Fire Sprinkler Systems’ Implementation in Residential Occupancies

Case Study: Application in Ontario Homes

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Political and Legal Foundations of Fire Protection

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Certification Statement

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: David Alkerton
Abstract

This study looked at fire sprinkler ordinances that have been put in place in small scale residential occupancies in different jurisdictions across North America. The purpose was to determine if fire sprinkler systems would be a recommended course of action to prevent the loss of life in similar Ontario residential occupancies. It was determined from the results of different studies that examined current fire sprinkler ordinances that the citizens of Ontario would benefit not only with respect to life safety but also with regard to limited property loss from a similar fire sprinkler ordinance. Current fire data from Ontario was analyzed and it was shown that smoke alarm laws are not doing enough to protect citizens. During the time period from 1999-2008 there were 629 residential fires in Ontario in which there was a fatality. In 29% of those fires a working smoke alarm was present. In other words, approximately 250 people died in fires where there was a working smoke alarm. It was also determined that municipal fire services and the Office of the Fire Marshal need to do more to promote the use of fire sprinklers and to educate the public about their use. Further study needs to be done to address the coming changes to the Ontario Building Code and how they will affect the number of fire fatalities in Ontario residential occupancies. Recommendations are offered for areas of further research.
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Introduction

The government for the province of Ontario in Canada has long struggled with the implementation of fire sprinkler systems in residential dwellings. There have been a number of jurisdictions within the United States that have legislated fire sprinklers into building codes for single family and low-rise residential occupancies. However, in Canada we have been reluctant to introduce such changes with the notable exception being the city of Vancouver in British Columbia. Vancouver implemented a by-law in April of 1990 and since then has seen fire sprinklers installed in 10,000 new one and two-family dwellings and more than 42,000 new multi-dwelling residences. Other prominent jurisdictions that have implemented fire sprinklers in smaller residential dwellings are Scottsdale, Arizona and Prince George’s Co. in Maryland. Both of these jurisdictions have had fire sprinkler ordinances in place for a number of years and have done extensive research on their effectiveness. Not only was it shown that they can be an effective tool to ensure life safety but they can also be effective in drastically reducing the amount of property loss that is caused in a fire emergency.

For the sake of this study I define one and two family dwelling units and multi unit dwellings three stories and under as ‘small dwelling units’. With the majority of fire deaths happening in small dwelling units in Ontario it is important to look at ways that we can prevent this from happening in the future. Many, if not all jurisdictions in North America require that well maintained smoke alarms should be installed in all residential occupancies, however, these devices may not be enough. Smoke alarms can be effective tools in warning occupants about a

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1 http://www.firesprinklers.org.uk/Services/Documents/Mandate%20for%20sprinklers1.pdf

potential fire emergency but they do nothing to prevent fire spread, fire suppression or smoke management.

There are many myths about the use and effectiveness of fire sprinkler systems. Many of which have been propagated and disseminated throughout society by people and industries that serve to inhibit the use of fire sprinkler systems, for financial, political or other potential gains. Their voices have been heard by many homeowners in Ontario. This has created an uphill battle for fire sprinkler advocates in Ontario. It is important that these myths be rebuked and that correct information be dispersed so current and future home owners are able to make an informed choice between the two options that are available, installing fire sprinklers or not installing fire sprinklers.

The primary purpose of this study is to look at the potential outcome of implementing small dwelling unit fire sprinkler systems, and to evaluate their effectiveness as a life safety tool. Factors such as life safety and cost effectiveness will be discussed to determine if the potential installation of fire sprinkler systems in small dwelling units would provide benefits to the people of Ontario.

**Background**

Fire sprinkler legislation with regards to small dwelling units has seen a short but important evolution since the new millennium. Fire sprinklers have been a requirement in the Ontario Building Code (OBC) since the mid eighties for certain types of occupancies, for example, industrial occupancies and areas where large numbers of people assemble. Members of Provincial Parliament (MPP’s) have brought forth private member’s bills that specifically apply
to small family dwellings. The first of these was in 2004 with Bill 141 “Home Fire Sprinkler Act”\(^3\). This bill was defeated for a number of reasons. The bill mandated all new detached, semi-detached and row houses in Ontario to have a fire sprinkler system installed per the regulations of the National Fire Protection Association (NFPA). This was seen as “too much too soon” for many with the political power to make changes and as “too much at all” for those in the Home Builders Association.

This particular bill was brought forward as a private member’s bill by Linda Jeffrey from the riding\(^4\) of Brampton-Springdale, which is just outside of Toronto. She has been an active MPP with regards to fire sprinkler legislation. After Bill 141 was not passed through parliament, Ms. Jeffrey began to modify the bill to make it friendlier to those in the construction industry while still holding true to its life safety principles. This revised bill was resubmitted in 2005. It was called Bill 2 “Home Fire Sprinkler Act”\(^5\), which was again defeated in Parliament.

Over the course of the early 2000’s there was a growing recognition from the public that fire sprinklers could help save lives. Local fire chiefs and Authorities Having Jurisdiction (AHJ) encouraged this growing interest in fire sprinklers. The Ontario Association of Fire Chiefs, Canadian Association of Fire Chiefs, and the Canadian Council of Fire Marshals and Fire Commissioners all came forward to advocate for the installation of fire sprinklers in all residential occupancies from single family dwellings to high rise residential units\(^6\). As the

\(^3\) [http://www.ontla.on.ca/web/bills/bills_detail.do?locale=en&BillID=332&BillStagePrintId=632&btnSubmit=go](http://www.ontla.on.ca/web/bills/bills_detail.do?locale=en&BillID=332&BillStagePrintId=632&btnSubmit=go)

\(^4\) A ‘riding’ is similar to a congressional district in the United States


support from different fire services increased, the media began to focus more on this, which in turn created more discussion and inquiries by the general public (Appendix A).

In 2008 Linda Jeffrey brought forward another variation of her original private members bill (Bill 141). This new bill titled “The Municipal Residential Sprinkler Act”\(^7\), or Bill 72, again had some variations from the original Bill 141 to help encourage its passage through the legislative process. The main change from previous versions was that the bill gave the right to individual municipalities to create by-laws (ordinances) to demand that all new detached, semi-detached, and row houses have fire sprinkler systems installed per the building code requirements. This new version, essentially, allowed those MPP’s without the political will, the ability to allow someone else to make the decision. If individual municipalities choose to ‘take on the builders’ they would be able to implement a by-law requiring fire sprinklers in residential occupancies. The political backlash from the builders would not be felt by the legislators at the provincial level, but by those at the municipal level. This bill was carried by parliament through two separate readings but was defeated in, what is known as ‘committee review’.

However, the government could not entirely ignore growing public concern on this issue and introduced significant changes to the Ontario Building Code which will take effect April 1, 2010. These changes include requiring all residential buildings four stories and greater to be completely protected with fire sprinklers. It is important to note that Ontario is the last of all of the provinces and territories in Canada to include such wording in its building code.

\(^7\) [Link to Bill 141](http://www.ontla.on.ca/web/bills/bills_detail.do?locale=en&BillID=1977&isCurrent=false&detailPage=bills_detail_the_bill&Intranet=)
Literature Review

There are very few formal studies that have been undertaken with regards to fire sprinkler systems in small dwelling units. Most notable have been studies of Prince George’s Co. and Scottsdale, Arizona. Both of these studies were conducted at least 10 years after legislation requiring fire sprinkler systems was first passed. Both were commissioned to evaluate the effectiveness of the legislation.

The study in Scottsdale, Arizona was a thirty-five page report compiled in 1995\(^8\). It looked at a number of aspects of the ordinance and its effectiveness. Issues such as a cost analysis of installation, average fire loss in dollars and life safety all played a prominent role in evaluating effectiveness. A cost analysis was completed, much to the dismay of home builders, and found that the costs of installing a fire sprinkler system had decreased over the course of ten years. Many home builders used the argument that the cost of installing a fire sprinkler system will greatly increase the cost of the house and in turn, make the house unaffordable for most home buyers. The study found that the opposite was true. The cost of installation had in fact dropped from $1.14 sq.ft to $0.59 sq.ft.\(^9\) (Appendix B) As more companies become familiar with the installation process and the code and standard requirements, their installations become more cost efficient. Also, as fire prevention officer’s gain more knowledge about these practices and procedures they can help to expedite the process of inspection and clearance for occupancy.

\(^8\) Automatic Sprinklers (Scottsdale, 1997); See also http://www.nfsa.org/anti-sprinklerleg/articles/ScottsdaleRpt10yr.pdf

\(^9\) Automatic Sprinklers (Scottsdale, 1997) pg. 19
This finding was also echoed in an NFPA study from 2009, which found that the cost of a fire sprinkler system amounts to approximately 1% of the cost of the house\(^\text{10}\). The president of the NFPA, John Viniello, commented that “Over a 30-year mortgage, that’s less than the price of a coffee per week! That’s a small price to pay to save the lives of your loved ones in the event of a fire”\(^\text{11}\).

The study of Scottsdale also found that there was a significant cost savings to houses with fire sprinkler systems installed in the event of a fire emergency. On average, the fire loss in a sprinklered home was $1,945 as compared to the average fire loss in an unsprinklered home of $17,067\(^\text{12}\). (Appendix B) This amounts to an average savings of $15,122.

Some other important findings were that the study attributed the city’s ordinance to the saving of eight lives\(^\text{13}\). Also, that in 92% of the cases where a fire sprinkler activated only one or two of the heads activated which substantially reduced the water flow required in these communities\(^\text{14}\).

In late 1989 an independent review was done of the ordinance by several fire service consultants and they found that:

\(^{10}\) http://www.casa-firesprinkler.org/files/sprinkler%20ordinance.pdf
\(^{11}\) http://www.casa-firesprinkler.org/files/sprinkler%20ordinance.pdf
\(^{12}\) Automatic Sprinklers (Scottsdale, 1997) pg. 4
\(^{13}\) Automatic Sprinklers (Scottsdale, 1997) pg. 4
\(^{14}\) Automatic Sprinklers (Scottsdale, 1997) pg. 4
“North Scottsdale is protected by some of the most unique and effective fire prevention measures in the nation. Scottsdale is like in first place, right at the top nationally, when it comes to built-in fire prevention systems, such as required by the City’s sprinkler ordinance.”

At the time of this ordinance being put in place (1985) the city council in Scottsdale was taking a major gamble, but time has shown that they were making positive changes to protect the well being and safety of the people in their community. To prove this you can ask the 8 people that survived fire emergencies in those fully sprinklered homes.

Prince George’s Co. in Maryland conducted a 15-year review of its single family dwelling fire sprinkler ordinance. It was released in August of 2009. It found many of the same results that were found in Scottsdale’s review with regard to cost analysis of installing a fire sprinkler system, average fire loss in dollars, and life safety. The cost of the installation fell dramatically to below $2.00 sq.ft. which is consistent with the national average of $1.61 sq.ft.\(^{16}\)

The study also found that in the 15-year timeframe evaluated there were 245 incidents where a fire sprinkler was activated. In all of those activations there was no loss of life due to fire. Further, there were only seven civilian injuries in the 245 incidents.\(^{17}\) This can be compared to the homes where no fire sprinklers were installed during the same 15 year time period. In such cases, there were 101 deaths due to fire and 328 civilian injuries.\(^{18}\) (Appendix B)

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\(^{15}\) Automatic Sprinklers (Scottsdale, 1997) pg. 30

\(^{16}\) Prince George’s Co. Study pg 4; See also http://www.homefiresprinkler.org/images/Prince-Georges-County-Report.pdf

\(^{17}\) Prince George’s Co. Study pg 4

\(^{18}\) Prince George’s Co. Study pg 7
Another major concern that was considered in the Prince George’s Co. study is the average fire loss in dollars. Like in Scottsdale, Prince George’s Co. has seen a considerable drop in the amount of losses that have occurred in buildings that are sprinklered compared to non-sprinklered buildings. In the 245 incidents mentioned above, the estimated fire loss in dollars was $1,352,820 compared to an estimated potential loss of $42,578,420. This difference represents a total of more than 41 million dollars in potential loss that could have occurred had it not been for the fire sprinkler ordinance that Prince George’s Co. has implemented.

Both the Scottsdale and the Prince George’s Co. studies help to prove the case for residential fire sprinklers in small dwelling units. In both cases the lawmakers in their respective jurisdictions had the political will to make what seemed like a difficult decision at the time. In retrospect, these choices seem easy and straightforward. Most people involved in the fire protection industry would argue that the installation of fire sprinkler systems in small dwelling units would help greatly reduce the number of fatalities in residential fires. These two studies help to strengthen the argument for fire sprinkler installation for those jurisdictions still on the fence about implementing such an ordinance.

**Ontario Fire Analysis**

The Ontario Fire Marshal (OFM) has compiled some interesting statistics regarding residential fires in Ontario. The statistics are for a ten year timeframe and began in 1999. Only a few of the statistical data sets will be discussed in this study as they pertain to residential fire

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19 Prince George’s Co. Study pg 4
sprinklers and the threat of residential fires in general. The whole set of data can be found on the OFM’s website.

The OFM compiled the death rate in residential fires. On average, 86 people died per year during the 10 year timeframe in a residential fire in Ontario (Appendix C). It is important to note that this statistic does not distinguish between high-rise and low-rise/single family dwellings. With the coming changes to the Ontario Building Code which requires fire sprinklers in all high rise buildings four stories and greater, you could conclude that the death rate should decrease. We have seen how residential fire sprinklers have saved lives in Scottsdale and Prince George’s Co. respectively. It is important that this statistic continue to be analyzed. The distinction between high rise and low-rise/single family dwellings is not defined in this data set. The building code change only applies to high rise residential units, and whether the number of fire fatalities decreases will greatly influence future changes.

Also, the OFM included a chart in its analysis of the age categories of those that were killed in residential fires during the time period in question (Appendix C). This chart shows that 58% of those killed in fires are in the age range of 15-64 years old. This means that 42% of the lives lost have been in the 0-14 and 65+ age categories. The majority of those that died in the 65+ category died because of a physical disability that prevented them from evacuating promptly.\(^{20}\) Within the 15-64 age category the majority of deaths were contributed to the victim being impaired by drugs or alcohol.\(^{21}\)


Smoke detectors and smoke alarms have long been the accepted method of fire prevention in Ontario. The OFM has looked at all fire fatalities in residential occupancies and done an analysis of the state of the smoke alarms in each case (Appendix C). Two important things can be noted from this chart, 1) that a smoke alarm was installed and was operating properly in 29% of the cases with fire fatalities, and 2) the smoke alarm did not work or was not installed in 35% of the cases with a fatality. Even with the current smoke alarm requirements in Ontario we are not doing enough to protect the people of this province. Even though smoke alarms are required they are not doing the job that they are intended to do. Also, enough is not being done to inspect and maintain smoke alarms in residential occupancies.

Finally, with all of the data collected by the OFM and all of the fatal fires being discussed the most obvious truth is that we are not doing enough to fight residential fires. The final chart included in Appendix C shows the range of occupancies that have been involved in fires with a fatality. The vast majority are residential occupancies.

**Results**

The findings of the Ontario study clearly indicate the acceptance of fire sprinkler installation as a critical fire protection tool in residential occupancies. In jurisdictions that have undertaken studies to evaluate their effectiveness, all have come to the conclusion that fire sprinklers have been an essential tool in saving lives during a fire emergency. The two major studies, as indicated in the literature review, can both be considered long term evaluations as their time frame incorporated at least 10 years. Both studies spoke of the initial and continued opposition to their respective ordinances. Each study outlined how the initial arguments against
the ordinance could be rebuked and how these arguments produced little substance when looking at the actual data that was collected. An unexpected finding came from the arguments against the residential fire sprinkler ordinances by a Texas fire chief. In fact, most of the opposition from the fire service echoes this argument by this particular chief.22 The Texas fire chief was concerned that adopting a residential fire sprinkler ordinance or any fire sprinkler ordinance would make the local fire department obsolete. This is not true as fire sprinklers, or smoke alarms for that matter, are not foolproof fire protection devices. Both methods can work in tandem to provide a much higher level of protection than either on their own. At this point, a trained firefighter will always be needed regardless of the fire protection devices that have been put in place.

Also, current data was reviewed from the province of Ontario as a jurisdiction without any such residential fire sprinkler ordinance. The data from the Ontario Fire Marshal indicated that the average number of fatalities per year in a fire emergency had decreased since smoke alarms became a requirement in the mid 1970’s.23 However, the data also indicated that the number of deaths in residential occupancies was well above those rates found in jurisdictions with residential fire sprinkler ordinances.

Discussion

The province of Ontario is making positive steps with the current legislation that comes into force in April of 2010. Through the experience in Scottsdale, Arizona and Prince George’s

22 Automatic Sprinklers (Scottsdale, 1997) pg. 28

Co. in Maryland we can see that residential fire sprinklers live up to all of the expectations that they have been proclaimed by advocates to do. I would question whether the government of Ontario is making these changes to protect the community. Another motive could be to gain political capital with the citizens of Ontario, this new legislation could show that they really care about the people. Regardless of the intent of the legislators, the fact remains that fire sprinklers will be installed in more buildings than in previous years. This is a positive step in demonstrating that this type of technology is a valuable tool in saving lives and property. I am confident that future statistics will show that the level of fire fatalities in residential occupancies will decline. If this is the case, it will be much easier to pressure the government to accept even more fire sprinkler related changes, namely their installation in single-family and low rise residential applications.

One of the major obstacles against more widespread fire sprinkler implementation is the misinformation that is being introduced into the discussion by home builders and politicians alike. Members of the community are ignorant when it comes to this issue and they rely on experts to give them the proper information. With both advocates for and against fire sprinklers acting as experts, the community is caught in the middle. There needs to be more marketing done by the advocates of fire sprinklers to promote their installation. Members of the fire service and the Fire Marshal’s office in Ontario need to make more of an effort to promote this issue to the public sector. When members of the community look for guidance on this issue they are likely to look to these types of organizations as experts. That is why it is important for researchers and academics to provide the fire service with all of the data and information that they can, which can then be used to inform the public.
I have spoken with a couple of my colleagues in the fire protection industry that feel that the changes to the Ontario Building Code are too restrictive. They feel that the changes should not be implemented in all cases. In their view fire sprinklers are not a fool proof way of providing protection in high rise applications (buildings 4 stories and greater). Also, they feel the code should provide a builder/designer with different options as to how a building should be protected. Also, since fire sprinklers do not always work, why are they being forced into the code? Others feel that if fire sprinklers are such an effective tool in combating fire fatalities why aren’t people demanding their installation? If there is a high demand for them the market will regulate itself and builders will have to install them in new buildings because people will not buy the home without the system installed. These are all legitimate concerns. When people are misinformed they are not given a chance to make an educated decision. When they are told that the system will leak water everywhere, or that it will drive up the cost of the home by a substantial amount, or that they are ineffective in providing life safety, home owners are more reluctant to spend their money on installation and maintenance. Who could blame them? If a fire sprinkler system is useless why would you want it in your home? It is when people are given the facts about their use and application and their life saving potential that they can make a more informed decision about installation.

When looking at Scottsdale, Arizona and Prince George’s County I am forced to compare those jurisdictions with that of Ontario. Both of the jurisdictions have a well trained work force, a well maintained public water service, and a modern and well equipped fire service. Ontario also shares all of these characteristics. The studies outlined in this study are a reflection of where Ontario could be as far as life safety is concerned.
How many people need to die in residential fires before the building industry understands that the steps and provisions that are in place are not working? This is evident when the statistics are examined. As stated previously, there are on average 86 deaths in residential occupancies per year. The fact is that smoke alarms have not been the most effective tool in saving lives in a fire emergency. Even with a properly installed smoke alarm, fire deaths are still occurring. In 29% of the instances where a fire fatality occurred in Ontario in the past 10 years, a smoke alarm has been installed and deemed to have operated properly (Appendix C). In other words, 181 people died in a fire in Ontario even though they had a working smoke alarm. Is this an acceptable level of loss? Is it acceptable when we can prove that in other jurisdictions there have been no lives lost in a fire emergency in residential applications?

One of the most interesting pieces of statistical information is from the OFM study on the number of fire fatalities broken down by building occupancy (Appendix C). It clearly shows that the vast majority of fatalities are occurring in residential occupancies. It is fair to say that the number of fatalities has been reduced since the smoke alarm requirement was introduced in the 1970’s but there is still more that can be done. Lives are needlessly lost in Ontario because fire sprinklers are not more widely implemented.

The statistical analysis cannot be manipulated or changed. The numbers prove that people’s lives are being saved by fire sprinkler technology. It is only a matter of time before all jurisdictions make the same decision as Scottsdale, Prince George’s County, and over 200 other jurisdictions have made. The people of those communities without this kind of ordinance deserve better. With a problem as clear and direct as the one we face in Ontario, it amazes me that we as a society continue to allow the builders and politicians to tell us what is right for us. The vast majority of fire protection experts firmly believe that fire sprinklers in residential
occupancies will help to save lives. In addition, we have studies that prove that fire sprinklers save lives and that the major dissidents to these ordinances have been proved wrong time and time again.

**Recommendations**

- collect data of fires in Ontario that occur in high-rise residential applications where fire sprinklers have been installed vs. where they have not been installed with the intent of furthering the argument for fire sprinklers in all residential occupancies

- encourage municipal fire services and the Ontario Fire Marshal to promote correct information regarding fire sprinkler systems and their implementation to the public to encourage pressure on the government to make widespread changes

- encourage the government to implement fire sprinklers in residential occupancies based on data collected from Scottsdale, Arizona and Prince George’s County studies.

- implement a study of the fire data from Vancouver, British Columbia to compare with data collected in Scottsdale, Arizona and Prince George’s County; this will provide a Canadian context for information regarding fire sprinklers.
References


Legislative Assembly of Ontario. (n.d.). Retrieved August 18, 2009 from,
References

Legislative Assembly of Ontario. (n.d.). Retrieved August 18, 2009 from,

http://www.ontla.on.ca/web/bills/bills_detail.do?locale=en&BillID=332&BillStagePrintId=632&btnSubmit=go

Canadian Automatic Sprinkler Association. (July 27, 2009.) Retrieved on August 18, 2009, from


Ontario Association of Fire Chiefs. (n.d.) Retrieved October 27, 2009, from,

Appendix A

“12 years later and still no sprinklers”
From: The Toronto Star
Date: June 29, 2007

“Sprinklers urged for all T.O. homes; Mandatory code would save many lives, just as in Vancouver, fire official says after Bleecker St. death”
From: The Toronto Star
Date: November 15, 2007

“Chiefs support mandatory sprinklers”
From: The Kitchener Record
Date: December 26, 2007
### Residential Fire Sprinkler Installation Costs

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<th>Custom Homes (sq.ft.)</th>
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<tr>
<td>$1.14</td>
<td>N/A</td>
<td>February 1986</td>
</tr>
<tr>
<td>$0.79</td>
<td>$0.89</td>
<td>June 1989</td>
</tr>
<tr>
<td>$0.63</td>
<td>$0.79</td>
<td>March 1993</td>
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<tr>
<td>$0.59</td>
<td>$0.70</td>
<td>January 1996</td>
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Chart reproduced for clarity from Scottsdale 10-year study (Figure 4-1, pg.19)

### January 1, 1985 through January 1, 1996

<table>
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<th>Description</th>
<th>Value</th>
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<td>Total Working Structure Fires in Sprinklered Buildings</td>
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<td>Occupancy Types for Incidents</td>
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<tr>
<td>Commercial</td>
<td>65</td>
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<tr>
<td>Multi-Family</td>
<td>26</td>
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<tr>
<td>Single Family</td>
<td>18</td>
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<td>Total Value of Incidents Properties</td>
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<td>Total Fire Loss at 109 Incidents</td>
<td>$211,950.00</td>
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<td>Definite Lives Saved</td>
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<td>Average Loss per Sprinklered Incident</td>
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<td>Average Loss per Non Sprinklered Incident</td>
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<td>Sprinkler Head Activation Rate</td>
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<td>1-2 Heads (100)</td>
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<td>3 or more (9)</td>
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<td>Estimated Sprinkler Water per Incident</td>
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<td>Estimated Suppression Water Comparison</td>
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<td>Estimated Sprinkler Flow per Residential Incident</td>
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<td>Estimated Suppression Water per Residential Incident</td>
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Chart reproduced for clarity from Scottsdale 10-year study (Figure 7-1, pg.30)
Appendix B

<table>
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<th>Fire Deaths &amp; Fire-Related Injuries</th>
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<td>Percent of Total Fire Deaths Occurring in Residential Dwellings</td>
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<tr>
<td>Fire Fatalities in Single-Family &amp; Townhouse Fires with No Fire Sprinklers</td>
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<td>Civilian Injuries in Single-Family &amp; Townhouse Fires with No Fire Sprinklers</td>
<td>328</td>
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<td>Fire Fatalities in Homes Protected with Fire Sprinklers</td>
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Chart reproduced for clarity from Prince George’s Co. 15-year study (pg.7)

Average Property Loss Per Incident

- Fires with no sprinklers/no fatalities: $9,983
- Fires with no sprinklers/with fatalities: $49,503
- Fires in homes protected with fire sprinklers: $4,883

Chart reproduced for clarity from Prince George’s Co. 15-year study (pg.8)
Fire Death Rate in Ontario: Residential Structure Fires

<table>
<thead>
<tr>
<th>Year</th>
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<tr>
<td>2004</td>
<td>6.8</td>
</tr>
<tr>
<td>2005</td>
<td>6.1</td>
</tr>
<tr>
<td>2006</td>
<td>5.7</td>
</tr>
<tr>
<td>2007</td>
<td>6.5</td>
</tr>
<tr>
<td>2008</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Notes: Does not include (1) fire deaths on Federal or First Nations properties
(2) (7) (3) (5) (4) (6) (9)

Fire Death rate: the number of fire fatalities divided by the population multiplied by 1 million

Ontario Fatal fires: 10 years 1999 to 2008
Decline of: 24% 15%

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Appendix C

1999-2008: Fire fatalities

Ontario Residential Fatal Fires
Children, Adult, Seniors

0 to 14, 103, 12%
65+, 253, 30%
15 to 64, 500, 58%

Total fatalities: 856
Excludes fire deaths on First Nations and Federal properties

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Appendix C

Smoke Alarm Operation:
Fatal Residential fires *
* Arson fires not included

N = 629

A smoke alarm was not present or did not operate in 35% of these fatal fires.

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Appendix C

Fatal Fires: Property Class

- Residential, 719, 86%
- Institutional, 9, 1%
- Outdoor or structures not classified by Ontario Building Code, 40, 5%
- Assembly Occupancies, 3, 0%
- Mercantile, 4, 0%
- Industrial, 7, 1%
- Business and Personal Services, 1, 0%
- Vehicles, 62, 7%

Number of fatal fires: 845

Ontario Fatal fires: 10 years 1999 to 2008

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