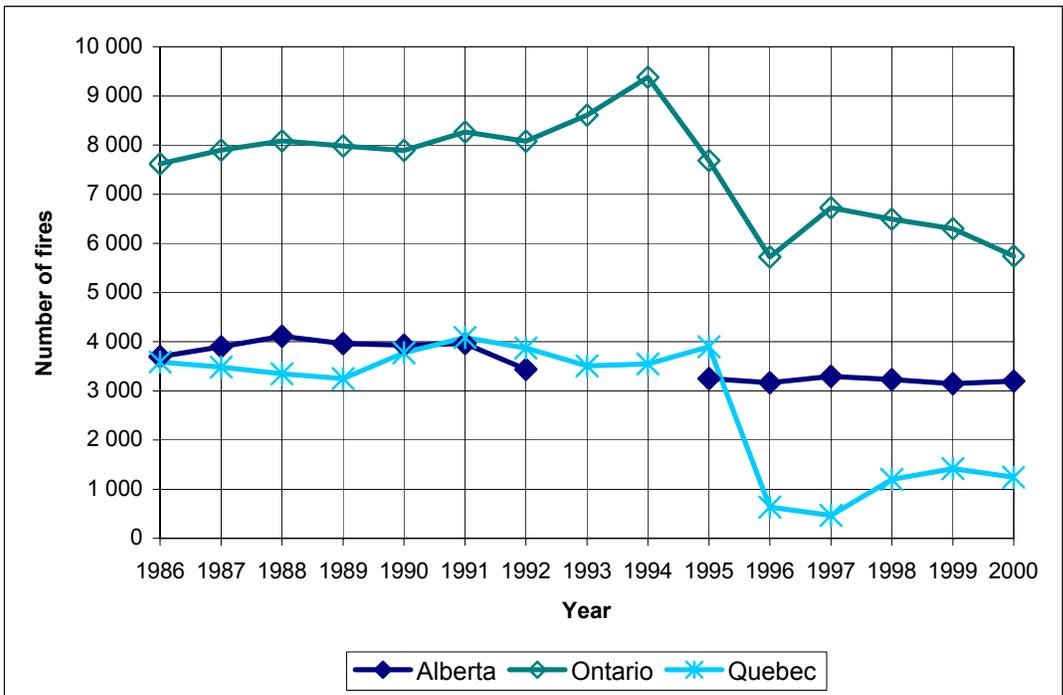


Figure 27: Number of fires in special properties by jurisdiction (1986-2000)

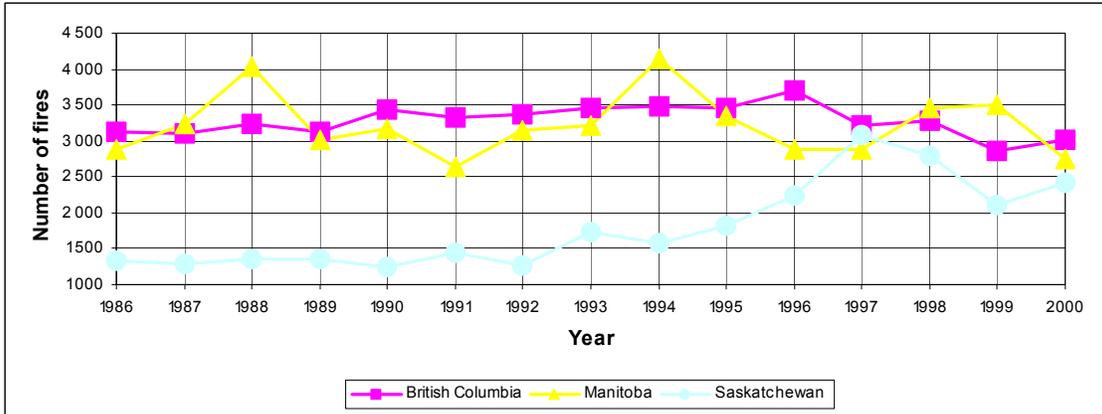


Figure 28: Number of fires in special properties by jurisdiction (1986-2000)

2.6.3 Fire in special property by occupancy

The relative importance of this category leads to splitting it into sub-groups in order to have an in-depth understanding of its components. Among the subcategories considered, the ground transportation vehicle come first with an average of 67% of the fires, then follows the outdoor property, and the special vehicle groups with 22% and 5% respectively. These three subcategories total around 94% of the fires occurring in the special property group. Figures 29 and 30 highlight the distribution of the fires in the group by occupancy as well as their trends from 1986 to 2000.

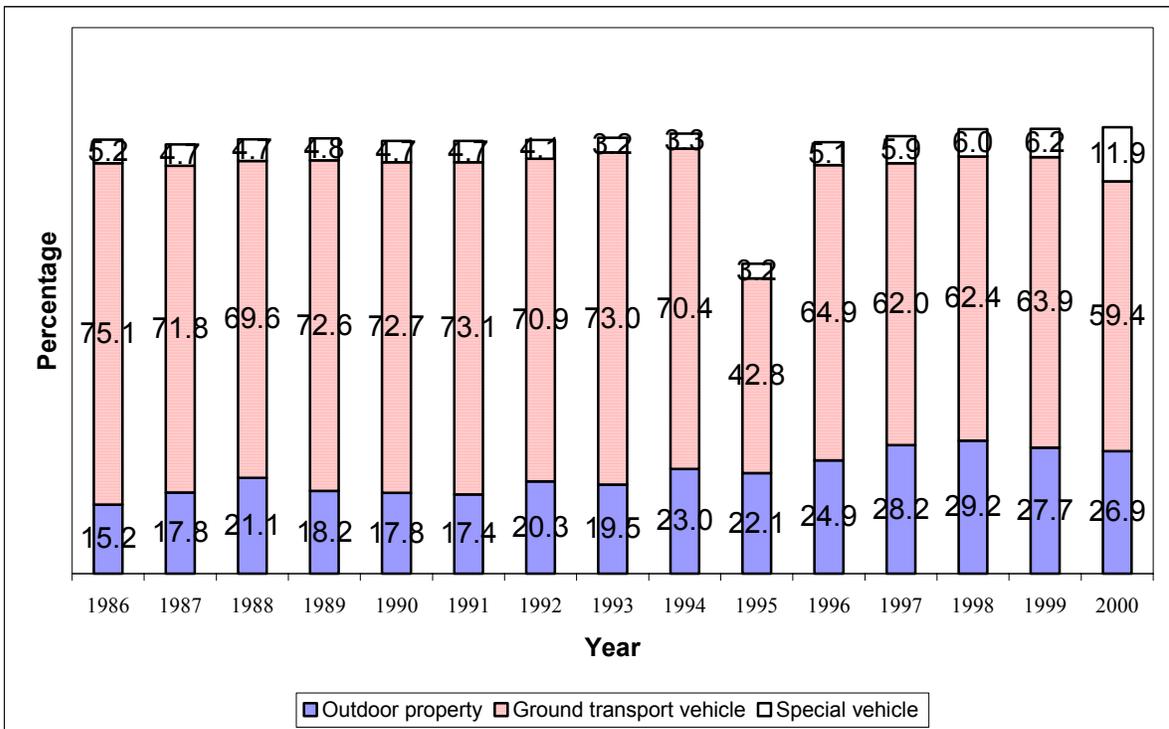


Figure 29: fires in special properties by occupancy (1986-2000) in percentage

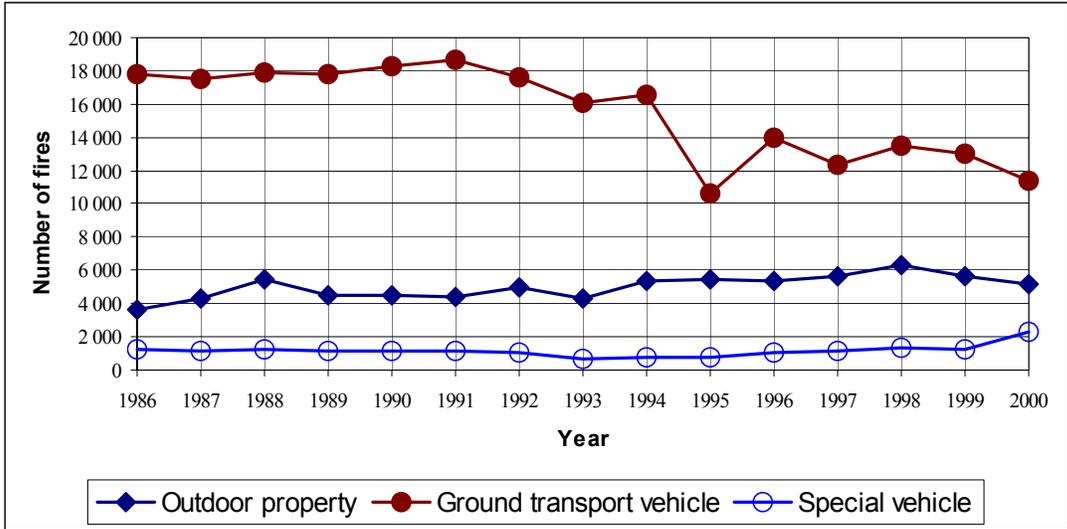


Figure 30: Number of fires in special properties by occupancy (1986-2000)

2.6.4 Fire losses in special property by occupancy

Once again, three subcategories cover more than 82% of the total cost of fire in the special property group. The majority of the loss took place in a ground transport vehicle (around 55%). The “special vehicle”, and the “construction, demolition, and vacant” subgroups come after with 16% and 11% respectively. In 1996, an unusual increase of the fire loss was recorded in the “construction, demolition, vacant” subgroup (47%), which consequently brought down the fire cost weight of the ground transport vehicle to 35%. Figures 31 and 32 illustrate the variation within the special property over the period.

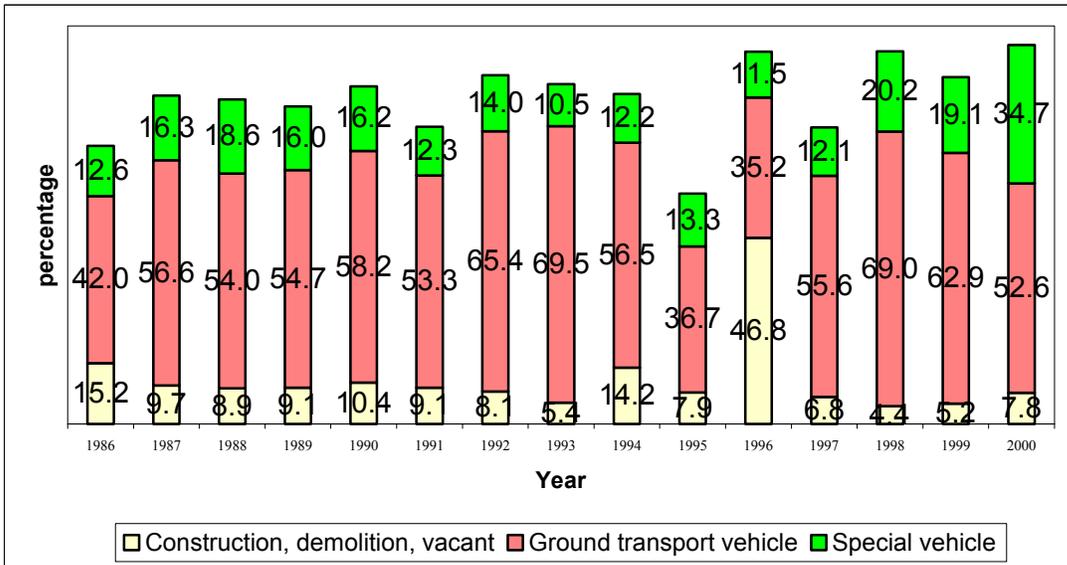


Figure 31: Fire losses in special properties by occupancy (1986-2000) in percentage

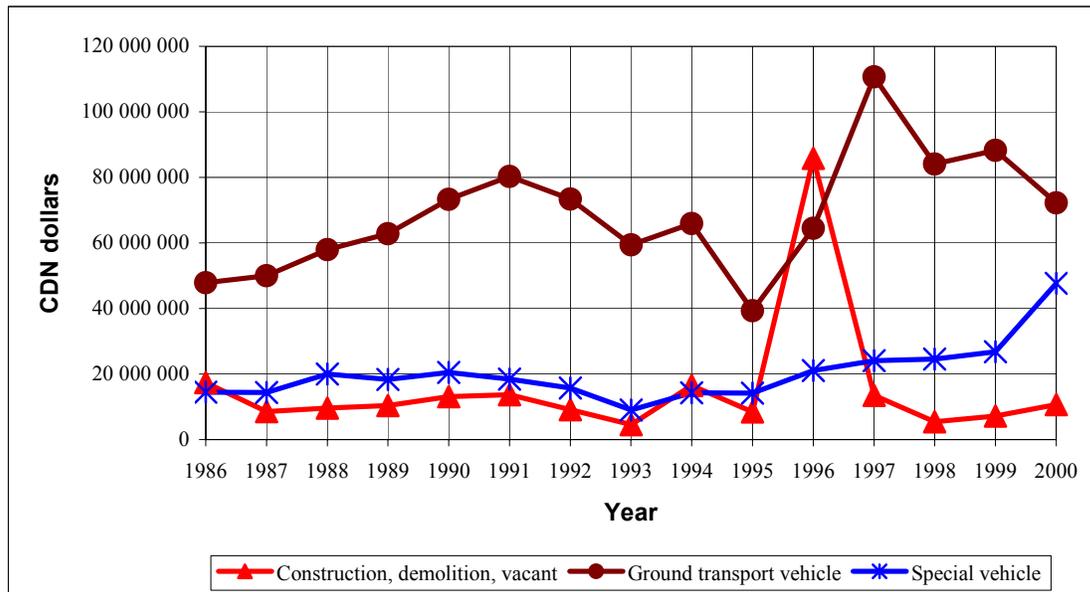


Figure 32: Fire losses in CDN dollars in special properties by occupancy (1986-2000)

3 IGNITION OBJECT – SOURCE OF IGNITION

The table below is helpful to understand the different items causing fire in Canada and what is included in each of them.

Sources of Ignition	Examples
Cooking Equipment	Stove, Range involved; Self Heat Appliances; Warming Appliances; Unclassified.
Heating Equipment	Central Heating Unit; Water Heating; Space Heaters, Wood Stove; Fireplace; Chimney; Flue Pipe; ...
Appliances & Equipment	Television, Radio, Stereo; Clothes Dryer, Air Conditioning, Refrigeration; Incinerator; ...
Electrical Distribution Equipment	Electrical Wiring; Electrical Components; Battery, Rectifier- includes charger.
Other Electrical Equipment	Electric Motors; Electric Equipment; Video Game Equipment; Photocopier, Facsimile, Computer Printer; ..
Smoker's material & Open flame	Smoker's material (all in conjunction with smoking); Cigarette; Pipe (Contents); Match; Lighter; Lamp; ...
Exposure	Structures; Lumber Yard; Outside Storage Containers; Open Fire; Forest, Grass, Trees, Shrubs, Brush; Vehicle.
Miscellaneous	Internal Combustion Engine, Exhaust System; Heat Treatment Equipment; Industrial Oven, Kiln; Tar Pot; ...

Table 2: Description of source of ignition terms

3.1 Fires by source of ignition

This section is certainly very useful and crucial since it points out the specific items responsible for fires in the country. If measures can be taken to control these items, fewer fires and consequently less damage will be recorded in the future. All the above factors make fire happen but not at the same level. Over the period 1986-2000, an average of 12% of the total fires in Canada originated from “cooking equipment”; each of the “heating equipment” and “electrical distribution equipment” contributed to 9% of the fires; the “smoker’s material” and the “smoker’s material or open flame unclassified” were involved in 6% of the fires (Figure 33). These are the 5 leading causes of fire in the country and accounted for around 42% of the fires over the period 1986-2000. Figures 34, 35 and 36 show the distribution of these fire factors and their trends over the period.

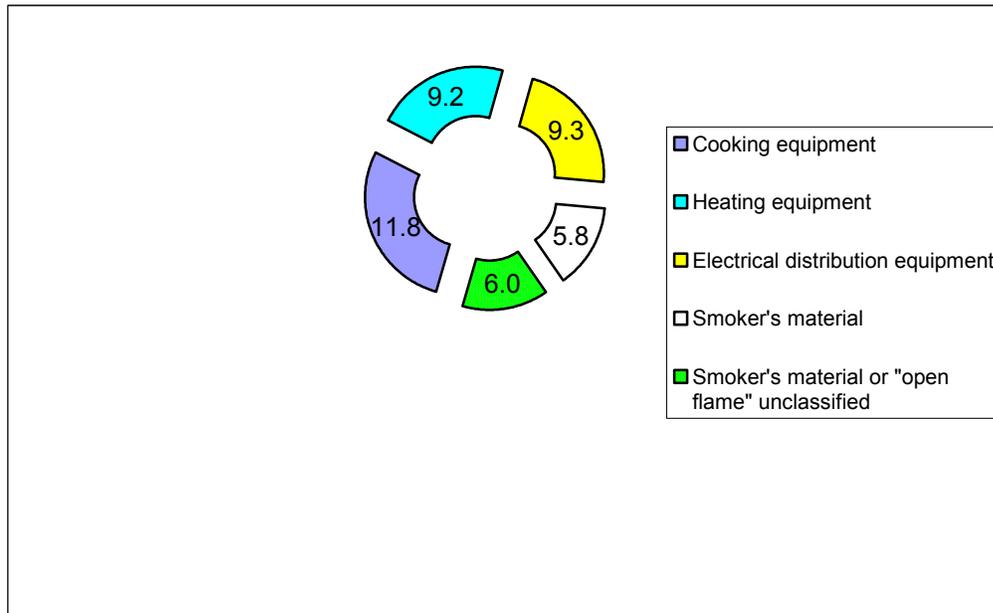


Figure 33: Average fire distribution by source of ignition for the period 1986-2000

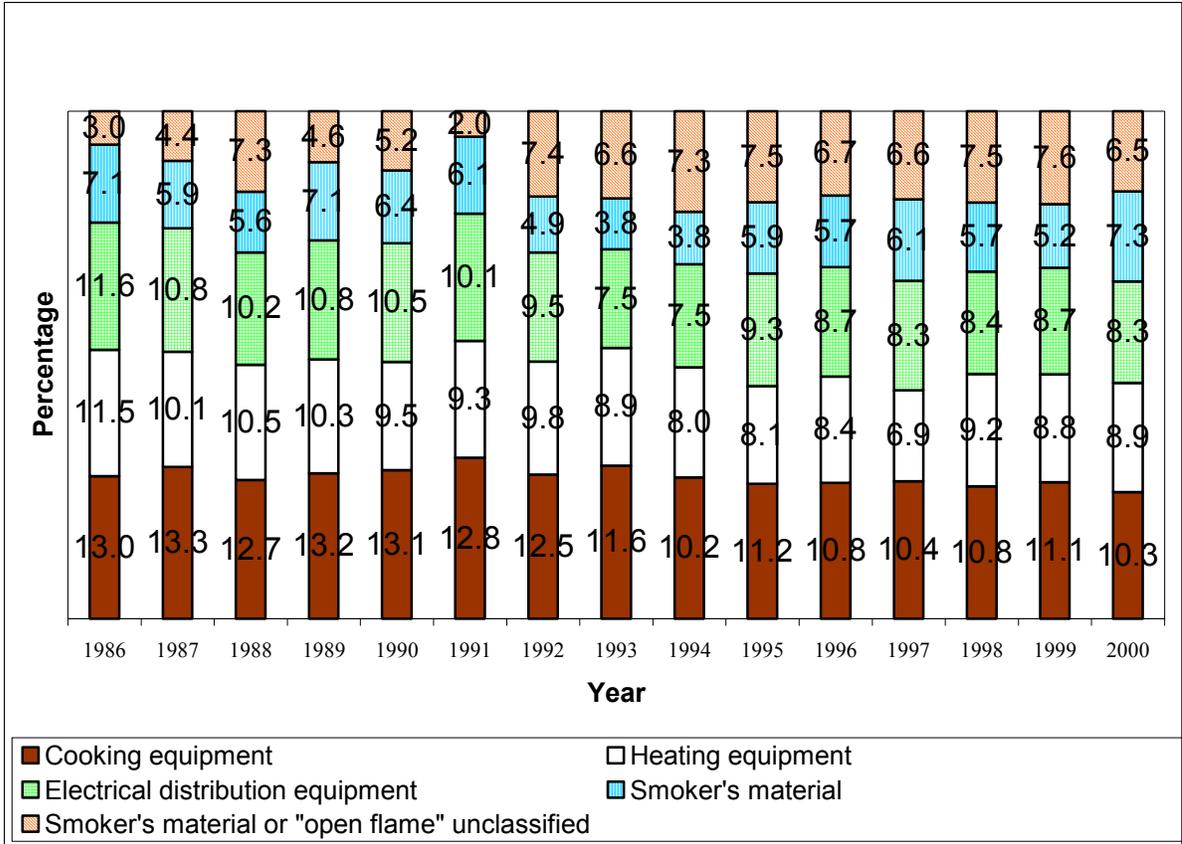


Figure 34: Fires by source of ignition (1986-2000) in percentage

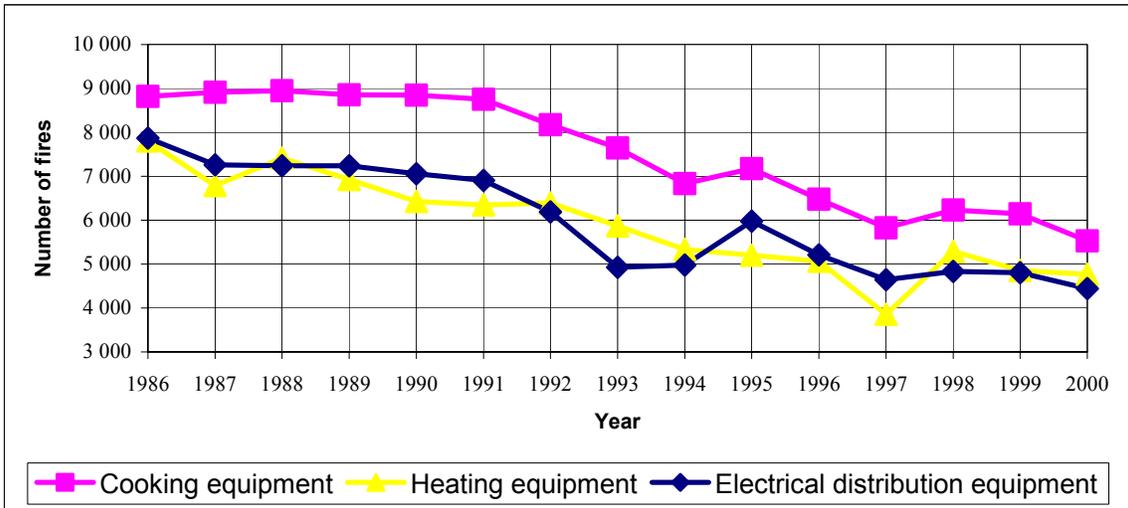


Figure 35: Number of fires by source of ignition (1986-2000)

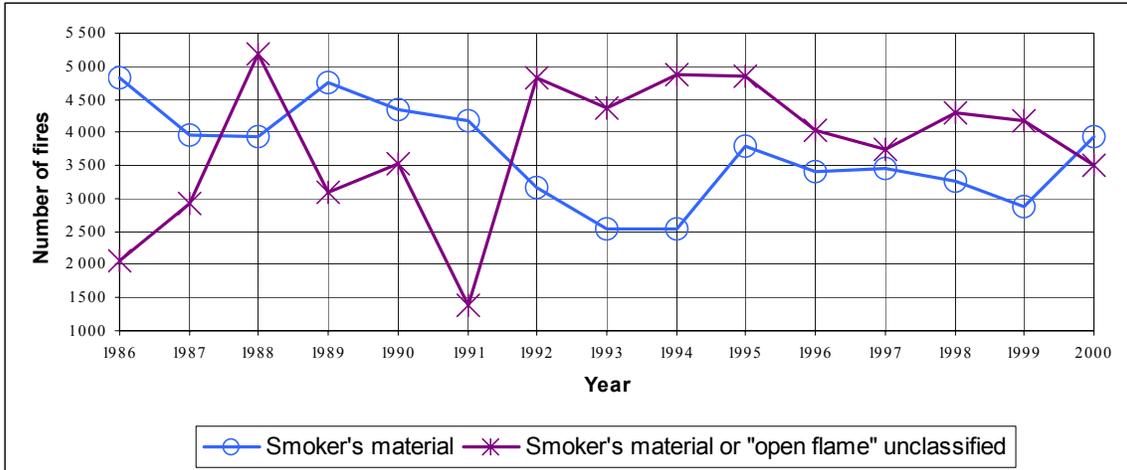


Figure 36: Number of fires by source of ignition (1986-2000)

3.2 Fire deaths by source of ignition

Smoker's material is by far the most fatal of all the fire factors. It is the cause of over one-fifth of the fire deaths in Canada. The same factors responsible for fires are also the most deadly ones. More than 50% of the fire-related deaths come from them. Figures 37, 38 and 39 present the variation of fire-related deaths in Canada by source of ignition from 1986-2000.

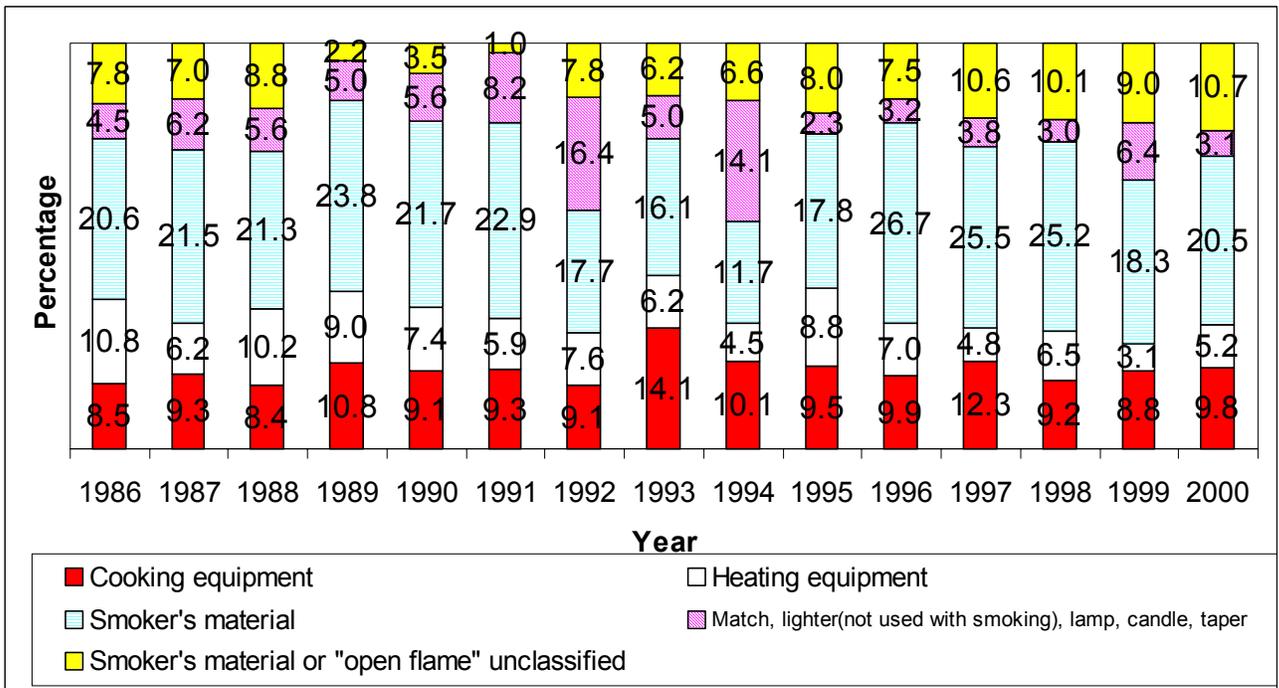


Figure 37: Fire-related deaths by source of ignition (1986-2000) in percentage

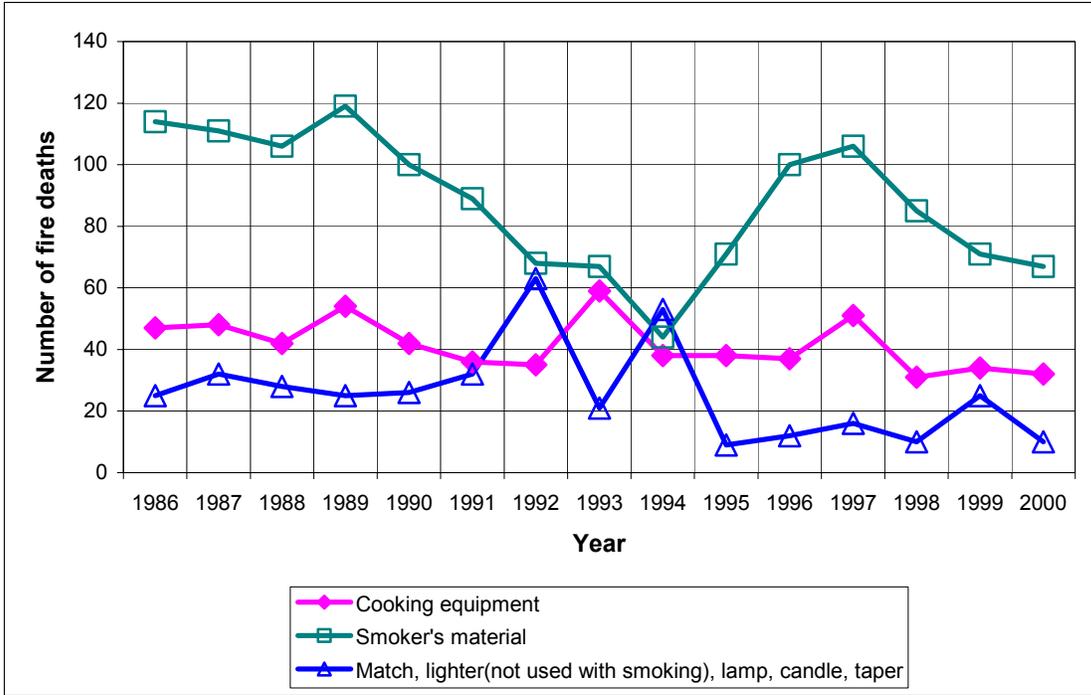


Figure 38: Number of fire deaths by source of ignition (1986-2000)

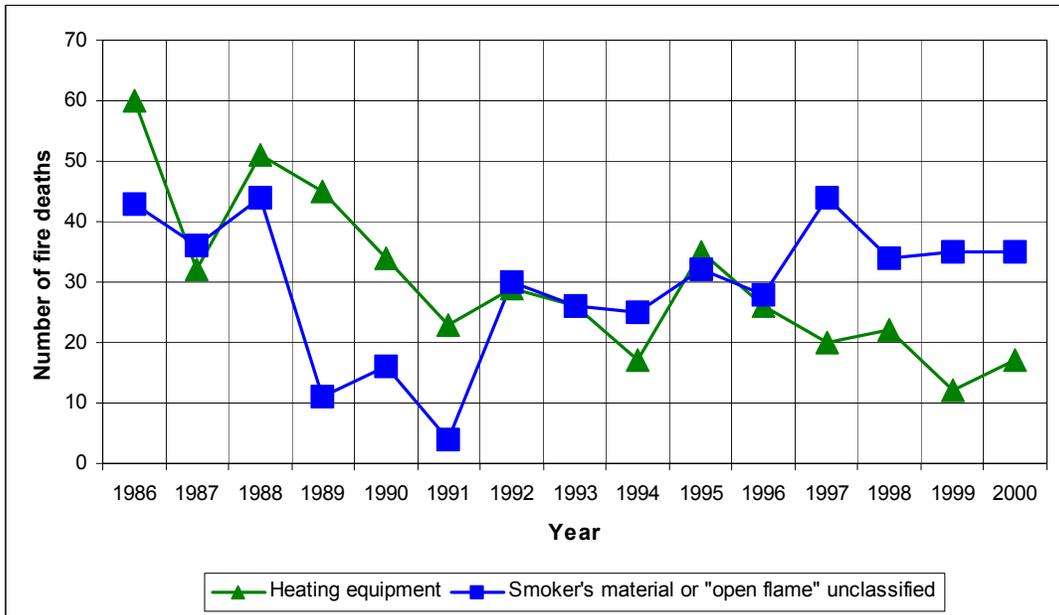


Figure 39: Number of fire deaths by source of ignition (1986-2000)

3.3 Fire losses by source of ignition

Even though the electrical distribution equipment leads the cost of fire over the period, it turns out that the fire loss is fairly distributed among the different fire factors. The weight of the five most significant fire causes relative to the total cost lies in the range 5-12% and all combined add up to 28% of the monetary cost. Figures 40, 41 and 42 give a better graphic representation of the fire loss by source of ignition over the period 1986-2000.

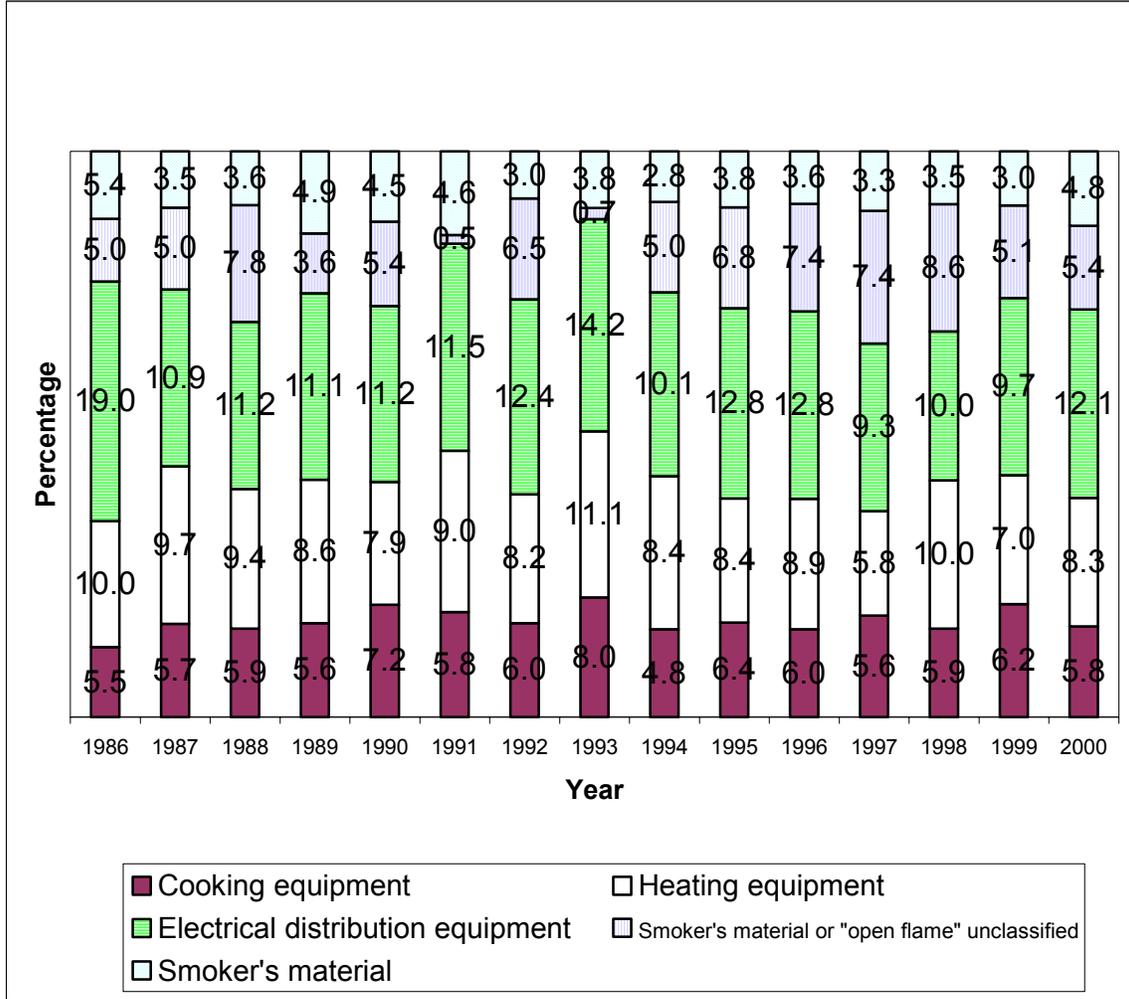


Figure 40: Fire losses by source of ignition (1986-2000) in percentage

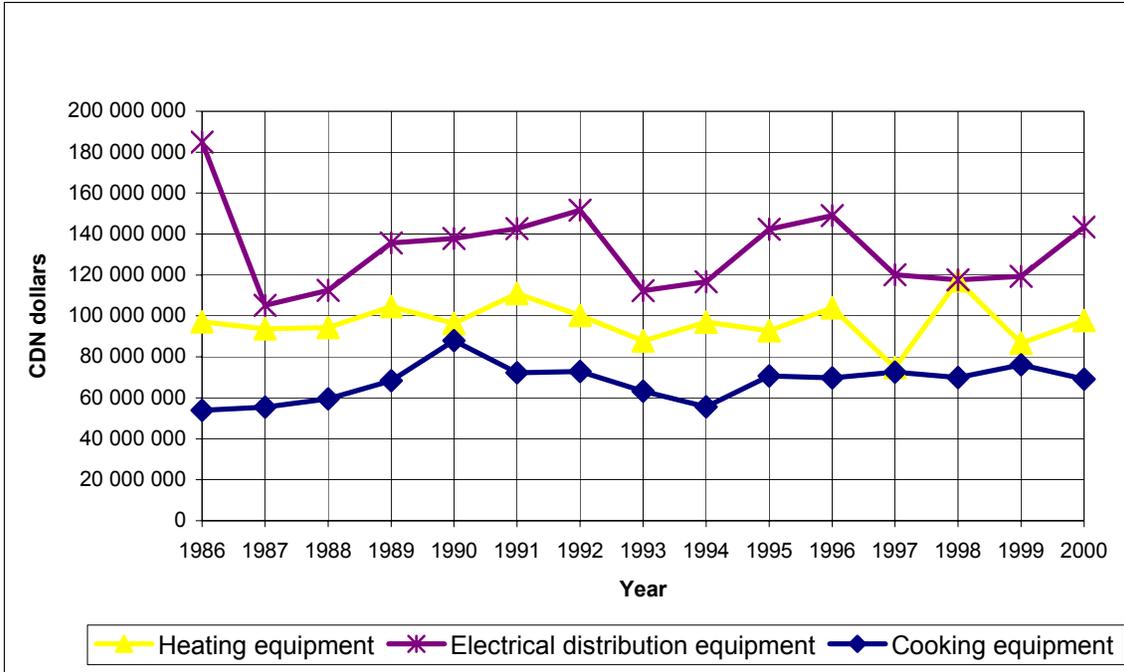


Figure 41: Fire losses in CDN dollars by source of ignition (1986-2000)

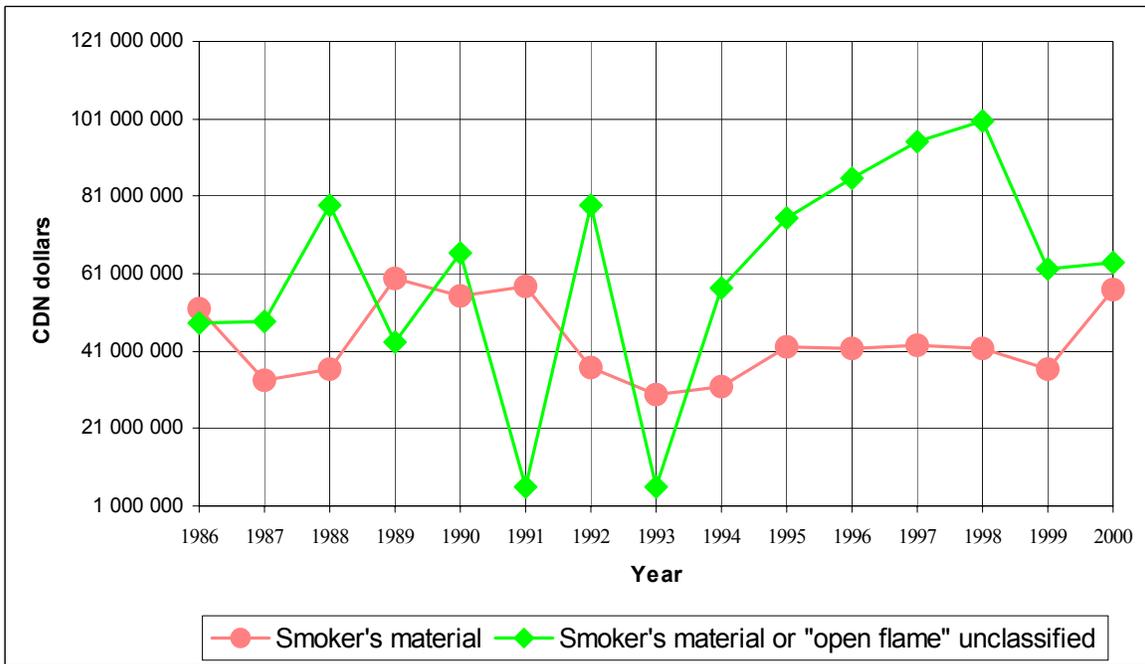


Figure 42: Fire losses in CDN dollars by source of ignition (1986-2000)

4 ACT OR OMISSION

The following table contains the different acts or omissions causing fires in Canada and also provides examples in order to clear any confusion.

Act or Omission causing fire	Examples
Misuse of Material Ignited	Misuse of flammable liquid; Improper Storage or Container; Overheated oil, grease, wax; ...
Mechanical, Electrical Failure Malfunction	Failure of part or control; Electric Short Circuit; Part worn out; Backfire (engine).
Construction, Design or Installation Deficiency	Design, Construction, Installation Deficiency; Installed too close to combustible; Over-fusing; ...
Misuse of Equipment	Overfuelling; Woodburning appliance.
Vehicle Accident	Road vehicle; Rail vehicle; Watercraft; Aircraft.
Miscellaneous	Tampering with Safety Devices; Hot exhaust/Catalytic converter; Act or omission not applicable.

Table 3: Description of Act or Omission Terms

4.1 Fires by act or omission causing fires

This section is closely related to the previous one but they refer to distinct situations. The source of ignition identifies the different items that are actually causing the fires; this section by contrast describes the context of the fires. With an average of 23% over the period, mechanical and electrical failure or malfunction starts most of the fires in Canada. The other main acts or omissions are “other set fires”, “arson or suspected arson”, “misuse of material ignited”, and “construction, design or installation deficiency” which are each responsible for at least 4% of the fires. All these items display a downward trend over the period 1986-1999 (see Figures 43, 44 and 45).

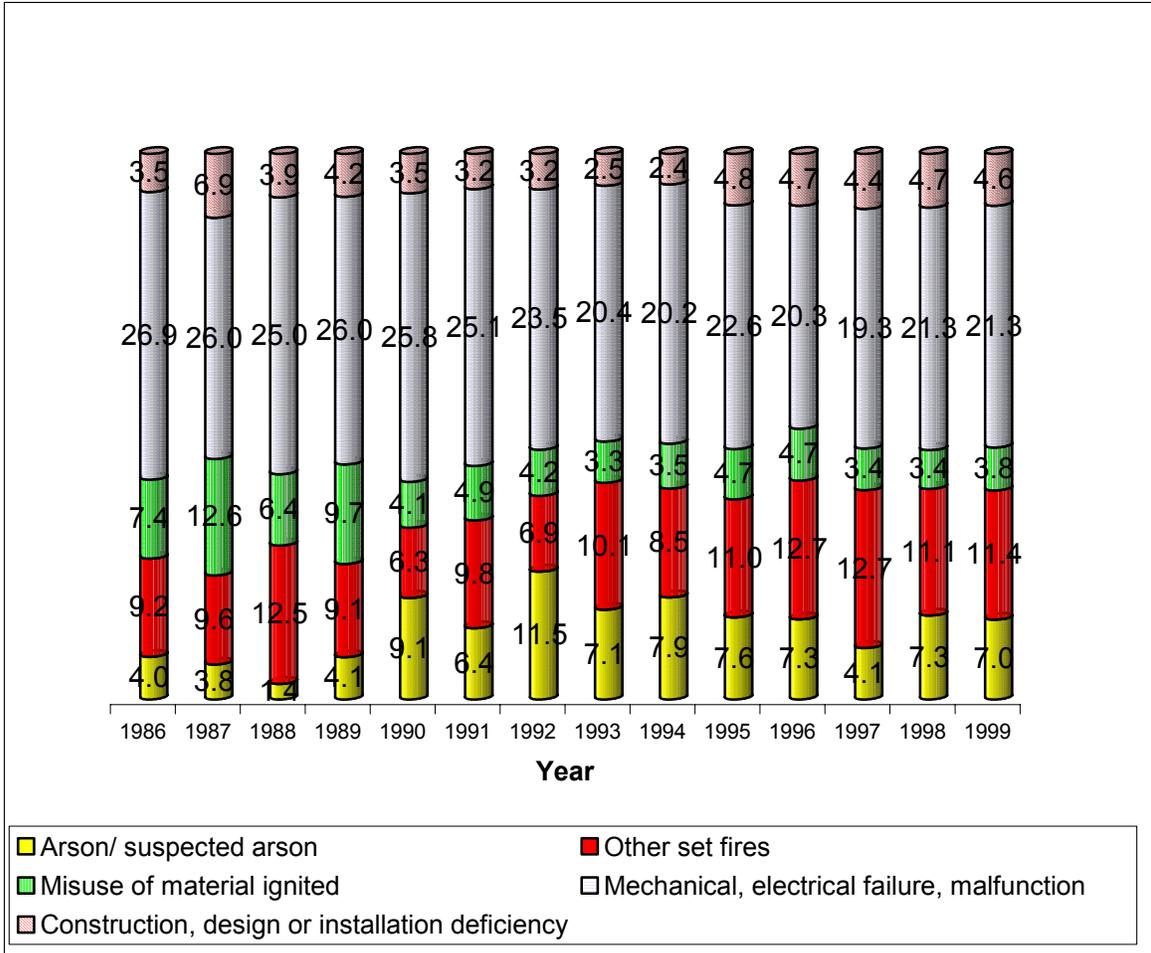


Figure 43: Fires by act or omission causing fire (1986-1999) in percentage

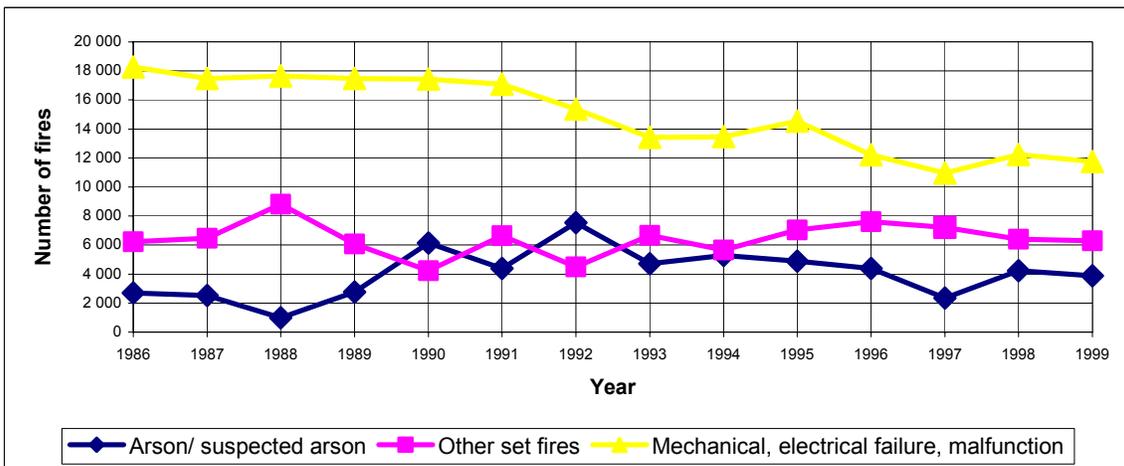


Figure 44: Number of fires by act or omission causing fire (1986-1999)

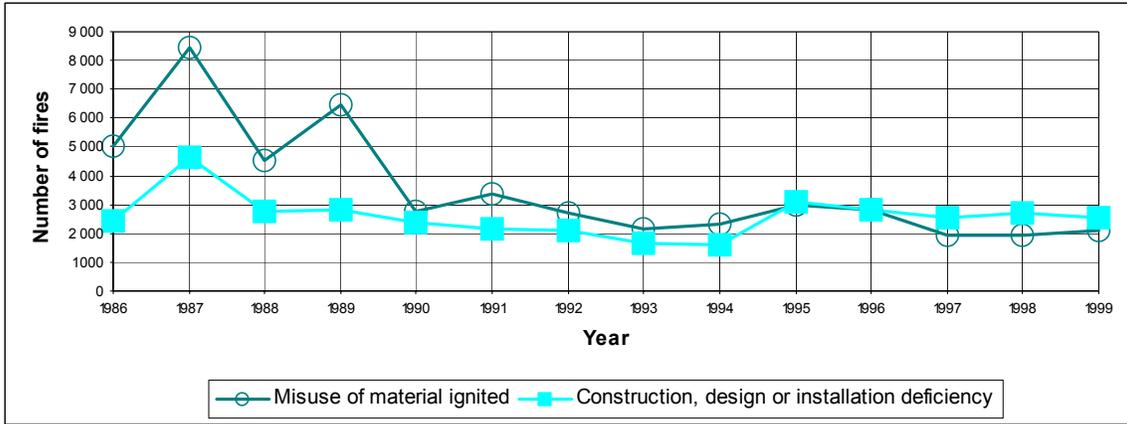


Figure 45: Number of fires by act or omission causing fire (1986-1999)

4.2 Fire loss by act or omission causing fire

The fire loss by omission causing fire follows the same pattern as the distribution of the fires by act or omission. Around 19% of the fire cost comes from the mechanical, electrical failure, while the other set fires account for 11%. The same five factors represent on average 45% of the total monetary loss from 1986 to 1999. As expected from the overall trend of the fire loss in Canada, the monetary damage caused by the five factors is generally sloped upward over the period. Figures 46, 47 and 48 illustrate that fact.

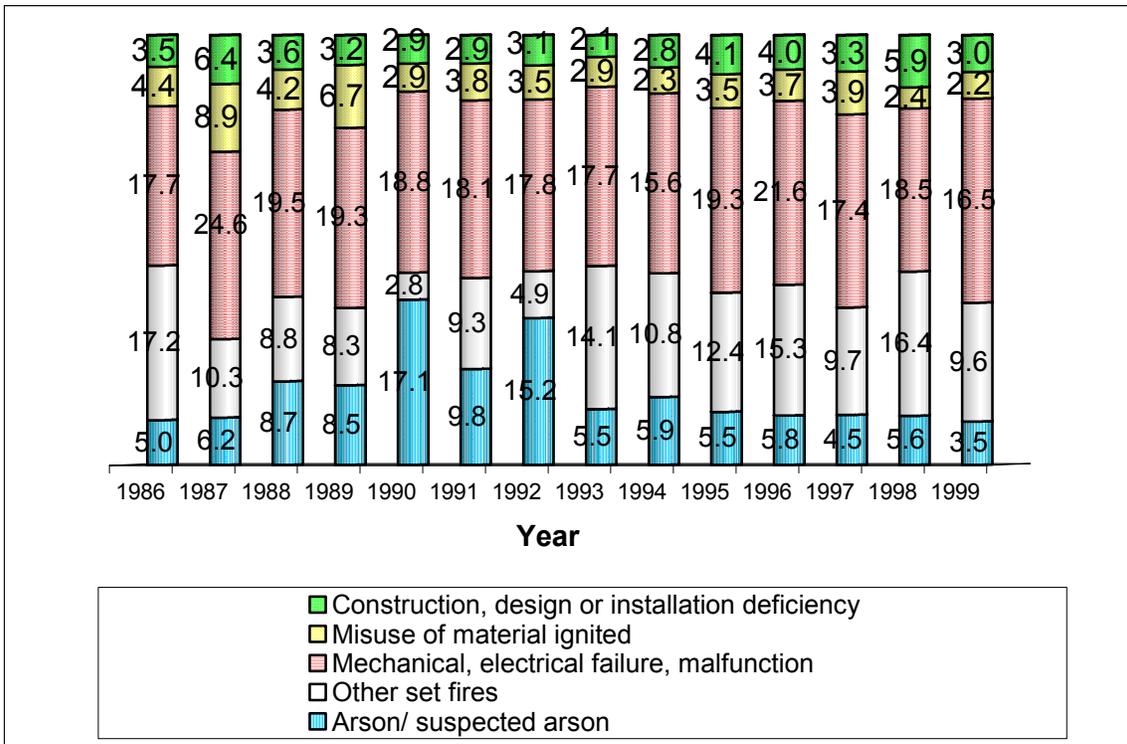


Figure 46: Fire losses by act or omission causing fire (1986-1999) in percentage

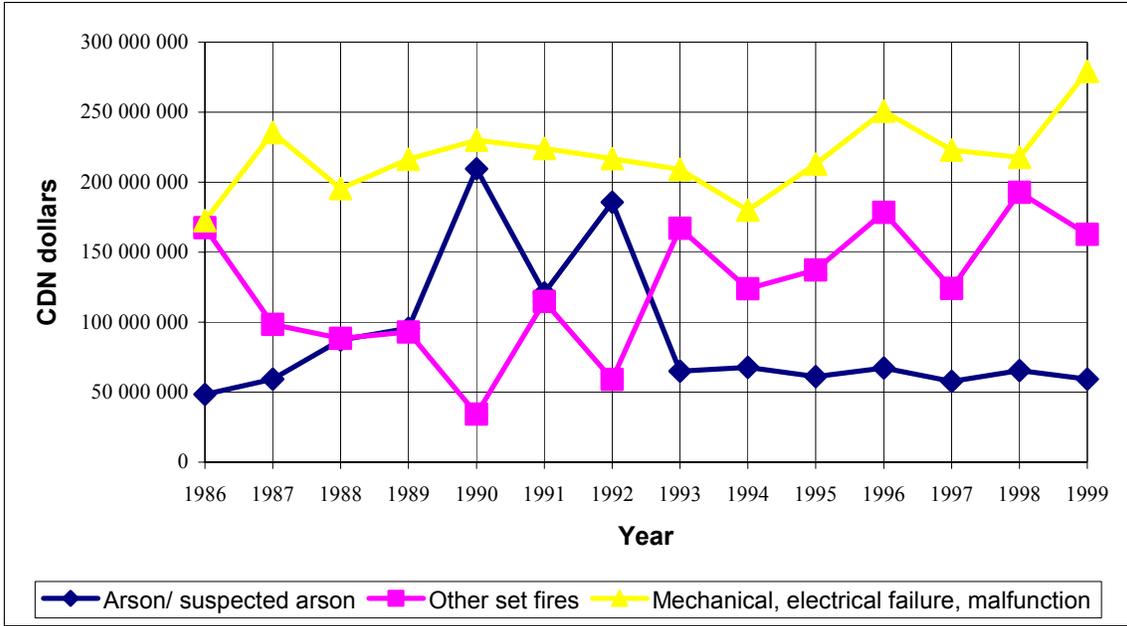


Figure 47: Fire losses in CDN dollars by act or omission causing fire (1986-1999)

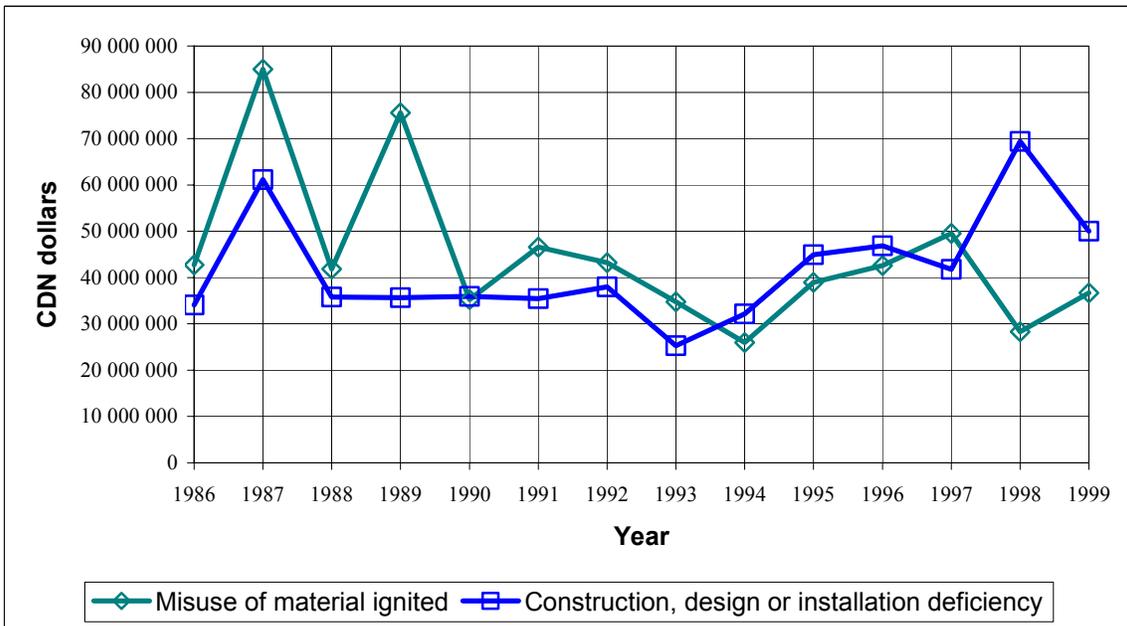


Figure 48: Fire losses in CDN dollars by act or omission causing fire (1986-1999)

CONCLUSION

This report presented the analysis of fire statistics in Canada from 1986 to 2000 in order to determine the trend of fire deaths and losses.

The overall trend of fires is downward from 1986 to 2000, but the resulting cost is moving in the other direction. On average, 63,622 fires occurred in Canada over the period under study. Because of these fires, 427 persons perished, 3,414 were injured, and the monetary loss amounted to \$1,150, 217,144.

Ontario, Quebec, Alberta, British Columbia, Manitoba, and Saskatchewan are the provinces in which 90% of the total fires occurred and over 92% of the total fire costs were recorded. It is also important to note that more than 42% of the fires, and approximately 80% of the fire deaths took place in residential properties. These fires occurred particularly in family residences and in apartments.

Finally, the main causes of fires and fire-related damages in the country are cooking and heating equipment, electrical distribution equipment, and smoker's material. They are responsible for over 42% of the fires and more than 50% of the fire fatalities. Mechanical and electrical failures constitute the primary starting point of fires across the country.

Residential property is the group of paramount importance in terms of fire incidents and fire damages. Therefore, this category requires special considerations.

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