MANDATORY SPRINKLERS IN VANCOUVER TEN YEARS ON

John N Robertson
City of Vancouver, British Columbia, Canada.
john_robertson@city.vancouver.bc.ca

ABSTRACT

The fire casualty and loss statistics for the City of Vancouver are reviewed to assess the impact of the mandatory sprinkler program for hotels and rooming houses on fire safety record for the City. The Vancouver statistics are also compared with the fire statistics for Canada in the periods 1981 to 1990 and 1992 to 1998 to assess the impact of the City requiring sprinklers to be installed in all new residential buildings. From the limited data available, it is concluded that significant cost benefits may be derived from the use of sprinklers such that the net cost per life saved is less than $1 million, and when evaluated over the anticipated life of most residential buildings may approach zero. The increasing use of sprinklers in Canadian Codes is briefly reviewed with specific reference to the use of sprinkler trade-offs in the code.

INTRODUCTION

Vancouver is the major commercial and mercantile centre for British Columbia. In 1970, its population was 444,000 and the City was poised for rapid growth through the following decades. Commencing in the early 1970's, it was realized that Vancouver's fire statistics were worsening rapidly, and were resulting in casualty figures which exceeded the North American average of the time of 3 deaths per 100,000 of population. A summary of the fire statistics from the City of Vancouver fire department are compared with Canada and other countries in Figure 1 for the period 1972 - 1974. In 1973, the worst year on record for the City, 40 deaths occurred which is approximately equivalent to an annual fire death rate of 8.9 persons per 100,000 population. This exceeded the average for both Canada and the US at that time by a factor of nearly three. Several technical and socio-economic factors were in play which enhanced the fire risk for the population of the City. These were:-

1. Vancouver did not adopt the National Building Code of Canada (NBC) until 1973. Prior to this time, buildings in the City were designed to an old style prescriptive code, largely developed before the advent of modern fire safety design..

2. Vancouver developed rapidly from its founding in 1886, particularly in the early part of the 20th century prior to the depression of the 1930's. Hence a large part of the building stock consisted of wood framed buildings erected to rudimentary codes.

3. Vancouver's mild maritime climate served as a magnet to draw into the City, unemployed and indigent persons from other parts of Canada which experienced harsh winter climates. This was exacerbated by the fallout from the 1960's counter-culture which had developed in and around the Kitsilano area of the City.

4. Vancouver's burgeoning population was placing pressure on the existing housing stock and driving rents and housing costs rapidly skyward. This pressure resulted in the conversion of

many large homes and old hotels in central parts of the City as rooming houses and long term hotels catering to the more economically disadvantaged strata of the population.

5. The incidence of drug, alcohol and tobacco use by the occupants of these buildings, coupled with the rudimentary fire safety features of the buildings led to increasing numbers of fire incidents and fire deaths.

SPRINKLER RETROFIT PROGRAM

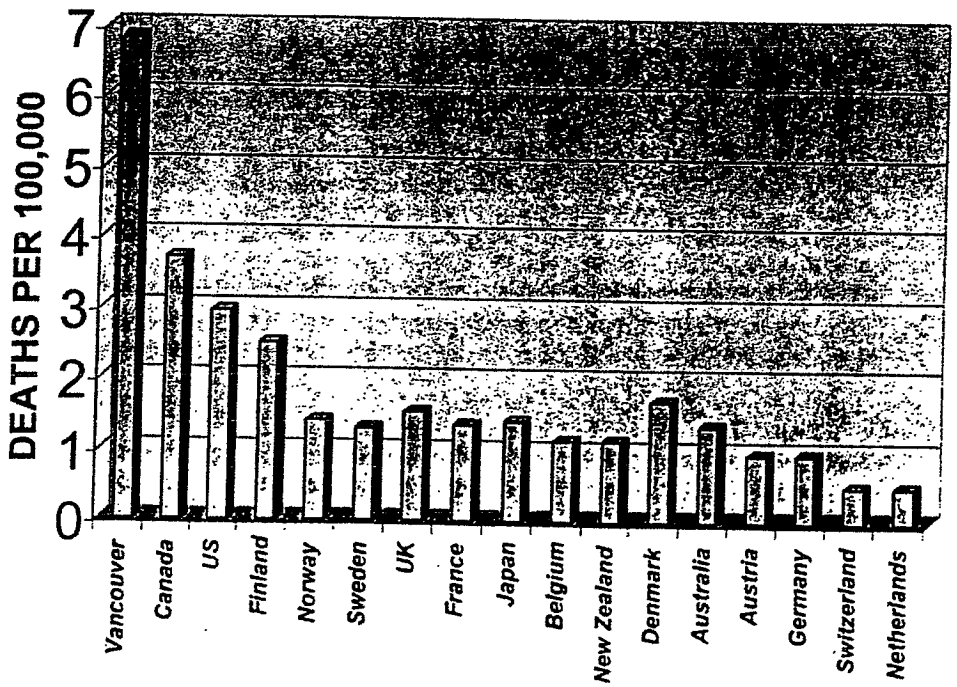
Accordingly, in early 1973, a task force was formed from Fire Department and Building Officials to investigate the fire problem in the City and to recommend simple but effective upgrade measures. Reporting in mid 1973, the task force recommended a phased approach to upgrading older non-conforming rooming houses and hotels. The basic components of the upgrade measures included:-

- Installation of automatic sprinkler systems.
- Installation of smoke detectors and fire alarms.
- Upgrading of suite doors and provision of closers.
- Upgrading of exits and fire escapes.

Generally, other non-conforming conditions were allowed to remain provided the basic upgrade measures were complied with. Subsequently the upgrade program was extended to hospitals in the City and nursing homes for senior citizens.

The upgrade program was administered by the Fire Department through the Fire Warden's office,

Fig 1 - FIRE CASUALTIES 1972 - 1974



additional staff being hired to carry out the inspections, to write up the orders and to follow through with enforcement activities. The first two phases of the upgrade program were 90% completed by the end of 1975, and the third phase commenced in October 1975. Initially, there was significant opposition to the measures from organisations such as the Rental Housing Council and some tenant groups. Then in 1978, four elderly ladies lost their lives in a fire at a rest home, which had resisted the upgrade measures. From this point on, opposition to the measures was muted, as the public came to appreciate the inherent hazards faced by the occupants of the buildings and the reasonableness of the measures.

Limited upgrading measures were also extended to rental apartment buildings, although sprinkler protection was not mandatory for these buildings except where major life safety deficiencies such as grossly non-compliant fire rated construction or inadequate exits were to be addressed. The Council also mandated at this point the creation of a building board of appeal to rule on appeals of upgrade measures, and their rulings were used to develop building code provisions for the upgrading of existing buildings when undergoing major renovations, additions or a change of use.

By 1980, approximately 800 buildings in the city had been upgraded which included 9,000 rooms and suites. The effect of these improvements on the City's fire casualties is clearly evident from Fig 2. In the period 1970 - 1975, the average casualty rate was 24.7 per year The corresponding number for the period 1980 - 1985 was 9.7 .

Armed with these statistics, and buoyed by public acceptance of the measures, the City began to more aggressively promote the use of sprinklers. Their use was aggressively pursued in addressing non-conformities in existing buildings. In 1979, the City developed a new section of its building code dealing with upgrade measures for existing buildings. These provisions placed heavy emphasis on automatic sprinklers as a compensatory feature to address a wide range of non-conformities in buildings constructed prior to the adoption of the National Building Code of Canada (NBC) in 1973.

In the 1980's the City administration began to look at look at the feasibility of adopting mandatory sprinklers in all sleeping accommodation in the City. Since the issuance of the 1973 U.S. report entitled "America Burning" which contained recommendations for sprinklering a wide range of residential buildings, significant progress had been made on developing residential sprinkler systems. The development of the listed quick response residential head in the early 1980's and the issuance of the second edition in 1980 of NFPA 13D - Installation of Sprinkler Systems in One and Two Family Dwellings and Mobile Homes, opened the way to economical and efficient means of sprinklering homes. This 1980 standard was followed in 1989 by NFPA 13 R, Installation of Sprinkler Systems in residential occupancies up to and including four storeys in height. These and other developments including the development of extended coverage and sidewall heads, listed plastic pipe for sprinkler systems and the data obtained from extensive testing of residential heads in actual fire scenarios, raised considerable interest across North America in using such systems to reduce its fire casualty rate.

Sprinkler ordinances had been adopted in some Californian municipalities where water supply problems and fire fighting considerations dictated that some form of automatic fire suppression would be required. In Canada, the City of Westmount in suburban Montreal was the only municipality to have mandated sprinkler protection of residential buildings before 1990. Accordingly, the City Building Inspector of the day Mr R V Hebert P.Eng. and the Fire Chief, Mr Don Pamplin, proposed to the Vancouver City Council that the Vancouver building code be modified to require automatic sprinkler protection of all residential buildings.

This proposal, to sprinkler all residential and institutional buildings, received strong opposition from the development community in the City. The Greater Vancouver Home Builders Association made vigorous representation to city council to oppose the move.. In March 1990, they submitted a consultants report recommending against the proposal. This report claimed that the use of sprinklers was unlikely to save many lives and quoted a report prepared by the Canadian Mortgage and Housing Corporation (CMHC) that the cost of installing the sprinklers would be approximately equivalent to an expenditure of $35 million (all costs in Canadian Dollars) per life saved. Other data presented in this report suggested that the cost per life saved could be as high as $95 million. Additional points made in the report included:-

- That the Vancouver fire risk was most closely identified with pre-1980 buildings.
- That hard wired smoke detectors as required under the 1977 NBC would provide equivalent protection at significantly lower cost.
- That the costs saved in construction due to the sprinkler trade-offs permitted in the code would be of little significance for one and two family dwellings.
- That downstream savings by the City in fire department costs would prove illusory.

The City responded by hiring their own consultants and preparing a report which refuted many of the points made in the GVHBA report. Specifically they pointed out that smoke detectors were only effective for persons capable of self preservation and that the cost effectiveness of sprinklers can be greatly influenced by local conditions. This view has been reinforced by the experience of our fire prevention inspectors who frequently find that smoke detectors are removed or disabled due to the frequency of false alarms. Needless to say, removal of active sprinkler heads has never been a problem.

Into this debate was injected an initial draft of the 1990 report from the Joint Task Group of the National Research Council of Canada (NRC). This report was undertaken by NRC as a part of the technical reviews conducted to assist with preparation of the 1995 edition of the NBC. Whilst this report did not recommend that sprinklers could be justified on an economic basis for single family homes in Canada, there were situations that merited sprinkler protection. These included:-

- Homes for the elderly and for persons with cognitive or physical disabilities.
- Homes constructed in unimproved areas lacking effective fire protection services.

Undaunted, the City Building and Fire staff weighed in with details of benefit/cost studies commissioned by the NRC Joint Task Group. These studies demonstrated that, depending on how the analysis was conducted, the cost per life saved could be variously evaluated at from a positive cost/benefit of $1.2 Million per life saved (i.e. future property damage mitigation outweighed the initial cost of the sprinkler installation) through to $31.9 million per life saved, close to the CMHC assessment. The results of this Task Group study are shown in Table 1.

In reality, the NRC analyses simply demonstrated the complexity of attempting to analyse the benefit/cost implications of a major public policy initiative of this type in the complex and rapidly changing realm of fire safety. The lack of detailed statistical data, the effects of changing demographics, the impact of the policy in reducing related construction costs, and the selection of values for inflation and interest rates in this type of economic analysis all trend toward producing widely diverging results for varying but credible input assumptions.

TABLE 1 - Summary of sprinkler life safety costs reported by the NRC Joint Task Group

Run Name	GVHC					
		Run 1	Run 2	Run 3	Run 4	Run 5
Cost to save a life ($ million)	35	4.2	2.2	(1.2)	17.3	31.9
Cost to prevent injury ($ 1000)	1500	353	269	(496)	1545	2878
Net life cycle cost of installing system ($)	2527	638	456	(1257)	3234	6138
Net Cost to society (dollar cost per dollar of property damage prevented)	10	3	2	(3)	10	19

It is interesting in this context to note that run 3 of the analysis, which demonstrated a positive benefit/ cost correlation was produced at the request of M G Levasseur of the Quebec Government. It was based on statistical data produced by the Province of Quebec indicating trends toward significant ageing in the general population and the likelihood of a higher incidence of fatalities among older persons. It also assumed lower construction costs based on combining the domestic and sprinkler supply system. To some extent, both these assumptions have proven accurate. The population of Canada is ageing rapidly, such that it is no longer viewed as a country of young people, with senior citizens forming the fastest growing segment of our society. In addition, the cost of installing residential sprinkler systems has actually fallen since 1990 in real terms due to reduced manufacturing costs and plastic piping which allows for simpler and faster installation. Despite average inflation in the range of 1% to 3 %, sprinkler installation costs in Vancouver have fallen slightly over the last ten years.

City staff weighed into the debate with additional studies on sprinkler benefits prepared by the Vancouver Chapter of Operation Life Safety and the Canadian Fire Safety Association which reported figures for the cost per life saved as low as $500. They also pointed out that the discount rate (interest rate less inflation) used in the GVHBA analysis was 4.5% and that this was too high for long term studies. While Canada had adopted a high interest policy in the late 1980's, this policy changed significantly in the 1990's such that a discount rate in the more traditional range of 2 to 3% would have been more appropriate.

Given these widely divergent opinions on the cost/benefit implications of a mandatory sprinkler policy, it is a credit to the elected and non-technical councillors of the day, that they did not duck the issue by sending the staff report recommending the policy back for further detailed analysis. The policy was debated in front of Council in several sessions in March and April 1990. Numerous delegations made presentations to Council and the hearings, which were at times fairly raucous, with viewpoints being vociferously advanced and defended. Eventually the issue was taken to a vote and passed with nine councillors in favour, two against. Two of the stronger proponents on Council were the then Mayor Gordon Campbell, now Premier of British Columbia, and Councillor Phillip Owen, now Mayor of Vancouver. Accordingly, on April 24th 1990, all residential buildings in the City including one and two family dwellings were required to be sprinklered. The Council ameliorated the policy in one area, requiring existing houses to be sprinklered only when renovations of a value in excess of 50% of the replacement cost of the dwelling were to be carried out.

In a sequel to this move, in 1996 the then City Building Inspector, Mr R L Maki P.Eng., proposed to council that the mandatory sprinkler policy be extended to all new buildings in the City except for small accessory type buildings less than 100 sq m in area and some temporary buildings. This applied to all new buildings of all occupancy groups in the City, existing buildings being required to be sprinklered only when triggered by the current upgrade triggers. At this time there was virtually no opposition from the development industry, and with the proposal endorsed by several professional bodies, Council had little difficulty in accepting the City Building Inspector's recommendations.

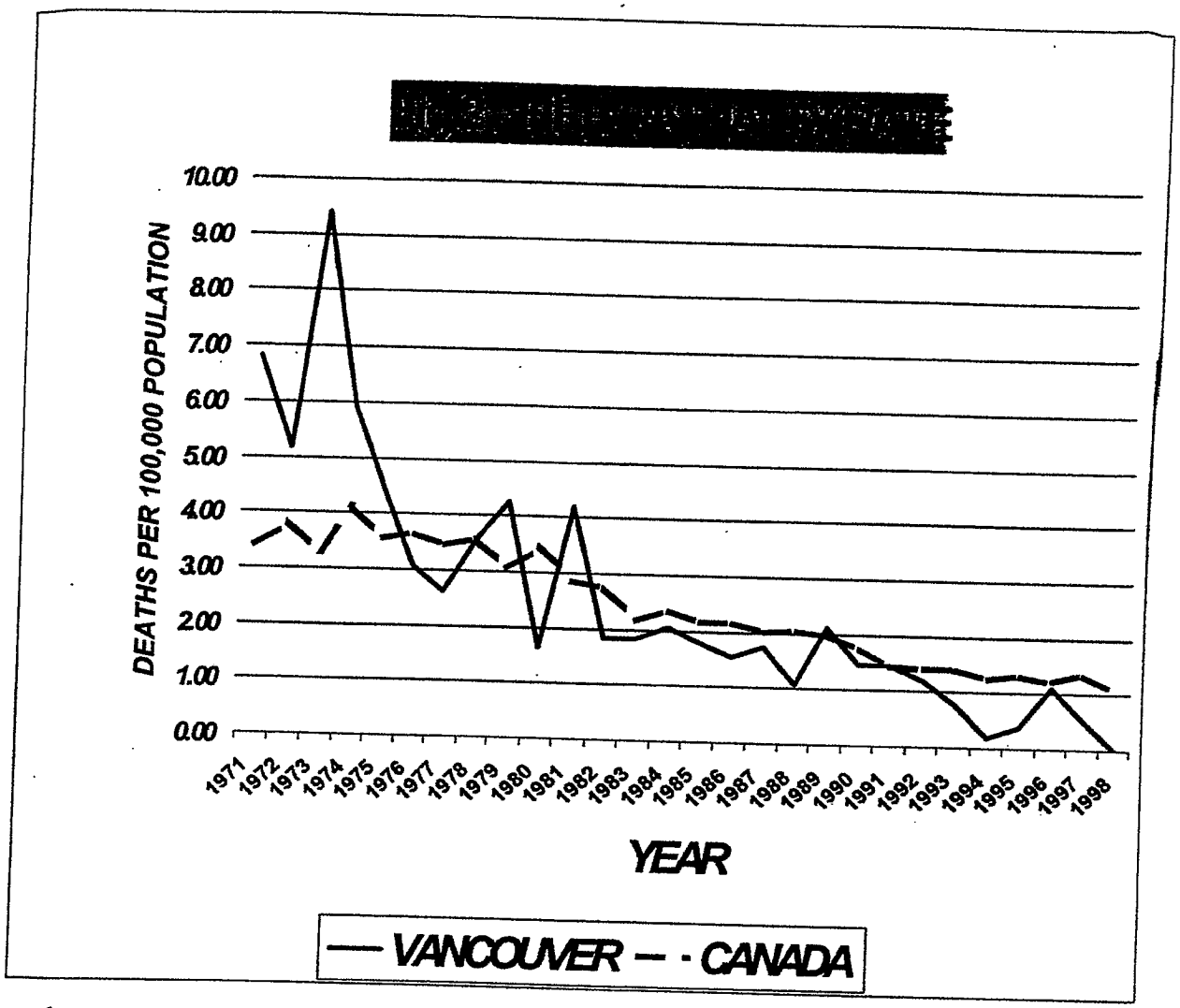
SPRINKLER COST BENEFIT ANALYSES

As realised from the results of the NRC study, a cost benefit analysis of a major fire safety initiative projected over the life of the subject buildings is inherently highly sensitive to the choice of major variables and the effect of future changes. These changes, which cannot be predicted with any level of confidence, may have a pronounced effect on the results of the analysis. They include:-

- Changes in demographics. Particularly significant are ageing of the population which affects a persons behaviour and capability for self preservation.
- Changes in societal perceptions around personal safety.
- Changes in behaviours such as smoking and drug and alcohol abuse which can significantly affect fire safety in residential dwellings
- Socio-economic factors which affect maintenance standards and replacement of outdated or faulty electrical systems and appliances.
- Changes in construction technology and the benefits of large scale implementation which may significantly reduce the cost of the sprinkler systems.
- Other improvements in related safety systems which may impact the casualty figures.
- Future changes in building codes. These may have the effect of improving the reliability of the systems and also their costs. Alternatively, they may permit an increased level of trade-offs in other areas of the code, thus reducing construction costs for the subject buildings.
- Predicting the reliability of the systems from existing data when their use is extended to a much broader class of buildings with very different levels of inspection and maintenance.
- In the case of sprinklers, predicting the frequency and costs associated with accidental, premature or unnecessary activations and the ensuing water damage.
- The impact of the systems on the costs of delivering public fire services, and the extent to which annual fire department costs might be reduced.
- Future changes in interest rates and inflation costs.

Although an economic engineering analysis to evaluate the benefit cost ratio for a mandatory sprinkler policy over the life cycle of a typical residential building is highly complex and beyond the scope of this report, it may be more informative to review the impact of mandatory sprinklers in Vancouver in retrospect. Existing City data has been used to retrospectively analyse the fire statistics and attempt to assess the costs of sprinkler installations in terms of cost per life saved. No attempt was made to allow for many of the complex factors listed above. It should be noted that while this study reports on the impact of sprinklering of residential buildings, many non-residential buildings were sprinklered to allow use of sprinkler trade-offs or to provide for fire safety upgrades, and after late 1996 all other buildings were required to be sprinklered. However, as 90% of Canadian fire casualties occur in residential buildings, the main benefits of the mandatory sprinkler program may be expected to occur in residential buildings.

A very a simple analysis was made using data developed from existing City fire records. By comparing City Fire records for the period 1981-1990, and 1992 to 1998 with comparable records for Canada as a whole, it was anticipated that the difference in the statistical trends could, to a large extent, be attributed



to the mandatory sprinkler program in the City. It was assumed that many of the other broad trends toward increasing fire safety would be reflected similarly in both the Vancouver and the Canada fire statistics. The period 1992 to 1998 was selected as residential buildings constructed under the new regulations were largely occupied in 1992 onwards, and because fire statistics for 1999 and 2000 are as yet unavailable for Canada.

These data are expressed in casualties per 100,000 population and are shown in Fig. 2. The figures indicate that the casualty rate for Vancouver declined at a faster rate than the Federal casualty rate for the period 1992-1998 . From these data, it can be estimated that in 1998, the casualty rate per 100,000 population in Vancouver declined by an additional 0.53 per 100,000 population relative to Canada as a whole, as shown in Table 2. This is equivalent to the saving of 3 lives per year. In short, by the year 1998, the average casualty rate in Vancouver had declined by 27% faster than the Federal rate and that the saving of 3 lives per year could largely be attributed to the mandatory sprinklering of new and some existing housing stock in the period 1992- 1998.

TABLE 2 - Comparison of fire casualty statistics for Vancouver and Canada

PERIOD	CASUALTIES PER 100,000 POPULATION	
	VANCOUVER	CANADA
1981 - 1990	*1.96*	*2.23*
1992 - 1998	*0.61*	*1.3*
%DECLINE	*69%*	*42%*

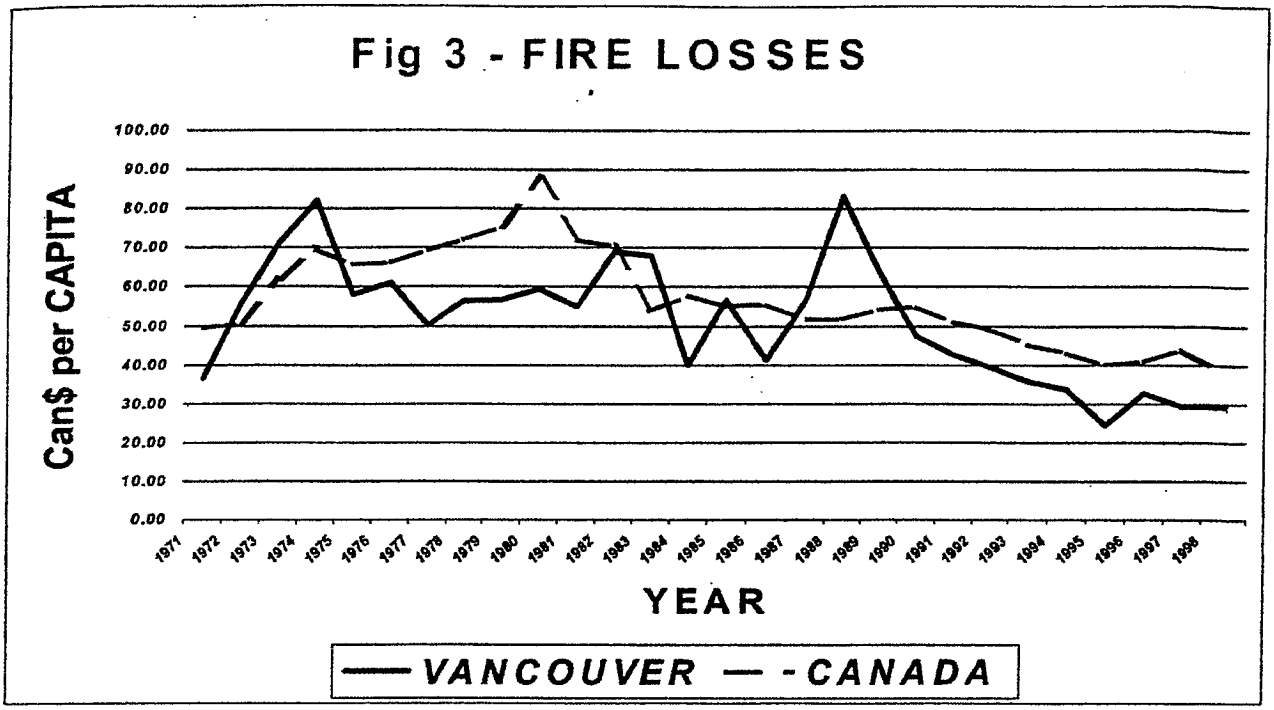
City records show that building permits for a total of $4.89 Billion of residential construction were issued in the period 1992 to 1998. This is equivalent to construction costs of $5.32 billion in current (2000) dollars. Costs for the installation of sprinkler systems as a percentage of total construction costs has remained relatively constant over the decade and is estimated in the range of 1.2% to 1.8% of total construction costs, depending on the type of system used. Using a blended figure for sprinkler installation of 1.5% of total construction costs, the cost of installing sprinklers would be $80 million in total over this seven year period or an average of $11.4 million per year in current dollars. If we assume this saves 3 lives per year or 21 lives over the seven year period, the cost per life saved is of the order of $3.8 million per life saved. However, given that maintenance costs for modern sprinkler systems are very low, and typically recouped from lower insurance premiums, these sprinkler systems will continue saving lives for the life of the building, typically of the order of 50 years or more. Applying the sprinkler costs to the 150 lives saved over a fifty year period yields a cost per life saved of $533,000. These figures do not take into account the cost savings associated with a reduction in fire department staffing and apparatus, the direct savings in property damage, or the reduction in construction costs afforded by the numerous sprinkler trade-offs permitted in the Vancouver Building By-law.

A similar analysis has been applied to the reduction in property damage due to sprinklers. The fire loss figures for the City of Vancouver and Canada from 1971 to the present are shown as per capita losses (Current Can$) in Fig 3. These figures have been adjusted for inflation using the Canadian Consumer Price Index as published by Statistics Canada. The figures indicate that the loss rate for Vancouver declined at a faster rate than the Federal rate for the period 1992-1998 as shown in Table 3 . From this data, it can be estimated that in 1998, the fire losses per capita in Vancouver had declined by an additional 22.6% or $11.31 per capita relative to Canada as a whole.

TABLE 3 - Comparison of fire loss statistics for Vancouver and Canada

PERIOD	FIRE LOSSES Can$ per CAPITA	
	VANCOUVER	CANADA
1981 - 1990	$58.10	$57.86
1992 - 1998	$32.01	$42.97
% DECLINE	48.3%	25.7%

From these figures, the average reduction in fire losses for the City of Vancouver during the period 1992 - 1998 is estimated at $6.29 Million per year or $44.0 Million over the seven year period. Subtracting these cost savings from the installation cost of $11.4 million for sprinklers yields a net cost per live saved of $1.71 million over the eight year period and $240,000 over the average 50 year life of a typical residential building.



Further, a cost benefit analysis carried out on behalf of the Canadian Mortgage and Housing Corporation (CMHC) for several Canadian Jurisdictions indicated that cost savings in the range of 20 - 30 % of the initial capital cost of sprinklers may be returned to municipalities over the life of the installation due to the lower demands for fire suppression services. Table 4 shows the results of this analysis when applied to 5 Canadian Municipalities

TABLE 4 - CMHC analysis of savings in fire fighting costs for sprinklered buildings.

	Net present value analysis of cost savings in municipal fire fighting services through the use of automatic sprinkler systems				
	Burlington Ontario	Brant Ontario	Edmonton Alberta	Port Alberni B.C.	Sherbrooke Quebec
Municipal Fire Protection Cost Savings	0*	7,400,000 Cr	38,490,383 Cr	2,762,164 Cr	8,892,648 Cr
Construction Cost of Sprinklers	42,300,000	38,000,000	130,112,965	11,719,655	29,246,975
% Savings	0	19.5	29.6	23.6	30.4

* Burlington's fire department future costs are driven by non-fire related emergency services

The above analysis is complex and unique to the specific conditions prevailing in each individual municipality. Factors such as the level of greenfield developments, non fire related emergency services and the mix of sprinklered and unsprinklered buildings will significantly alter the analysis. However, if we apply an average saving of 20% of sprinkler construction costs to the above sprinkler benefit/cost analysis, this yields a net cost per live saved of $950,000 over the eight year period of the study and $153,000 over an average 50 year life of a typical residential building.

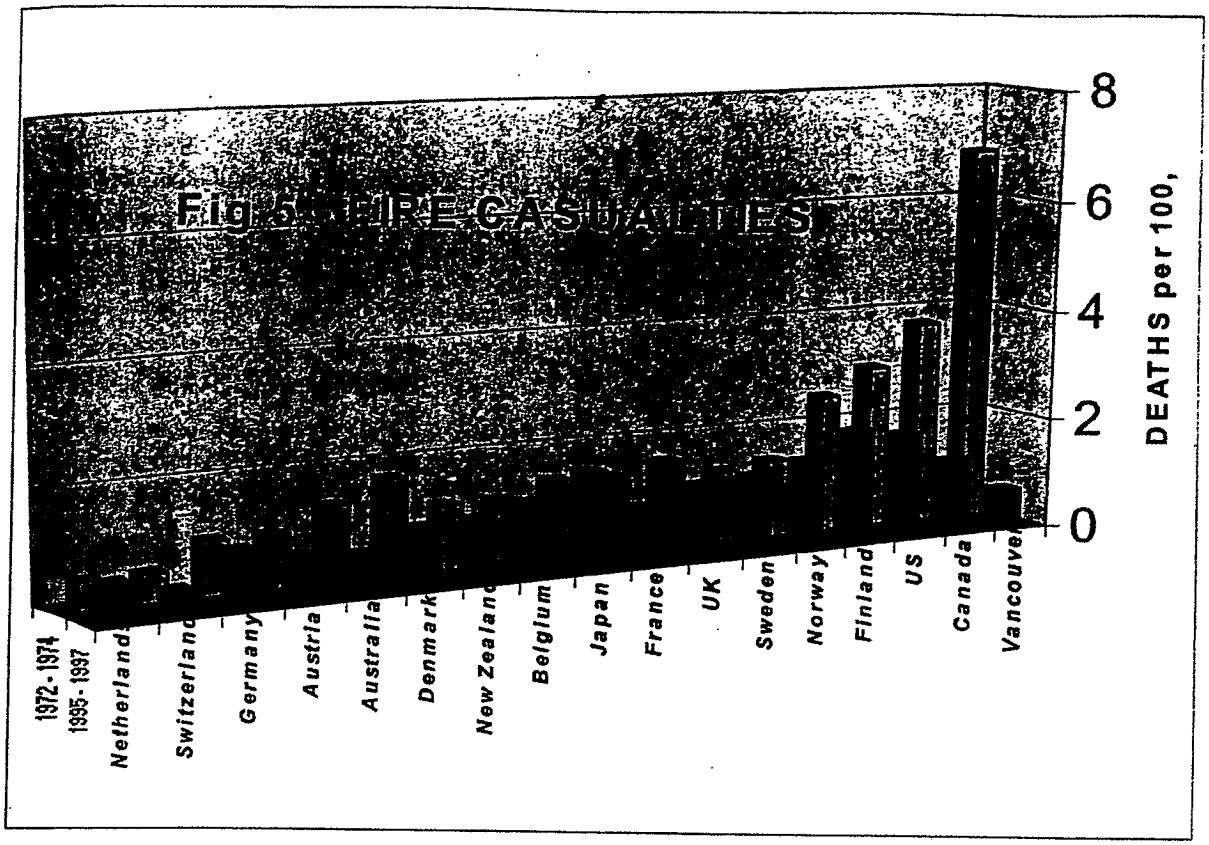
These figures do not take into account, reductions in construction costs due to the sprinkler trade-offs permitted in the codes. These may be significant for high rise apartments where smoke control systems are waived when sprinklers are installed. In additjon, in the City of Vancouver, most medium density residential construction consists of four storey wood frame buildings. These could not be built of wood frame if they were not sprinklered. Also, most one and two family dwellings utilize the sprinkler trade-offs to permit increased window openings close to the property line. The effect of these trade-offs in the case of high and medium density residential construction is to significantly reduce the net cost of installation of sprinklers by factors of up to 100%.

Other factors will come into play as the City matures. As the number of sprinklered buildings increases with new denser construction forms replacing existing older buildings, and as the population ages, these trends will change. In addition, with casualties less than 1 per 100,000 in a City approaching 600,000, the room for significant improvements will be limited until all the unsprinklered buildings have been replaced or retrofitted with sprinklers. However, the figures do indicate that current experience has yielded much more favourable benefit/cost ratios than were assumed in the 1980's prior to introduction of the policy and that these figures indicate that for major Canadian cities, mandatory sprinkler requirements for residential buildings are consistent with sound economic guidelines for public safety initiatives.

Using the above assessments, the net cost of sprinklering per life saved for the City of Vancouver falls below $1,000,000 in the period 1992-1998 and, when evaluated over the expected life of the buildings, may be effectively close to zero. These figures are well below the limits which most public agencies consider prudent to apply to public safety programs on a per life saved basis. The CMHC report of 1990 indicated that contemporary Canadian safety agencies were adopting safety policies with expenditures in the range of $170,000 to 2.2 million per life saved. Accounting for inflation, this would correspond to expenditures of $250,000 to $3 million. For comparison, the Economist reported in November 2000 that the British Department of the Environment Transport and the Regions considers expenditures of £1 million or Can$2.1 million per life saved as providing an acceptable goal for road safety improvements. By contrast, the cost of the current British safety upgrading of the British railway system by Railink has been evaluated at approximately $5 million (Can$11 million) per life saved.

The above analysis is necessarily rudimentary. The above assessment of sprinkler effectiveness and its associated benefit/cost ratios based on sprinklering of new buildings in the City since 1990 is questionable, since virtually all the deaths and much of the damage has been incurred in unsprinklered buildings. However, the impact of the City's aggressive sprinkler policies in dramatically reducing fire deaths is unrefutable. Fig 2 shows that the annual fire deaths in the City declined from a high of 9 casualties per 100,000 population in 1973, to less than one casualty per 100,000 in the 1990's, with zero casualties in 1998. By this time, it was estimated that 39,700 dwelling units in the City were sprinklered, or 25.7% of the total residential stock. While different jurisdictions with different housing construction types and with differing socio-economic conditions may experience different benefit/cost ratios, the effects of Vancouver's sprinkler program may be seen in the dramatic reduction in Vancouver's fire casualty rate compared to other countries as seen in Fig 5.

These statistics are comparable with the US experience. Kimberly Rohr, in the NFPA January 2000 report entitled "U.S. Experience with Sprinklers" noted that the estimated impact of residential sprinkler systems in homes is a 73% reduction in death rate, therefore proving that a policy of encouraging or requiring greater use of residential sprinklers needs to be adopted nationally. She also reported that the impact of sprinklers on residential fire losses was to reduce losses from US$9,400 per fire to US$5,400 per fire.



MANDATORY SPRINKLERING IN THE NATIONAL BUILDING CODE OF CANADA.

In 1983, the Canadian Association of Fire Chiefs presented a proposal to the Standing Committee on Use and Occupancy of the National Research Council that all residential buildings in Canada be sprinklered. Consideration of this request was deferred until a paper then in preparation by the codes section of the Institute for Research in Construction (IRC) could be considered. This paper entitled "Automatic Sprinkler Protection in Buildings Regulated by the National Building Code of Canada " prepared by Alastair J M Aikman and John F Berndt was completed in February 1987. This paper was considered by the Standing Committee on Fire protection, which recommended that in principle sprinkler protection should be extended to all high buildings and to institutional and residential occupancies. They also recommended that a Joint
Task Group be formed to study the implications of extending mandatory installation of sprinkler systems to one and two family dwellings.

The Joint task Group was formed with representation from the Standing Committees on Use and Occupancy. Fire Protection. and Housing and Small Buildings. The Task Group commenced work in June 1988 and issued their report in March 1990. They recommended that sprinkler protection not be made mandatory in houses except for houses intended to accommodate persons with special needs.

Based on this report and the wealth of referenced material. the Standing Committee on Fire Safety recommended mandatory sprinklers for all high buildings and institutional buildings and public theatres. They also recommended sprinklers for all buildings exceeding specific height and area limits. These recommendations were incorporated into the 1995 National Building Code of Canada and adopted by most Canadian Provinces. with the notable exception of Ontario. They required that all residential buildings greater than 3 stories in height would be required to be sprinklered. and that residential buildings of 3 storeys or less may be required to be sprinklered depending on area. Currently. there are

no proposals before the Standing Committee on Fire Safety and Occupancy to significantly expand the mandatory sprinkler requirements in the NBC.

Currently, the Standing Committee is examining further modifications to the code to allow for the benefits of sprinklers, although most of these are relatively minor in nature. However, noting that there are approximately 60 identifiable modifications or relaxations in the code permitted in sprinklered buildings, it is important to limit these so that complete reliance for fire safety is not placed solely on the proper operation of a sprinkler system. While the record and reliability of automatic sprinklers is excellent, and a properly designed and installed system should control a fire at least until the arrival of the fire department, total reliability cannot be assured. Recent concerns and problems in Vancouver include:-

- Reliability of municipal supplies. In 1986 one of two incoming water pipelines fractured, resulting in abnormally low water pressures through much of Vancouver. A recent 1998 failure of a water pipeline crossing of the Fraser river also failed resulting in lower than normal pressures in outlying municipalities.
- Systematic failure of sprinkler system components due to design or manufacturing problems. The recent replacement program for Omega type residential sprinkler heads is still underway and our inspectors are still finding these heads in residential buildings.
- Concern over deliberate or accidental contamination of water supplies requiring extensive flushing and temporary closure of water distribution lines.
- Fire in concealed spaces unprotected or poorly protected by sprinklers
- Freezing of sprinkler piping due to poor installation or failure of heat tracing systems
- The potential for widespread failure of municipal water supplies following a major earthquake, such as occurred in Kobe in 1995.

CONCLUSIONS

1. That faced with an unacceptably high casualty rate, the mandatory retrofit of sprinklers into the rooming houses and hotels in the City of Vancouver in the 1970's was largely responsible for reducing the casualty rate from over 7 deaths per 100,000 to 1.96 deaths per 100,000 by 1980.

2. That the introduction of mandatory sprinklers for all new residential buildings accompanied by the requirement for sprinklering residential buildings undergoing major renovations has significantly assisted in further reducing the casualty rate in Vancouver for the period 1992 - 1998 to 0.53 deaths per 100,000.

3. That while evaluating the cost of sprinklers in terms of lives saved is highly complex, the Vancouver experience indicates that the cost per life saved from the program to date is less than $1 million and that when extended over the anticipated life of the buildings, will reduce to below $200,000. These costs may reduce to near zero when the cost savings from reduced construction costs generated by sprinkler trade-offs are incorporated into the analysis.

4. That Canadian codes are requiring sprinklers in an increasing number and size of occupancies and that the trend to more widespread use of sprinklers as the primary focus for fire safety in Canada is likely to increase in the future. While sprinklers offer a cost effective method of reducing fire casualties and losses, over reliance on sprinklers to the detriment of other fire safety measures is to be avoided, particularly in areas subject to seismic disturbances or interruptions in the municipal water supply.

NFPA Report:

Residential Fire Sprinklers Have Come of Age

Submitted by Sean Tracey, P. Eng., Canadian Regional Manager, NFPA International

Over the past few years the technology behind residential fire sprinklers has advanced so much that all new homebuyers should consider installing them. These systems are extremely reliable and we now have over ten years of records on their effectiveness. Installation costs of these life safety systems are on a par with most of the non-essential upgrades in the construction of any new home. They have come of age and coalitions of concerned parties have started to spread the word of the benefits of residential sprinklers.

In North America, eight out of ten fire deaths occur in the home. Installing smoke alarms and a sprinkler system reduces the risk of death by 82 per cent compared with having neither. Progressive cities such as Vancouver, British Columbia and Scottsdale, Arizona have a decade or more of experience with residential fire sprinklers. To date, neither city has experienced a fire fatality in any of these sprinklered homes. These facts and many others, including demonstrations, are available from the international Home Fire Sprinkler Coalition's website at www.homefiresprinkler.org.

In the past many myths circulated on residential fire sprinklers and often these systems were inaccurately portrayed in the media. It is time to set the record straight. One of the greatest myths that has been circulated is that the potential water damage from a sprinkler system is worse than the fire. This is just not the case. The truth is that sprinklers will only discharge in the immediate area of the fire and they use a fraction of the water that a fire department would use. In 90 per cent of the cases, the fires were contained by only one sprinkler head. The City of Vancouver's 10-year experience record with residential sprinklers indicates the average damage due to a fire in a non-sprinklered residence is close to 14 times more than in a sprinklered residence. Another myth, that sprinklers are ugly, is not accurate. Modern sprinkler fixtures are inconspicuous and can be flush mounted into a ceiling. In some cases, sprinklers are concealed by cover plates, colour matched to each room. The third myth is that these sprinklers go off accidentally. This, too, is not true. The odds

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The odds are 1 in 16 million of an accidental discharge and one study has even suggested these mishaps are less damaging and less frequent than any mishap involving standard home plumbing.

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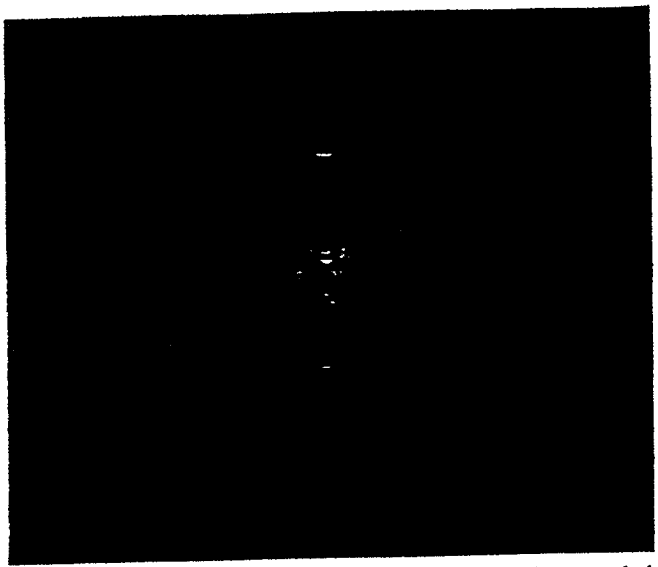

The technology advancements in these systems make them excellent choices in rural locations where fire department response may be longer. The engineering hurdles have been overcome and they can now operate as stand alone systems off of rural wells. In some cases, they can even use water supplies already available within existing well systems. These systems could potentially extinguish or contain a fire until the responding volunteer fire department arrives on scene. This would significantly reduce the severity and damages of any fire.

In urban applications the installation costs are also falling. The installation costs are now approximately 1.5 per cent of the home value — a price comparable to a flooring upgrade. This is definitely within reach of many home buyers. Awareness of these systems and the demand for them is increasing and so is the number of contractors installing them. Several homebuilders have even taken the added step of voluntarily installing them or offering them as an upgrade package to new home buyers. Builders across Canada have seen the potential benefits in the form of trade-offs. These trade-offs can provide significant benefits to municipalities and developers making residential fire sprinklers a win-win proposition for all parties. As the Coalition becomes more successful with its information campaign, we hopefully will see all new home buyers making an informed decision on whether a residential fire sprinkler system is the right choice for their family.

Dictaphone

David Gutteridge
Regional Sales Director

2355 Skymark Avenue
Mississauga, Ontario
L4W 4Y6
Tel.: 905-625-0300 ext. 2405
Toll Free: 888-471-3463 ext. 4656
Fax: 905-625-0225
www.dictaphone.com

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