

Associate Committee on the
NATIONAL BUILDING CODE
National Research Council
Canada

**Report of the Joint Task Group on
Mandatory Installation of Sprinklers in Houses
to the Standing Committees on
Fire Protection, Housing and Small Buildings, and Occupancy**

**NOTE: This document is a working paper prepared for consideration by
Committees dealing with the National Building Code of Canada.**

The views and recommendations expressed in this document are those of the joint Task Group on Mandatory Installation of Sprinklers in Houses and represent neither those of the Associate Committee on the National Building Code nor those of the Institute for Research in Construction.

References to Code Articles in the Body of the' report and in the proposed revision action sheets refer to the 1990' edition of the National Building Code of Canada.

**This document is not a formal publication of the
National Research Council of Canada.**

March 1990

**Report of the Joint Task Group on
Mandatory Installation of Sprinklers in Houses
to the Standing Committees on
Fire Protection, Housing and Small Buildings, and Occupancy**

Table of Contents

Executive Summary	2
Definitions	4
Formation and Scope of Joint Task Group	4
Terms of Reference of Joint Task Group	7
Membership of the Joint Task Group	7
Summary of Meetings of the joint Task Group	8
Response to Terms of Reference	11
Recommendations	16
Other Options Considered	21

Appendix A, Reports of Working Groups	25
Working Group 1 - Standards	26
Working Group 2 - Life Safety	32
Working Group 3 - Cost Aspects	36
Working Group 4 - Alternative Measures	38
Working Group 5 - Cost Benefit Models	42

Appendix B, Recommended Revisions to Part 9 of the National Building Code of Canada 1990	59
R.A.S. - 9.7.1.3	60
R.A.S. - 9.10.1.10	61
R.A.S. — 9.10.9.14	62
R.A.S. - 9.10.9.16	64
R.A.S. — 9.10.11.2	66
R.A.S. — 9.10.12.5	68
R.A.S. - 9.10.14.3[70]	
R.A.S. - 9.10.14.6	71
R.A.S. - 9.10.14.12[72]	
R.A.S. - A-9.10.19.3.(1)	72

Appendix C, References	75
Presentations to joint Task Group	76
Publications and other documents reviewed by Joint Task Group	77
Correspondence	80

Executive Summary

The Joint Task Group on Mandatory Installation of Sprinklers in Houses recommends to the Standing Committees on Fire Protection, Housing and Small Buildings, and Occupancy that the installation of automatic sprinkler systems not be made mandatory in houses, except for houses that are intended to accommodate persons with special needs. In the opinion of the joint Task Group and based upon the *information* available at present, the projected number of lives that would be saved does not justify the necessary expenditure required to install these systems in all, new houses.

The Joint Task Group does, however, recommend to the three Standing Committees that changes be made to the National Building Code to include further considerations regarding life safety measures and further compensatory measures that would be available if automatic sprinkler systems are installed. These measures are summarized below. To ensure that a sprinkler system provides the appropriate level of safety necessary for the acceptance of these compensatory measures, it is recommended that all sprinkler systems that are installed should conform to the appropriate NFPA standard.

It is worthy to note that the lack of complete and uniform Canadian fire statistics became evident during the joint Task Group deliberations.

1. A sprinkler system, whether voluntary or mandatory, should be installed in *conformance* with the applicable NFPA standard (13, 13D or 13R). The NBC should make specific reference to these standards.
2. Unprotected openings in an exposing building face should be permitted to be doubled when the building is sprinklered in accordance with NFPA No. 13, 13D or 13R provided that all rooms and spaces with unprotected *openings* adjacent to the exposing building face are sprinklered.
3. A house that is intended to accommodate persons with special needs, including mental or physical disabilities, should be required to have an automatic sprinkler system installed.
4. A reduced spatial separation should be permitted for an exposing building face of a house that is sprinklered and that is not easily accessed by fire fighters.
5. The fire-resistance rating required for a wall separating attached houses should be reduced if both houses are sprinklered.

6. The fire-resistance rating required for the exterior wall of a house in close proximity to a property line should be reduced if the house is sprinklered.
7. Protection required for soffits above window openings in a building with a concealed roof space spanning more than two attached houses should be waived if all houses are sprinklered and provided that all rooms and spaces with unprotected openings exposing the soffit are sprinklered.
8. Windows should not be required to be openable for emergency egress and their shape should not be regulated in a sprinklered house
9. The fire separation required between a garage serving up to 5 vehicles and adjacent houses should be waived if both the houses and garage are sprinklered.
10. Special *consideration* should be given to houses with respect to fire fighter access by adding an Appendix Note clarifying that where the terrain makes access limited or impossible the access requirements could be relaxed or modified if the house is sprinklered.
11. Authorities having jurisdiction should implement a program of periodic inspection of smoke alarms.
12. The number of smoke alarms should be increased from current requirements to include at least one in the living room.
13. Recommend to the appropriate governmental authorities that incentives should be offered to encourage the installation of automatic sprinkler systems in houses. For example, municipal assessments should not include automatic sprinkler systems in determining the assessed value of houses.
14. Recommend to the Associate Committee on the National Fire Code that where automatic sprinkler systems are installed the onus of responsibility should be on the owner to have the system inspected and maintained by qualified personnel.
15. If a check valve is required by local plumbing regulations to separate the automatic sprinkler system from the domestic water system, the use of a single rubber faced check valve installed in accordance with NFPA 13D or 13R should be acceptable.
16. Appropriate authorities should improve the national fire statistics gathering system by employing a standardized format which will reflect

current Canadian experience and will be useful in evaluating the contribution of various fire safety measures. Fire loss statistics should be reviewed periodically for purposes of updating the cost/benefit model used by the Joint Task Group to assess the impact of mandatory automatic sprinkler system installation in houses.

17. Promotion of public education should be encouraged in order to improve awareness of the benefits of the new residential automatic sprinkler technology and of other fire safety measures.

Definitions

Brief explanations of the terminology used to distinguish conventional, quick response, and fast response sprinklers were given together with a review of the technology involved. From these explanations, the joint Task Group noted that the technologies are changing at a rapid pace and that the terminology can be confusing. It was the consensus of the joint Task Group that the term "residential sprinkler" be used exclusively in dealing with the work of the joint Task Group as it **is an accurate description for any sprinkler** intended for use in houses, as permitted under NFPA 13D or NFPA 13R.

The term houses as used during the work of the joint Task Group and as used in this report refers to single family dwellings, attached and semi-detached dwellings, row houses, duplexes and triplexes. Duplexes and triplexes refer to buildings in which the **dwelling units are located above one another. A primary common feature is the absence of shared egress facilities.**

Formation and Scope of Joint Task Group

In April 1983, the Canadian Association of Fire Chiefs presented a proposal that automatic fire extinguishing systems be installed in all residential occupancies. After **consideration of this presentation the Standing** Committee on Use and Occupancy determined that this proposal and all subsequent requests related to mandating sprinklers in different occupancies and types of buildings be deferred on the basis that an Institute for Research in Construction (IRC) Codes Section committee paper dealing with the subject of mandatory sprinklers in buildings was in preparation.

An' IRC **Codes Section committee 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. With the completion of this paper, and with numerous outstanding requests by groups interested in presenting information on the subject, the item was placed on the Agenda of the 6th meeting of the Standing Committee on Fire Protection held on the 23rd and 24th of February, 1987 (see Appendix T in the minutes of that meeting). In addition to the review of the

committee paper, presentations were made at that meeting and correspondence was reviewed. All of this material led the Standing Committee on Fire Protection to reach the following conclusions:

1. It was recommended in principle that supervised automatic sprinkler systems be mandatory in all high buildings.
2. It was recommended in principle that supervised automatic sprinkler systems should be mandatory in all residential occupancies in high buildings and in all *institutional* buildings.
3. It was recommended in principle that automatic sprinkler systems be mandatory in one and two family dwellings.
4. It was recommended in principle that automatic sprinkler systems should be mandatory in all other residential occupancies.
5. It was recommended that a joint Task Group be established to study the implications of the mandatory installation of sprinkler systems in one and two family dwellings. The Joint Task Group would be comprised of representation from the two Part 3 Standing Committees and the Part 9 Standing Committee on Housing and Small Buildings.

It was the consensus of the committee that the following points be used to develop the Terms of Reference for the joint Task Group-

- Examine the use of Standards NFPA 13 and NFPA 13D as potential referenced standards.
- Examine feedback from communities that **already** have mandatory automatic sprinklers in one and two family dwellings.
- Analyze the potential impact on life-safety of the **mandatory** installation of automatic sprinklers in new one and two family dwellings.
- Analyze available statistics on fire deaths in one and two family dwellings. Determine where deaths are occurring in new housing stock and in existing housing stock.
- Develop recommendations for the implementation of residential sprinklers in one and two family dwellings.
- Study the feasibility of inspecting and maintaining automatic sprinkler systems in one and two family dwellings.

On the 3rd, 4th, and 5th of June, 1987, the 6th meeting of the Standing Committee on Occupancy reviewed the Codes Section committee **paper and** the deliberations of the Committee on Fire Protection (see Appendix U in the minutes of that **meeting**). **The conclusions reached at that meeting were:**

1. It was recommended that a joint Task Group, as recommended by the Standing Committee on Fire Protection, be established to study the implications of the mandatory installation of automatic sprinkler systems in one and two family dwellings. In addition to the subjects

recommended by the *Standing* Committee on Fire Protection, the following Terms of Reference were also to be considered:

- Examine the cost aspects of alternative life safety systems.
 - Examine the benefits to be achieved by alternative life safety systems.
 - Review the information and recommendations contained in the committee paper prepared by IRC Codes Section staff.
 - Examine trade-off potentials in consideration of the mandatory *installation* of automatic sprinklers in buildings.
 - Study the cost implications of *installing* mandatory automatic sprinklers.
 - Study any other item the joint Task Group may consider necessary.
2. It was recommended that the joint Task Group study the desirability of extending mandatory sprinkler requirements for those facilities regulated under Part 3 of the NBC.

At the 33rd meeting of the *Standing* Committee on Housing and Small Buildings held on 16th and 17th of June, 1987, the Committee was unanimous in its support for the formation of the joint Task Group and agreed that the Part 9 Committee be represented (see Appendix V in the minutes of that meeting). In addition, it recommended that the Terms of Reference should include examination of all residential buildings under the jurisdiction of Part 9 and not just one and two family dwellings.

On October 14, 1987, the three Standing Committee chairmen met with members of the Technical Unit of the IRC Codes Section in Ottawa to review the aforementioned recommendations (see page 11 of Appendix T in the minutes of that meeting). This meeting established that a joint Task Group on mandatory automatic sprinkler *installation* in houses would indeed be established, and the 11 member' Joint Task Group structure was determined. In addition, terms of reference were finalized. The terms of reference and Joint Task Group membership are described later in this report.

The Standing Committee Chairmen's meeting defined the scope of what is, meant by the term "houses" in this context, *which* in turn determined the scope of the work of the joint Task Group. This meeting considered the second recommendation of the Standing Committee on Occupancy to undertake a study on extending mandatory sprinkler requirements for facilities regulated by Part 3 of the NBC. It was agreed by the Chairmen that this work would be performed after the completion of the work of the joint Task Group and would not be included in the scope of work

The appointment of the members of the joint Task Group then followed and the joint Task Group commenced its work at a meeting convened on June 7, 1988.

Terms of Reference of Joint Task Group

- Examine the use of standards NFPA 13 and NFPA 13D as potential reference standards.
- Examine feedback from communities that already have mandatory automatic sprinklers in houses.
- Analyze the potential impact on life safety of the mandatory installation of sprinklers in houses.
- Analyze available existing statistics on fire deaths in houses. Breakdown of statistics required to indicate proportions of fire deaths in new or existing housing stock.
- Develop recommendations for the implementation of residential sprinkler systems in houses.
- Study the feasibility of inspecting and maintaining automatic sprinkler systems in houses.
- Examine the cost aspects of alternative life safety systems.
- Examine the benefits to be achieved by alternative life safety systems.
- Review the *information* and recommendations contained in the committee paper prepared by IRC Codes Section staff.
- Review tradeoff potentials in consideration of the mandatory *installation* of automatic sprinkler systems.

Membership of the Joint Task Group

Mr. G. J. Sereda (Chairman)
Associate
The Cohos Evamy Partners
Calgary, Alberta

Mr. L. G. Hamre, P.Eng.
Fire Safety Engineer
Canadian Portland Cement Association
Ottawa, Ontario

Mr. P. Harding
Manager of Construction
Grinnell Fire Protection Systems
Toronto, Ontario

Mr. H. Keppler
Keppler *Construction* Ltd.
Peterborough, Ontario

Mr. T. K. Lenahan, P.Eng.
President
Gage-Babcock & Associates Ltd.
Vancouver, British Columbia

M. G. Levasseur, Ing.
Gouvernement du Quebec
Quebec, Quebec

Mr. T. MacDonald, P.Eng.
Assistant Manager
Advisory Services Section
Ontario Buildings Branch
Toronto, Ontario

Mr. L. S. Morrison, P.Eng.
President
Professional Loss Control Ltd.
- Fredericton, New Brunswick

Mr. W. Purchase
Director of Building & Development
City of St John's
St. John's, Newfoundland

M. J. *Sincennes*
Chef inspecteur, Bureau de *prevention*
Service d'incendie de Hull
Hull, Quebec

Mrs. M. Soper
Consumers' Association of Canada
Winnipeg, Manitoba

Mr. W. Graham *
Vancouver, British Columbia

M. R. Laroche **
Gouvernement du Quebec
Quebec, Quebec

Mr. A. J. M. Aikman
Technical Advisor, Part 3 NBC
IRC Codes Section,
National Research Council
Ottawa, Ontario

Mr. J. C. Haysom, P.Eng.
Technical Advisor, Part 9 NBC
IRC Codes Section,
National Research Council
Ottawa, Ontario

Mr. H. W. **Nichol**
Technical Secretary,
IRC Codes Section,
National Research Council
Ottawa, Ontario

- * Served as alternate to Mr. Keppler for the second meeting.
** Served as alternate to M. Levasseur during the fifth **meeting**.

Summary of Meetings of the Joint Task Group

First meeting held on June 7, 1988 in Ottawa, Ontario

The first meeting was held to acquaint the joint Task Group members with the terms of reference, to explain the role of members and to develop a schedule of meetings.

It was agreed that 3 meetings should be sufficient for public input followed by **two further meetings to draft and complete a report to be sent to the Standing Committees**. The public input meeting locations would be determined on the basis of response to announcements in the NBC/NFC News.

The joint Task Group reviewed the terms of reference and a number of the members volunteered to obtain information that would assist the joint Task Group in responding to the Standing Committees.

Some articles that related to the use of sprinklers in residential occupancies were reviewed. These articles clarified the terminology associated with sprinklers and included costs associated with the installation of residential sprinklers in the United States.

Second meeting held on 25 to 26 October 1988 in Montreal, Quebec

The primary purpose of the meeting was to hear public input from groups and individuals from the Province of Quebec and other locations.

The Joint Task Group reviewed an IRC Codes Section staff document titled "Possible Outcomes of the Work of the Joint Task Group on Mandatory Automatic Sprinkler Installation in Houses". It was agreed that the list of recommendations should be revised and that the document be reintroduced at a future meeting at a time when the presentations are complete and the Joint Task Group is formulating its conclusions.

A total of twelve presentations were heard. They included items dealing with:

- the installation of residential sprinklers on a voluntary basis but with incentives;
- reduction in insurance premiums for sprinklered houses; alternative life safety systems;
- mandatory installation of sprinklers through municipal bylaws;
- costs of automatic sprinkler systems in houses;
- advantages to fire departments through having districts in which the buildings are protected by sprinklers.

The Joint Task Group reviewed a number of articles and items of correspondence which had been received since the first meeting.

Third meeting held on 21 to 22 March 1989 in Vancouver, British Columbia

The joint Task Group heard sixteen presentations from interested groups in western Canada. The content of the presentations was similar to those which the joint Task Group had heard at the second meeting in Montreal. Further cost information was made available to the joint Task Group as well as material related to the installation of sprinklers in buildings in **rural areas where there is no adequate municipal water supply.**

To familiarize themselves with the aspects of appearance, materials and the costs of typical installations, the Joint Task Group made a half-day visit to a

number of construction sites in West Vancouver where residential sprinklers had been installed.

A prototype computer model to study-the cost aspects related to the installation of sprinklers in houses was presented to the joint Task Group to familiarize them with the general characteristics of the model which was to be used by CMHC as part of a presentation which would be made at the fourth meeting.

Articles relating to the efficacy of smoke alarms in saving lives in residential fires were reviewed to establish a comparative basis for considering the value of sprinkler systems during later stages of the joint Task Group's activities.

Fourth meeting held on 25 to 26 April 1989 in Ottawa, Ontario

Ten presentations were made to the joint Task Group at this meeting. The general content of the presentations was in distinct contrast to those at the two previous meetings. Although there were some presentations favouring the installation of sprinklers in housing the majority of the presentations sharply opposed the installation of sprinklers in houses on the basis that the total cost of installation was *not* justifiable *on* the expenditure to save a life.

Following the presentations the joint Task Group discussed the format that would be used for the final report to the Standing Committees and divided up a number of items to be handled by five working groups. It was requested of the working group members that they **consult between themselves and** forward draft reports to the IRC Codes Section in time to be included with the agenda for the fifth meeting. It was agreed that the first day of the next meeting would be used by the working groups to refine their reports to the Joint Task **Group in light of the draft reports of the other working groups.**

Fifth meeting held on 13 to 15 September 1989 in Ottawa, Ontario

At the beginning of the meeting the members of the joint Task Group reviewed a revised version of the IRC **Codes Section staff document titled "Possible Recommendations Arising from the Work of the joint Task Group on Mandatory Automatic Sprinkler Installation in Houses."** This document was used extensively by the joint Task Group members in the working group meetings and in the main meeting.

During the first day, the five working groups met separately and revised their reports for use during the following two days. On the second day, the entire Joint Task Group reconvened and, following presentation and discussion of the working group reports, addressed the various items *contained* in the terms of reference. The decisions that were arrived at by the joint Task Group are listed in the following section of this report. **A number of items were not**

concluded at this meeting because of insufficient time. IRC Codes Section staff were requested to assemble the material considered by the joint Task Group during the first five meetings and draft a report for consideration at the sixth meeting.

Sixth meeting held on 23rd and 24th October 1989 in Ottawa, Ontario.

The primary purpose of the sixth meeting was to review drafts of material for inclusion in the final report of the joint Task Group and to prepare the final report for submission to the *Standing* Committees. On the first day the five Working Groups reviewed the drafts that they had prepared before the meeting and also reviewed work that had been done by the other Working Groups. On the second day the joint Task Group met as a whole and reviewed the Working Group reports and recommendations. The Joint Task Group also considered a document prepared by IRC Codes Section staff that outlined a number of outcomes that could be considered together with a number of draft revision action sheets *concerned* with items in Part 9 that could be modified if an automatic sprinkler system were installed in a house. This material had been prepared in response to earlier requests from the Joint Task Group.

This report is the final outcome of the sixth meeting and *contains* the findings and recommendations of the Joint Task Group for forwarding to the three Standing Committees responsible for appointing the joint Task Group.

Response to Terms of Reference

- Examine the use of standards NFPA 13 and NFPA 13D as potential reference standards.

It was concluded that NFPA standards 13D and 13R should be referenced directly in the NBC for automatic sprinkler installation in houses, as defined by the Standing Committees. The standards should be applied whether the systems are installed voluntarily or are mandated, in order to ensure that the system will *function* adequately and also to have an acceptable system that will permit alternative measures to those specified in the NBC to be **accepted with confidence**.

- **Examine feedback from communities that already have mandatory automatic sprinklers in houses.**

The majority of the statistical material available to the joint Task Group *concerning* the benefits of automatic sprinkler systems originated in the United States. There are no adequate statistics from communities in Canada due to a lack of mandated sprinkler

requirements. The **Joint Task Group was unable to draw any firm conclusions from the data because of** a difficulty in making comparisons between sprinklered and unsprinklered buildings in the relatively small set of examples:

- Analyze the potential impact on life safety of the mandatory installation of sprinklers in houses.

Included with next item.

- Analyze available statistics on fire deaths in houses. Breakdown statistics required to indicate proportions of fire deaths in new or existing housing stock.

The Joint Task Group concluded that, in general, based on the limited available data, new housing units have fewer reported fire incidents than occur in older buildings. In the incidents that have been reported there are fewer deaths and injuries than in older buildings. In order for sprinklers to have the **most beneficial impact on the annual death and injury totals it would** be necessary to retrofit sprinklers in the existing housing stock as well as installing them in new buildings. The **Joint Task Group was unable to find definite reasons for the poorer record for older buildings however there was some speculation** concerning the possible contribution of lack of maintenance, and socio-economic factors.

- Develop recommendations for the implementation of residential sprinkler systems in houses.

On the basis of the material that was considered by the joint Task Group, it was concluded that installation of automatic sprinkler **systems in all new houses would not be cost effective on a mandatory basis.** Many of the potential benefits from the *installation* of automatic sprinkler systems accrue to the community in the form of **reduced fire fighting costs and reduced water supply costs. Unless the community had a majority of its houses and other buildings sprinklered only a portion of these costs could be saved. Savings in insurance costs were** relatively small in comparison to total insurance premiums (10% to 15%).

The following additional reasons for not recommending the mandatory installation of sprinklers in houses were contributed individually by Joint

Task Group members and are not the result of a consensus of the joint Task Group as a whole:

- , Mandatory automatic sprinkler systems in new houses should not be imposed on Canada as a whole. Individual municipalities should handle it themselves, although it is recognized that there are only several charter cities and cities within the Province of Quebec that can apply their own regulations. Further, it is presumed that most provinces will wish to avoid creating a disparity between the NBC and provincial codes.

If automatic sprinkler systems are made mandatory for new houses, then coroners' inquests could recommend mandatory sprinklers for specific situations including retrofit of public and other housing, which could be cost prohibitive for those having to carry it out.

- , The advantages of hard wired smoke detectors have not been given their due. Individuals should be given the choice of whether or not to sprinkle their houses, in light of any retrofit advantages that may accrue down the road as the result of other recommendations of this joint Task Group.
- , The decisions of this joint Task Group do not stop consumers from installing sprinklers in their houses nor do they prevent builders from installing them in the houses they build. It is better that such decisions be market driven.

The fire death record does not warrant any further measures. The money that would be spent would be money better spent in other areas.

The fire death levels in Canada are apparently acceptable to the Canadian public and are not high enough to cause any concern leading to a demand for mandatory sprinklering, except by special interest groups.

- Study the feasibility of inspecting and *maintaining* automatic sprinkler systems in houses.

The Joint Task Group concluded that if a community were to mandate the installation of automatic sprinkler systems in houses, the systems should be inspected on a regular basis to ensure their continuing reliability. Although there were some suggestions that this should be undertaken by the municipal fire department, it was agreed that it was a function that should be addressed in the National Fire Code and then left to the adopting authority to determine the most effective way of implementing the requirement.

- Examine the cost aspects of alternative life safety systems.

The report prepared by Working Group 4 identified a number of alternative approaches to the installation of automatic sprinkler systems-that might have a beneficial effect on reducing life loss in houses. The costs are approximate and are based on presentations made to the joint Task Group and other sources consulted by members of the Working Group.

The costs ranged from \$10.00 for a simple battery operated smoke alarm to items that would add 3% or more to the cost of the building. These options show varying possible benefits in reducing injuries, fatalities and property loss.

- Examine the benefits to be achieved by alternative life safety systems.

Alternative methods that involve active fighting of a fire by use of portable extinguishers or water hoses would encourage an occupant to remain in a burning building which is contrary to standard evacuation recommendations. By having persons remain in the building who are not trained in fighting fires there is a possibility that additional deaths and injuries could occur.

Methods that involve application of fire retardant paints *or* the use of fire retardant treated framing and sheathing have not been demonstrated to provide a significant continuing benefit in terms of life safety but **could help to contain a fire and reduce property loss.** **The use of additional smoke alarms could** identify a fire at an earlier stage and provide more time for safe evacuation. Some of the **information that was reviewed suggests that a substantial number of smoke** alarms become defective within 10 years of installation. The additional smoke alarms **would give a measure of redundancy so that** the failure of **one unit would not leave a house without** any means of detecting a fire. However, the number of false and unwanted alarms could increase and cause occupants to disable the systems leaving them **without the benefit of early warning of a fire.**

Systems that rely upon a signal being sent automatically to an external station or a fire department are **valuable in reducing property loss but** would have a lesser impact on life loss.

In response to a perceived problem with **smoke alarm reliability the Joint Task Group was convinced that a program of mandatory inspections** and public education should be instituted to replace defective smoke alarms and enhance the performance of the remaining units.

- **Review the information and recommendations contained in the committee paper prepared by IRC Codes Section staff.**

The joint Task Group concluded that the information contained in the IRC Codes Section staff committee paper was more relevant to larger buildings and was therefore outside the scope of work that the joint Task Group had been formed to consider. It was understood that a future Task Group would be formed to develop policy proposals concerning the possibility of requiring more extensive installation of sprinkler systems in buildings regulated by Part 3 of the NBC.

- **Review tradeoff potentials in consideration of the mandatory installation of automatic sprinkler systems.**

The Joint Task Group considered a number of items that could be modified or relaxed if an automatic sprinkler system conforming to an appropriate NFPA standard were to be installed in a house. The nature of the costs and benefits that might accrue from application of these items was difficult to assess and consequently was not evaluated.

Only one current benefit in the NBC 1990 arises as a result of sprinklering a house. Article 9.10.14.6. permits the doubling of opening size in an exterior wall if the building is sprinklered.

A number of additional items should be considered by the Standing Committees including:

Relaxation of requirements affecting window size and location. In a sprinklered house, windows would not need to be openable and their shape need not be regulated. Article 9.7.1.3. (See Appendix B)

Where there is no adequate fire fighting service readily available limiting distances are required to be doubled. In the case of a sprinklered house this could be waived by amending Article 9.10.14.3. (See Appendix B)

The soffit protection required by Article 9.10.12.5. could be omitted in the case of houses where all of the units are fully sprinklered. (See Appendix B)

Party walls used to separate individual units of multi-family housing need not have a 1 hour fire-resistance rating if the units on both sides are sprinklered. The value of the fire-resistance rating required by Article 9.10.11.2. could be reduced to 45 minutes or eliminated. (See Appendix B)

The values of fire-resistance and permission to have openings in exterior walls that are less than 1.2 m from a property line could be modified to reduce the fire-resistance rating and permit some window openings if the unit is **fully sprinklered**. Article 9.10.14.12. (See Appendix B)

Where fire separations are used to separate dwelling units in accordance with Article 9.10.9.14. the values to be used for the fire-resistance rating could be reduced if the units on both sides of the fire separation are fully sprinklered. (See Appendix B)

It is currently required that a storage garage serving 5 cars or fewer be separated from adjacent dwelling units by a fire separation with a 1 hour fire-resistance rating. It is recommended that the fire-resistance rating can be waived if the garage and all adjacent dwelling units are sprinklered. Article 9.10.9.16. (See Appendix B)

Recommendations

- An automatic sprinkler system, whether voluntary or mandatory, should be installed in conformance with the applicable NFPA standard (13, 13D or 13R). The NBC should make specific reference to these standards.

At present the reference to Part 3 in Part 9 of the NBC can only apply if NFPA 13 is the referenced standard. It was considered that NFPA 13D and 13R should be accepted for sprinklering of houses and that it would be appropriate to have more specific referencing to these standards in the NBC. Because the installation of a safety system would be expected to be fully operational by most occupants and that any trade-off benefits could only be granted if the system continued to function as expected it was necessary that all sprinkler systems should be designed and installed to a recognized standard even if installed voluntarily. (See Appendix B)

- A house that is intended to accommodate persons with special needs, including mental or physical disabilities, should be required to have an automatic sprinkler system installed.

It was recognized that there is an increasing trend to move persons with mental and physical disabilities out of institutions and that the number of these persons is expected to increase as the average population age increases. Because of the problems that these persons have in evacuating a building by themselves in an acceptable length of time, it was considered that it would be reasonable to require the installation of a residential automatic sprinkler system in a building that was intended for occupancy by these persons.

- A reduced spatial separation should be permitted for an exposing building face if a house is sprinklered. (Article 9.10.14.12.)

Because of the reduction-of intensity of [fires. in](#) a building with a sprinkler system it was considered to be appropriate to permit a reduction in spatial separation requirements for a building that is sprinklered. Based on information concerning the performance of residential sprinklers in containing and controlling fires, it was considered that in most cases there will be no appreciable spread of fire through unprotected openings. (See Appendix B)

- The fire-resistance rating required for a wall separating attached houses should be reduced if both houses are sprinklered.

In situations where there are houses side by side with a common wall, the NBC currently requires that the wall should have a specified fire-resistance rating as well as being a fire separation. It was considered that the value of the fire-resistance rating could be reduced by at least 15 minutes if both of the adjacent houses were to be sprinklered. There were some suggestions that no specific rating was necessary, however, it was pointed out that the type of construction required to achieve appropriate sound and damage control would not lead to any significant savings even if the fire-resistance rating were reduced to zero. A reduction in fire-resistance rating from 1 hour to 45 minutes would permit some potential for savings. (See Appendix B)

- The fire-resistance rating for the exterior wall of a house in close proximity to a property line should be reduced if the house is sprinklered.

It was understood that the requirement for a fire-resistance rating for a wall near a property line is to prevent the spread of fire to an adjacent building on a neighbouring property. It was agreed that, in the case of a fully sprinklered building, the potential for a fire to develop to an extent that the neighbouring property would be threatened is substantially reduced and that it would be appropriate to permit a reduction to 30 minutes from 45 minutes for the fire-resistance rating of the wall under consideration. (See Appendix B)

- Protection required for soffits above window openings in a building with a concealed roof space spanning more than two attached houses should be waived if all houses are sprinklered and provided that all rooms and spaces with unprotected openings exposing the soffit are sprinklered.

As a result of a number of fires in which fire has spread from a window opening through openings in the soffit into a shared roof space and then spread to adjacent units, the NBC places limits on the design of

the soffits where there is an interconnected roof space above more than two residential suites. It was considered that the possibility of exposure would be substantially reduced or eliminated if all of the suites were sprinklered. However, it is possible that a suite could be sprinklered in accordance with the applicable NFPA standard but one of the rooms with a window opening under a soffit **would** not have to be sprinklered. The additional provision that all rooms with windows exposing a soffit be sprinklered, whether or not required by the NFPA standard, is necessary. (See Appendix B)

- Windows should not have to be openable for emergency egress and their shape should not be regulated in a sprinklered house

The NBC requires that windows in bedrooms be openable and of such dimensions that they could be used in a fire emergency to permit the evacuation of the occupants of the bedroom by this means. It was agreed that in a sprinklered house the threat of fire was sufficiently reduced that it should no longer be necessary to evacuate persons by **these means. Concern was expressed that this would eliminate** windows from bedrooms, however, it was pointed out that there are separate requirements that assured a minimum area for windows in bedrooms. (See Appendix B)

- The fire separation required between a garage serving up to 5 vehicles and adjacent houses should be waived if both the houses and garage are sprinklered. (Article 9.10.9.16.)

Although the NBC currently requires that a garage that serves more than one dwelling unit and contains up to five cars be separated from the dwelling units by a fire separation with a 1. hour fire-resistance rating, it was considered to be unnecessary to have a fire-resistance rating for this fire separation if the **garage and all adjacent** houses are sprinklered. Requirements to prevent the migration of fuel vapours **and exhaust products into the houses would have to be maintained.** (See Appendix B)

- Special consideration should be given to houses with respect to fire fighter access by adding an Appendix Note to Article 9.10.19.4. clarifying that if the house is sprinklered the access requirements **could be modified where the** terrain makes access limited or impossible. (c.f. Appendix note A-3.2.5.7.(1))

One of the benefits of installing a sprinkler system in a house is the probability that a fire **would** be controlled and extinguished in its incipient stages and that the need for rapid response by the **local fire department would be substantially reduced. Accordingly the need for** access routes for fire department vehicles to the immediate vicinity of

the building would be reduced to the point that the current requirements of fire departments could be modified substantially if the building in question were sprinklered. (See Appendix B)

- Authorities having jurisdiction should implement a program of periodic inspection of smoke alarms.

Information was presented to the joint Task Group indicating that the smoke alarms installed in residential buildings do not have the life expectancy that was initially predicted for them. It was noted that a ULC committee is suggesting that these units should be replaced after ten years. It was also considered that it **would** be prudent for authorities having jurisdiction to initiate a program of inspection of smoke alarms to ensure that the units that are installed are in operational order and that defective units are replaced. In the case of battery operated units, the inspection **would** ensure that working batteries are installed.

- **The number of smoke alarms should be increased from current requirements to include at least one in the living room.**

The Joint Task Group considered suggestions that the number of smoke alarms required in dwelling units should be increased to require one on every **level** of a building. There were no dear statistics that led to the conclusion that this should be implemented. It **was agreed** that there were statistics showing that the probability of a fire leading to fatalities was highest for living rooms and that **there was an increased probability of fatalities arising in situations where the smoke from a living room fire was delayed in reaching the smoke alarms in sleeping areas by reason of intervening obstructions or by distance.**

- Incentives should be offered to encourage the installation of sprinkler systems in houses. For example, municipal assessments should not include sprinkler systems in determining the assessed value of houses. If accepted by the Standing Committees, this recommendation should be forwarded to the Federation of Canadian Municipalities.

Although the Joint Task Group did **not recommend that sprinkler systems should be mandated in houses, it did agree that there were benefits that would** accrue to a municipality with sprinklered houses. Accordingly it was agreed that a recommendation should be forwarded to the appropriate regulatory authorities, including the Federation of Canadian Municipalities, that incentives should be **offered to encourage the installation of automatic sprinkler systems in houses.** Although many financial incentives were discussed, one of the more positive ones was one that involved the deletion of the value of a

sprinkler system from the assessed value of a house. This would be a continuing benefit to the owner and would reflect the reduced servicing costs that would be borne by the municipality.

- Where sprinkler systems are installed, the onus of responsibility should be on the owner to have the system inspected and maintained by qualified personnel. If accepted by the Standing Committees, this recommendation should be forwarded to the ACNFC.

Because a life safety system is only of value if it functions in case of need, it was deemed to be appropriate that an owner be required to have periodic inspections undertaken. This is of critical importance if the presence of the sprinkler system has been used to grant modifications to the fire protection requirements of the NBC. Although there were suggestions that this should be undertaken by municipal departments, it was concluded that it was the owner's responsibility to assure the **local authority that the sprinkler system was being maintained in operational order.**

- If a check **valve is required, the use of a single rubber faced check valve installed in accordance with** NFPA 13D or 13R should be acceptable to separate the sprinkler system from the domestic water system.

There is a potential for problems in systems that are administered by more than one authority. In the case of residential automatic sprinkler systems in houses, compliance with both the plumbing codes and the sprinkler codes is required. Although it **was agreed that there is a need** for a check valve to prevent backflow from a dedicated sprinkler system to a separate domestic system in the same building, it was agreed that there is no need to have more than one **check valve and that a single rubber faced check valve was** fully adequate. This is to be recognized in the 1990 Canadian Plumbing Code, but should also be affirmed by authorities having jurisdiction who may not be familiar with the requirements.

- **Unprotected openings should be permitted to be doubled when the** building is sprinklered in accordance with NFPA No. 13, 13D or 13R provided that all rooms and spaces with **unprotected openings adjacent to** the exposing building face are sprinklered

Although the NBC currently permits the area of unprotected openings in an exposing building face to be doubled if a building is sprinklered, it was the opinion of the joint Task **Group that this had been determined in** the context of NFPA 13 which requires that all rooms and spaces be sprinklered. In making recommendations that NFPA 13D and 13R **should also be accepted it was acknowledged that this would permit**

certain rooms such as bathrooms and closets to remain unsprinklered. It was agreed that if the unprotected openings were to be **doubled in a building sprinklered in accordance with NFPA 13D and 13R**, then there should be a further control by requiring that these rooms should also be sprinklered if they **have unprotected openings. (See Appendix B)**

Other Options Considered

• **Mandatory Sprinklers in Rural Houses**

It was moved and seconded to recommend to the Standing Committees on Fire Protection; Occupancy; and Housing and Small Buildings that houses that are situated more than 7.5 km from a fire station and with a limiting distance less than 3 m from a property line be required to have an automatic sprinkler system. Not Carried

The Joint Task Group noted that this recommendation would largely apply to farm houses. It was the consensus of the joint Task Group that the reasons for which it was decided not to recommend mandatory sprinklers in all **new houses apply equally for rural houses. It was observed** that persons living in rural areas where there is not the same level of fire services do so at their own choice.

This recommendation originated from the Report of Working Group 4 on Alternate Life Safety Systems.

• **Mandatory Sprinklers in all Semi-detached Dwellings, Row Houses, Duplexes and Triplexes**

It was moved and seconded to recommend to the Standing Committees on Fire Protection; Occupancy; and Housing and Small Buildings that automatic sprinklers be mandated in all semi-detached dwellings, row houses, duplexes and **triplexes. Not Carried**

It was the *consensus* of the Joint Task Group that there are no additional life safety considerations in these types of dwellings and that the reasons for which it was decided not to recommend mandatory sprinklers in all new houses apply **equally** here.

This recommendation originated from the document entitled Possible Recommendations Arising from the Work of the Joint Task Group on **Mandatory Automatic Sprinkler Installation in Houses.**

- **Mandatory Sprinklers in all Semi-detached Dwellings, Row Houses, Duplexes and Triplexes Remote From Fire Fighting Services**

It was moved and seconded to recommend to the Standing Committees on Fire Protection; Occupancy; and Housing and Small Buildings that automatic sprinklers be mandated in all semi-detached dwellings, row houses, duplexes and triplexes which are more than 7.5 km from fire fighting services. **Not Carried**

The Joint Task Group noted that the life loss records for these types of dwellings are no different than for one- and- two-family dwellings. It was the consensus of the joint Task Group that the reasons for which it was decided not to recommend mandatory sprinklers in all new houses apply equally here.

This recommendation originated from the document entitled Possible Recommendations Arising from the Work of the Joint Task Group on Mandatory Automatic Sprinkler Installation in Houses.

- **Mandatory Sprinklers in Houses Which are not Owner Occupied**

It was moved and seconded to recommend to the Standing Committees on Fire Protection; Occupancy; and Housing and Small Buildings that automatic sprinklers be required in all houses which are not owner occupied. **Not Carried**

Concern was expressed regarding the level of fire safety in rental versus owner occupied houses. It was noted that Part 9 does not distinguish between rental and owner occupied houses. It was the consensus of the Joint Task Group that a recommendation of this type would be very difficult to control and also would assume that there is a difference in assumed hazard levels that has not **been established**.

- **Smoke detectors connected to fire stations.**

The material presented at one of the meetings with regard to the connection of smoke alarms in a house to the fire station by means of telephone lines was considered. It was the consensus of the Joint Task Group that this should not be made mandatory but was an option open to municipalities who had the resources to respond to such a system. It was pointed out that in many municipalities, particularly those with volunteer services, it would be difficult to implement. It was observed that the primary benefit involved the saving of property loss rather than of life loss.

- **Portable fire extinguishers**

The Joint Task Group considered the suggestion that portable fire extinguishers should be required in all houses. There were several points raised for and against the mandating of these items. Although it was agreed that small fires could be extinguished if the occupant had a portable extinguisher readily to hand and know how to use it, there was the added risk to occupants who tried to fight a fire or remained in a building while searching for a portable extinguisher, or using a faulty portable extinguisher, instead of getting out of the building and calling for the fire department. It was observed that it would require considerable effort and time to train all house occupants in the correct methods of using portable fire extinguishers as well as being able to recognize the situations that were not readily handled by portable fire extinguishers and still might not have any substantial impact on property or life loss.

- **Waiving requirements for noncombustible cladding**

There were suggestions that the requirements for noncombustible cladding for exposing building faces that are close to a property line could be waived if a house were to be sprinklered. The Joint Task Group considered that there was not enough information available concerning the effect of fire spread between buildings which are very close together and in addition that the requirement was more particularly concerned with fire spreading from a neighbouring building than spreading *in* a neighbouring building. Thus sprinklering of only one of the buildings would not be of value. Further the control of sprinklering in a neighbouring building is not possible under the current concepts in the NBC.

Appendix A

Reports of Working Groups

Report of Working Group 1 on Standards

The Joint Task Group on Mandatory Sprinklers is charged with the responsibility of studying the implications of mandating the installation of automatic sprinkler systems in houses, where houses are defined to include single family dwellings, attached and semi-detached dwellings, row houses, duplexes and triplexes.

The National Fire Protection Association (NFPA) has long been recognized in North America as a fire protection standards writing authority. Use of NFPA standards as referenced by the National Building Code of Canada is a long standing practice and one that should continue particularly with reference to sprinkler design and installation standards.

Standard for the Installation of Sprinkler Systems, NFPA No. 13-1989.

The foreword to NFPA No. 13 includes the following statement: "NFPA 13, Standard for the Installation of sprinkler Systems, is the oldest standard published by the National Fire Protection Association and, in some ways, predates the Association itself. The first edition of the sprinkler standard was published in 1896, the year in which the National Fire Protection Association was organized. The purpose of this standard is to provide a reasonable degree of protection for life and property from fire through standardized installation requirements for sprinkler systems based upon sound engineering principles, test data, and field **experience.**"

Standard for the *Installation* of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes, NFPA No.13D-1989.

Publication of a report entitled "America Burning" caused the formation in 1973 of the NFPA **Sprinkler Subcommittee on Residential and Light Hazard Occupancies**. The subcommittee was charged with developing a standard that would produce a reliable but **inexpensive sprinkler system** for these occupancies, where the majority of fire deaths were and are occurring. The basic philosophies for residential systems are:

- Cost was of major importance. **A system having slightly less** reliability and fewer operational features than described in NFPA 13 but which could be installed at a substantially lower cost was necessary if acceptance of a **residential system was to be achieved.**
- Life safety would be a primary goal of NFPA 13D, with property protection a secondary goal.
- System design should be such that a fire could be controlled for sufficient time to enable people to escape.
- Piping arrangements, components, and hangers must be compatible with residential construction techniques.

- The fire record could reasonably serve as a baseline to permit omission of sprinklers in areas of low incident of fire deaths - thus saving cost.

The first draft document produced by the subcommittee actually encompassed residential systems for one-and two-family dwellings, mobile homes, and multifamily housing up to four stories in height. However, when finally adopted in 1975, the multifamily housing portions had been eliminated because of strong feelings that such systems needed to be designed in accordance with NFPA 13. The need for an installation standard covering these low rise residential occupancies was evident and NFPA 13R was developed.

Standard for the Installation of Sprinkler Systems in Residential Occupancies up to Four Stories in Height, NFPA No. 13R-1989.

The first edition of this standard appeared in 1989 in which residential occupancies are defined as:

- 1) Apartment buildings
- 2) Lodging and rooming houses
- 3) Board and care facilities (slow evacuation type with 16 or less occupants and prompt evacuation type)
- 4) Hotels, motels, and dormitories

Under the Joint **Task Group terms of reference** NFPA 13R would therefore apply to row houses and triplexes.

General Analysis

The items of reference include mandating the installation of automatic **sprinkler systems in houses, where houses are defined to include:**

- | | |
|--------------------------------------|---------------|
| • single family dwellings | NFPA 13D-1989 |
| • attached & semi-detached dwellings | NFPA 13D-1989 |
| • row houses | NFPA 13R-1989 |
| • duplexes | NFPA 13D-1989 |
| • triplexes | NFPA 13R-1989 |

These items are not code defined and are not consistent with the terminology used in NFPA 13D and NFPA 13R

It is suggested that the terms of reference be restated to read One and Two Family Dwellings defined as follows:

Dwelling:

Any building which contains not more than one or two "dwelling units" intended to be used, rented, leased, let or hired out to be occupied, or which are occupied for habitation purposes.

Dwelling Unit:

One or more rooms arranged for the use of one or more individuals living together as in a single housekeeping unit, normally having cooking, living, sanitary, and sleeping facilities.

Since NFPA 13D clearly restricts its application to one and two family dwellings, inclusion of these definitions would create uniformity between the Code and the referenced standard. Currently in the NBC, if the one and two family dwellings are separated from each other by masonry firewalls having a 2 hr fire-resistance rating, the units may be considered as separate buildings. In these instances NFPA 13D could be applied separately to each building.

Row houses and triplexes (containing more *than* two dwelling units) would therefore be required to be sprinklered in accordance with NFPA 13R.

STANDARDS COMPARISON

GENERAL INFORMATION:		
	N.F.P.A. 13D	N.F.P.A. 13R
Scope:	(1.1) One & two family dwellings and mobile homes	(1.1) Residential up to 4 stories
Purpose:	(1.2) To prevent flashover	(1.2) To prevent flashover
Acceptance Tests:	(1.5) At normal operating pressure	(2.1) At 345 kPa above system design pressure.
Fire department pumper connections:	(1.5) Not required Note: If fire department provided system must be NFPA 13.	(2.4) May be required pumper connection is hydrostatically tested to NFPA 13.
WATER SUPPLY:		
Duration:	(2.1) 10 min.	(2.3.1) 30 min.
Water Supply Sources:	(2.2)	(2.3.2)
	a) City main	a) City main (+ pump if necessary)
	b) Elevated tank	b) Elevated tank
	c) Pressure tank (NFPA 22)	c) Pressure tank (NFPA 22)
	d) Storage tank + pump (NFPA 20)	d) Storage + pump (NFPA 20)

	N.F.P.A. 13D	N.F.P.A. 13R
Multi-Purpose Piping Systems:	(2.3) a) Plus 5 g.p.m. b) Smoke detection required c) <u>if permitted</u> by A.H.J.	(2.3.3.) Domestic and sprinkler flow to be added together
SYSTEM COMPONENTS		
Valves	(3.1) Single control valve for both domestic and sprinkler systems	(2.4.1) Single control valve for both domestic and sprinkler systems and separate control valve for domestic system.
Gauges	(3.2.1) dry system (air) - water supply tanks (air)	(2.4.3) Supply and System Side
Piping	(3.3) Per table or listed (<u>Min. 175 p.s.i.</u>)	(1-5) Per table or listed (<u>Min. 175 p.s.i.</u>)
Piping Supports	(3.4.1)-To local Plumbing Code or per pipe listing	(2.4.4) As per NFPA 13
Sprinklers	(3.5) Only listed Residential sprinklers <u>Note</u> -Presently there are no residential sprinklers listed for use on dry systems. (4.3.2.) Dry type standard sprinklers permitted in unheated areas not intended for living purposes	(2.4.5.1) Listed residential sprinklers inside dwelling (2.4.5.6) Standard sprinklers outside dwelling units.
Painting	(3.5.6.1) Sprinklers may not be painted except by original manufacturer	(2.4.5.9.1) Sprinklers may not be painted except by original manf.
Alarms	(3.6) Local waterflow (Not required if provided with smoke alarms to NFPA 74)	(2.4.6) Local & connected to building fire alarm system. (If fire alarm system required)
SYSTEM DESIGN		
Design Criteria	(4.1) maximum 2 head <u>design</u>	(2.5.1.1) maximum 4 head <u>design</u>
Position of Sprinklers	(4.2.1) As per <u>manufacturer listing</u>	(2.5.1.7.1) As per <u>manufacturer listing</u>

	N.F.P.A. 13D	N.F.P.A. 13R
System Types	(4.3.1) Wet pipe (4.3.2) Dry pipe (4.3.3.) Anti-freeze	(1.6.1) Wet pipe (1.6.2) Dry and anti-freeze
Pipe Sizing	(4.4.1) As per design criteria (4.4.2.1) Min 3/4" (1" steel)	(2.5.3) As per NFPA 13
Piping Configuration	(4.5) May be looped, gridded, straight runs, or combinations thereof	As per NFPA 13
Location of Sprinklers	(4.6) All areas with 5 exceptions:- small bathrooms, small closets, carports, garages, attics, entrance foyers	(2.6) All areas with 4 exceptions:- small bathrooms, small closets, carports, garages, attics. Foyers not waived.
Maintenance	Not detailed (Should be addressed by the National Fire Code)	(2.7) Owner is responsible to keep system in good working order.

Recommendations

1. Recommend that sprinkler installation standards be those published by the National Fire Protection Association (NFPA No. 13, 13D or 13R as applicable).
2. Recommend that Part 9 include specific reference to NFPA No. 13, 13D and 13R.
3. Recommend that unprotected openings be doubled when the building is sprinklered in accordance with NFPA No. 13, 13D or 13R
4. Recommend that where sprinkler protection is used to permit the doubling of unprotected openings, all rooms with unprotected openings adjacent to the exposing building face be sprinklered.
5. Recommend that the use of a single rubber faced check valve installed in accordance with NFPA No. 13D or 13R be acceptable to separate the sprinkler system from the domestic water system for sprinkler systems using copper or plastic pipe.

6. Recommend that the following standards are appropriate for use in the design and installation of sprinkler systems for the following buildings contained in the joint Task Group Terms of Reference:

• <u>Single Family Dwellings,</u>	NFPA No. 13D-1989
• <u>Attached or Semi-detached Buildings</u>	NFPA No. 13D-1989
• <u>Rowhouses *</u>	NFPA No. 13R-1989
• <u>Duplexes</u>	NFPA No. 13D-1989
• <u>Triplexes</u>	NFPA No. 13R-1989

* Where each building unit is separated from adjacent units by at least a 1 h fire separation extending from the basement to the underside of the roof, NFPA No. 13D may be used.

7. Recommend that the terms "dwelling, dwelling unit, attached or semi-detached, rowhouse, duplex and triplex" be defined. The definitions for dwelling and dwelling unit should be coordinated with the definitions appearing in NFPA No. 13D and 13R.

**Report of Working Group 2
on Life Safety**

A. Analyze the Potential Impact on Life Safety of the Mandatory Sprinkler Installation of Sprinklers in one and two Family Dwellings

To begin to answer this concern, it would be difficult to consider how the Canadian record with regard to fire loss could be much worse.

Canada and the United States of America have taken turns over the last 35 years of sharing the worst fire loss record on a per capita basis for seventeen industrialized nations. Canada has twice the rate of Britain and 3 times the rate of the Netherlands.

After experiencing a substantial decrease in the number of fire deaths with the introduction of mandatory smoke detectors, the Canadian statistics have started to level off with no reduction in the last year (1987).

The introduction of mandatory sprinklers would obviously add to existing fire safety programs, the introduction of a proven 100 year record of reliability (97%-NRC) and the fact that there has never been a multiple fire death in a fully sprinklered building (NFPA-FM).

The Working Group considered the following information in addition to the unenviable fire loss stated previously

Projections call for the elderly population to increase from 10% now to 25% by the year 2032, or over a doubling. At present this 10% of the population accounts for 30% of the residential fire deaths, assuming the same proportion of deaths in this group in the future it may account for 75% of the deaths, a substantial increase.

We know that the elderly and the young are statistically at greater risk.

Health care costs are increasing to the point that the removal of the senior from institutions is being pursued and this will mean they will reside longer in older houses.

House ownership is increasing so is our elderly population on a % basis; this will have a future impact.

Urban centers are undergoing larger population increases. (Metro Toronto - 2011 study) shows a 25% increase by year 2011. This will burden fire services, municipalities, etc.

- ' Central Mortgage and Housing Corporation is presently promoting small residential units in backyards for parents; if used these should be sprinklered.

Statistics from fire departments reveal that the introduction of even partially sprinklered communities has a decided impact on the growth of fire service costs, whether they be in City of Quebec as was heard from Chief Chevalier or in Fresno California - a total community where the fire service increased 50% while the city population increased 100%. This represents a net efficiency increase of 100% (i.e.) 6/100,000 of population in 1955 to 3/100,000 in 1985 and an ongoing decrease in fire death statistics.

When you consider that cost of fire service protection for urban locations (over 100,000 population) **is 4 times greater than** for rural fire protection, and that it is expected that 60% of our population will be in urban communities by the year 2000, the introduction of automatic fire sprinklers will obviously decrease fire service costs and increase fire safety.

- B. Examine feedback from communities that already have mandatory automatic sprinklers in 1- and 2- family dwellings.

Because of the very recent introduction of residential type sprinkler *installation* in one and two family dwellings, it is difficult to solely examine areas of mandated use as these at present are limited in number. What is available is an *ongoing* set of statistics supplied by **the United States of America Fire Marshal's Office and Operation Life Safety on areas throughout** the United States of America that have introduced mandatory and voluntary residential sprinkler programs.

The latest report of Operation Life Safety (January 1989) lists 54 fires extinguished by residential sprinklers with a projected saving of 44 lives.

In Cobb County, Georgia, where a pilot project of 40 residential houses was built in consultation with fire officials, building officials and builders totally on a voluntary basis - this number of installation has now grown to over 50,000 **occupancies**.

The number of communities in the United States and Canada which have either introduced or are planning to introduce mandatory or voluntary codes or ordinances has in the last few years grown from a handful to well over 250. In Canada, there has been the enactment of guidelines or mandatory legislation at the municipal level in provinces such as Quebec, Saskatchewan and British Columbia. What is clear from the available information is that wherever residential sprinklering is introduced, after

the initial *learning* curve they have become popular and show considerable growth.

Where mandatory sprinkler legislation was introduced, e.g. Scottsdale, San Clemente, West Mount & Greenburg, all share a common experience.

Proposal started with pressure from fire service and sprinkler industry

Pressure against was from Home Builders Associations

The motivation for city officials was to increase life safety and to slow or decrease fire service costs

After introduction, no significant problem and an appreciable increase to life safety in general.

- C. Analyze available existing statistics on fire deaths and fire losses, e.g. deaths, injury and property loss in one and two family dwellings. Analyze the statistics to indicate where fire deaths are occurring, i.e. in new housing stock or in existing housing stock.

The latest available statistics that can be used to answer this request were the 1987 Labour Canada and **the 1988 Quebec Fire Service statistics.**

1987 National statistics show

439 residential fire deaths - this shows no decrease from previous years. This represents 85% of total fire deaths of which **277 occur in one and two family dwellings.**

Residential fire injuries were 2603 or 68% of total for a 5% increase over the previous year. Note: 1307 of these injuries were in one and two family dwellings.

Residential fire losses equal 40% of total fire loss dollars. \$255,000,000 of **the total \$400,000,000 residential loss occurs in one and two family dwellings.**

The 1988 Quebec statistics which **give a breakdown** by age of house show the following

76% of total fires were residential

75% of those residential fires were in one and two family dwellings

62% of the deaths were residential

63% of the total dollar damage was residential.

One and two family dwellings are the most vulnerable to amount of fire damage. 1983 to 1987 Province of Quebec statistics show that

Building Type	%Loss of Property Value
Assembly	3.2
Storage	8.5
Institution	0.4
Residential (1 and 2 family)	16.4
Other residential	5.1
Business	10.2
Mercantile	3.6
Industrial	3.6
Average value	5.1

By age of building

Age in years	% of fires	% of deaths	deaths per 100 fires
0-5	7	3.4	1.0
5-10	5	8.1	1.1
11-20	27	19.0	1.5
21-30	18	15.0	1.7
31-50	17	24.0	3.0
over 50	12	27.0	4.6

These statistics are similar to those in other publications i.e. 75% to 80% in houses over 20 years.

Both Ontario and Quebec have tracked residential death statistics in dwellings with smoke alarms between 1982 to 1988. Quebec reported 56 deaths while Ontario had 88 between 1983 to 1988. This would indicate an *ongoing* problem of **maintenance with regard to smoke alarms. This is similar to United States of America numbers that indicate between 45 to 60% of smoke alarms are inoperative during inspections.**

However, it should be noted that fire statistics also indicate that the age of the house and its relationship to fire do not change when smoke alarms are added.

Report of Working Group 3 on Cost Aspects

Following a review of the information provided to the joint Task Group, Working Group 3 prepared the following statistics related to Cost Aspects Associated with the Installation of Sprinkler Systems in Houses.

Costing

Average cost of installing a pvc sprinkler system
within a typical 140 m² house

□3000.00 or □21.00 per m²

60-70□ increase for copper

Costs associated with increased servicing from city mains (urban areas)

□730.00 for a 38 mm service or □1214 for a 50 mm service

No pricing available for a 32 mm service

Costs Associated with increased servicing for rural areas □Storage tank and pump

□2,000.00

Associated costs (i.e. Real estate fees, builders' profits, land transfer tax, etc.)

Urban □750.00

Rural □1,250.00

Maintenance Costs Annually □70.00

(Service check assuming no part replacements) - The Working Group recommends mandating an annual inspection of the sprinkler system

Cost Associated with financing a sprinkler system of □3,000.00 (urban) at 12□ for 30 years □8,000.00

Cost Associated with financing a sprinkler system of □5,000.00 (Rural) at 12□ for 30 years □13,000

Note: * The members of the Working Group consider that these figures might be reduced as much as 50□ once the industry becomes experienced in installing systems and the number of installation companies increase.

Experienced US cities show an average cost for the same house in Canadian dollars to be □1,800.00.

General Recommendations

1. Cost associated with mandating annual inspections should be borne by the municipality.
2. Tax incentives should be offered to individuals who install sprinkler systems equivalent to the cost of the system, e.g. \$3000.00 of assessed value.

Report of Working Group 4 on Alternative Measures

Advantages	Disadvantages
Portable Hand-Held Extinguishers \$20 to \$120 <ul style="list-style-type: none"> • Readily available • Efficient when used by a trained person 	<ul style="list-style-type: none"> • One time use • User must be trained • Must be readily accessible (in view) • Must correspond to the right class of fire • Must be maintained • Discharge time 8 to 20 sec. • Operation difficult for disabled • Good for small fires only
Dedicated Appliance Extinguishers \$400 to \$500 <ul style="list-style-type: none"> • Automatic operation • Install on kitchen range 	(e.g. Fire Fox) Located in one area only (1 m ²) Maintenance One time use Possibility of re-ignition
Fire Retardant Wood Framing & Sheathing \$200 to 250/MBF <ul style="list-style-type: none"> • Reduces fire spread for a certain time • Augments the collapse time • Increases exposure time of adjoining buildings 	<ul style="list-style-type: none"> • Absorbs moisture - may create corrosion to metal in framing • Augments building cost by 3%
Fire Retardant Paints \$5.50 to \$6.50 per litre more than normal paint <ul style="list-style-type: none"> • Reduces combustibility and surface flame spread (10 to 20 min.) 	<ul style="list-style-type: none"> • Finish not as durable as standard paint • Touching will reduce effectiveness • Cannot be mixed or reduced • Must be applied according to manufacturer's specifications

Advantages	Disadvantages
<p><u>Residential Water Hoses</u></p> <p>\$400</p> <p>Normally accessible to all areas of the house</p> <ul style="list-style-type: none"> • Time of use not limited (City water system) 	<p>e.g Fire Aid)</p> <p>Class "A" fire only</p> <p>Ineffective in area of fire hose</p> <p>User may remain in building to fight fire and thereby delay calling the fire department</p> <p>Must be trained user</p> <p>Operation difficult by the disabled</p> <p>Small fires only</p>
<p><u>Fire Retardant Building and Finishing Materials</u></p> <p>\$12.50 per litre</p> <p>Reduces spread of fire (increases escape time and response time of fire dept.)</p>	<p>Not easily applied in retrofit</p> <p>Cost of repainting may be prohibitive for benefit gained</p> <p>Loses efficiency with time</p> <p>May contain health hazard</p>
<p><u>Noncombustible Insulation Materials</u></p> <p>Cost not determined.</p> <p>Will not contribute to fire spread when exposed</p>	<p>Will not stop or reduce surface fires</p>
<p><u>Steel Stud Construction</u></p> <ul style="list-style-type: none"> • \$0.20 to \$0.50/m² of wall more than wood stud <p>Prevent fire spread over exterior surfaces to upper floors or roof (no openings)</p> <p>Ability to prevent fire by outside exposure</p>	<p>Will not stop surface fire</p> <p>Exposed to fire has no advantage over wood stud</p> <p>Must be covered up</p> <p>More expensive</p> <p>Rarely used in exterior wall because of thermal bridging</p> <p>Not cost effective</p> <p>Installation more difficult, need expansion gap to be fire rated</p>

Advantages	Disadvantages
Containment of Fire Through Design (Automatic Doors, Smaller Rooms)	
Cost not determined	
<ul style="list-style-type: none"> • Stop fire from spreading 	<ul style="list-style-type: none"> • Difficult to maintain integrity • Difficult to pass legislation to implement containment features
Fire Retardant Furnishings	
Cost not determined	
<ul style="list-style-type: none"> • Reduce propagation of fires 	<ul style="list-style-type: none"> • Not readily available in wide choice of fabrics
Smoke Detectors	
\$10 to \$275	
<ul style="list-style-type: none"> • Rapid detection & alarm • Relatively inexpensive • Relatively easy to install and maintain • Statistically effective in reducing fire deaths & fire loss • Interconnected detectors possible 	<ul style="list-style-type: none"> • Can easily be made inoperative • Difficult in remembering to maintain • Efficiency reduced by 40% in 10 years & effective life 20 years • Subject to false alarms if not properly located • Difference in price reflects the quality
Smoke Detector Systems connected to Fire Department,	(e.g. Vigil)
approx. \$450	
<ul style="list-style-type: none"> • Fire Dept. called automatically (1 min.) • Monitors the smoke detector and its equipment • False alarms may be controlled (30 secs) • Has back up power (Battery) • Can monitor automatic sprinkler system • Can monitor a central alarm system • Fire department monitor has details on the building • System may be installed to cover any risk in house 	<ul style="list-style-type: none"> • Must be plugged into the telephone system • Must be installed with hard wiring • Emergency power available for 24 hours only • Smoke detector efficiency same as standard detector

Advantages	Disadvantages
Automatic Sprinkler System (2nd Generation)	e.g. Fire Fox)
Cost not determined	
<ul style="list-style-type: none"> • On-off sprinkler heads • Combined smoke, heat and flame detector 	

Recommendations

- 1) Increase the number of smoke detectors.
- 2) Install residential automatic sprinklers everywhere where there are disabled people and old people.
- 3) Install residential sprinklers in the building mentioned **below in Option 4.**
- 4) Install a smoke alarm system that can be inter-connected, hooked up to the fire department and monitored.
- 5) Install mixed residential sprinkler systems in all houses.

Options

- 1) Increase the number of smoke alarms and have them inter-connected.
Places such as bedrooms and living rooms should be protected by smoke alarms. Price: \$175
- 2) Install sprinklers where disabled people and old people reside.
- 3) Install automatic sprinklers (mixed) as specified in: "Corporation des maitres en tuyauterie du Quebec".
Price: \$900.
- 4) An automatic sprinkler system should be installed in a building situated more than 7.5 kilometres from a fire station and the building is spaced more than 6 metres from the next building.
- 5) An automatic sprinkler system should be installed in a building situated more than 4 kilometres from a fire station and the building is spaced less than 6 metres from the next building.
- 6) All row houses situated more than 3.5 kilometers from a fire station should be sprinklered.

Report of Working Group 5 on Cost Benefit Models

As noted in the minutes of meeting 4, this Working Group reviewed the cost-benefit models in order to recommend which one should be used by the joint Task Group, either as reviewed or with modifications.

There were five models available to the joint Task Group for use in determining the costs or benefits of mandating sprinklers in houses. The models available were:

1. CMHC/Scanada
2. Harmathy
3. NHBA
4. Reugg /Fuller
5. Ontario Ministry of Housing.

Each was reviewed in whole or in part and it was agreed that the CMHC/Scanada model would be the most appropriate for use by the joint Task Group. This decision was based on the following:

1. The model used Canadian information as much as possible.
2. Results are given in both a societal basis as well as on an individual basis.
3. This model was available on computer format, therefore modifications were relatively simple.

The CMHC model is based on the following general formula:

$$ENB = (DI + PL + C + IN + MTS + \mathbf{OB}) - (\mathbf{PI} + \mathbf{OP} + \mathbf{M} + \mathbf{P} + \mathbf{OC})$$

Where ENB = Expected Net Benefit
and Benefits:

DI = reduced risk of death and injury
 PL = reduced risk of direct property loss
 C = cost of temporary shelter
 IN = savings on fire insurance costs
 MTS = reduction in local property taxes
 OB = other benefits

and Costs:

PI = **purchase and installation costs**
 OP = operating costs
 M = maintenance costs
 P = property taxes on value of system
 CC = other costs

The model does not include all the trade-off or costs that might be applicable to sprinklering new houses. For example, savings on insurance costs are assumed to be offset by an increase in property taxes. Also, cost savings for items such as reduced water main sizes, increased densities, building construction trade-offs, etc. are not considered. Such items may have an effect on the results if incorporated into the model, however at this time the benefits or costs of the same are unknown and not easily established.

The model does take into account the reductions in the cost of the fire service. It is assumed that 40% of **the annual cost per house of \$204 is reduced** by sprinklers and 25% of that reduction is passed on to the homeowner.

In studying the model a number of values were found that either did not seem appropriate or did not coincide with the values in the rest of the written report that accompanied the model. Initial modifications to the model were made in order to remove any unknowns. Once it was understood how the model worked and why certain variables or equations were used, the Working Group was then able to generate results.

The model considered can be manipulated to give a variety of results. It was decided that rather than trying to come up with what are assumed 'correct' values for outputs, it would **be more beneficial to determine the upper and lower limits of the costs or benefits. This it was felt would** put the issue of costs or benefits more into perspective. A number of runs were made with the model, changing certain variables to give a number of scenarios. In considering the benefits to be derived, the CMHC run is the most pessimistic and, apart from Run 3, Run 2 is the most optimistic. Run 1 is an optimistic estimate but it does take into consideration that a new house, with smoke alarms and other factors that **would** improve life safety, would be somewhat safer than the present housing stock. Runs 4 and 5 apply to rural applications. The following are the variables to which **the model** is most sensitive:

# deaths	. This is the expected number of deaths per million houses without sprinklers. The CMHC run assumes all are new houses equipped with smoke alarms and these new houses are more fire safe than older houses and that they will remain just as safe for their useful life. Run 2 is equal to the present death rate, all houses included. Runs 1, 4 and 5 consider only new houses but assumes them to be neither as safe as the CMHC run nor as unsafe as the present housing stock.
Deaths reduced	. The per cent expected reduction in deaths if all new houses were sprinklered.
Value of life	† Figures from studies which assign a value to a human life are generally in the range of \$500,000 to \$1,000,000.

- Value of injury † **Figures from studies** which assign a cost resulting from a human injury are generally in the range of \$30,000 to \$60,000.
- Injuries reduced † The per cent expected reduction in injuries if all new houses were sprinklered.
- Property damage † The average cost of property damage per house for new housing stock. This figure was assumed to remain constant regardless of whether or not smoke alarms were present.
- Damage reduced † The per cent expected reduction in damage if all new houses were sprinklered.
- Economic life † The mortgage period. A five year change in this variable only causes a 10% change in the outputs.
- Maintenance cost † The annual cost of inspecting and maintaining the system. For the CMHC run, this cost was assumed to be done by the homeowner, taking one hour of his time which is worth just over \$10. For the other runs this cost was eliminated.

The variable -to which the model is probably the most sensitive is the sprinkler cost. The cost selected for the urban runs 1 and 2 was \$1500.00 and the cost used for the CMHC run was \$3000.00. For urban run 3 a cost of \$1000.00 was assumed for the sprinkler portion of the combined system. For the 2 rural runs, an optimistic cost of \$4000 as well as a more pessimistic cost of \$7000 were chosen.

The results of the various runs are shown in the table below.

SENSITIVE VARIABLES

	CMHC	Urban			Rural	
Run Name		Run 1	Run 2	Run 3	Run 4	Run 5
Variable						
No. deaths (per million houses)	14	24	46	65	24	24
Deaths reduced (per cent)	55	90	90	90	90	90
Value of life (\$1000)	500	1000	1000	1000	1000	1000
Value of injury (\$1000)	30	60	60	60	60	60
Injuries reduced (per cent)	44	90	90	90	90	90
Property damage (\$)	44.8	44.8	44.8	44.8	44.8	44.8
Damage reduced (per cent)	65	80	80	80	80	80
Economic life (years)	30	25	25	30	25	25
Sprinkler Cost (\$)	3000	1500	1500	1000	4000	7000

MODEL RESULTS

	CMHC		Urban		Rural	
Run Name		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

Considering these results, the members of the Working Group considered that, based on current data, mandating the installation of sprinklers in houses can not be justified on an economic basis..

Urban run 3 is based upon trends in statistical material derived from the province of Quebec and presented by M. G. Levasseur for review by Working Group 2 and the joint Task Group. The assumed death rate is considerably higher than the present death rate and the values forecast in the CMHC study. It is based upon trends in aging of the population and the current higher incidence of fatalities among older persons. **It assumes that in the first third of the next century the death rate will have increased from 46 to 65 persons per million houses. The data was input and the run undertaken during the sixth meeting at the request of M. G. Levasseur.** The value of \$1000 for the cost of installing a sprinkler system is based on the assumed additional cost for the sprinkler portion of a combined domestic and sprinkler supply system.

The following 10 pages summarize the input and output used to derive the preceding two tables of values.

Computer Runs 1 to 5

BENEFITS			
REDUCED PROBABILITY OF OCCUPANT DEATH			
NUMBER OF OCCUPANT DEATHS DUE TO FIRE	0.0000240	PER HOUSE	
SPRINKLER REDUCTION	90%	OF DEATHS	
VALUE OF LIFE SAVED	\$1,000,000		
ANNUAL BENEFIT	\$21.600	->	\$21.600
REDUCED PROBABILITY OF FIREFIGHTER DEATH			
NUMBER OF FIREFIGHTER DEATHS DUE TO FIRE	0.0000003	PER HOUSE	
SPRINKLER REDUCTION	90%	OF DEATHS	
VALUE OF LIFE SAVED	\$1,000,000		
ANNUAL BENEFIT	\$0.292	->	\$0.292
REDUCED PROBABILITY OF OCCUPANT INJURY			
NUMBER OF OCCUPANT INJURIES DUE TO FIRE	0.0002000	PER HOUSE	
SPRINKLER REDUCTION	90%	OF INJURIES	
VALUE OF OCCUPANT INJURIES AVOIDED	\$60,000		
ANNUAL BENEFIT	\$10.800	->	\$10.800
REDUCED PROBABILITY OF FIREFIGHTER INJURY			
NUMBER OF FIREFIGHTER INJURIES DUE TO FIRE	0.0000667	PER HOUSE	
SPRINKLER REDUCTION	90%	OF INJURIES	
VALUE OF FIREFIGHTER INJURIES AVOIDED	\$60,000		
ANNUAL BENEFIT	\$3.600	->	\$3.600
REDUCED PROBABILITY OF DIRECT PROPERTY DAMAGE			
AVERAGE LOSS PER HOUSE PER YEAR	\$44.80		
SPRINKLER REDUCTION IN PROPERTY DAMAGE	80%		
ANNUAL BENEFIT	\$35.840	->	\$35.840
REDUCED PROBABILITY OF INDIRECT PROPERTY DAMAGE			
AVERAGE LOSS PER HOUSE PER YEAR	\$2.90		
SPRINKLER REDUCTION IN PROPERTY DAMAGE	80%		
ANNUAL BENEFIT	\$2.320	->	\$2.320
REDUCTION IN HOMEOWNER SHARE OF FIRE PROTECTION			
COST PER RESIDENCE OF LOCAL FIRE SERVICE	\$204.80	PER YEAR	
OVERALL SPRINKLER REDUCTION	40%		
PORTION ACCRUING TO OWNERS OF SPRINKLERED HOMES	25%		
ANNUAL BENEFIT	\$20.480	->	\$20.480
TOTAL ANNUAL BENEFITS			\$94.932

COSTS		
INITIAL COST		
SYSTEM PURCHASE AND INSTALLATION	\$1,500	(1500 S.F.)
ONGOING MAINTENANCE		
"WAGE RATE" FOR OWNER MAINTENANCE	\$10.50	PER HOUR
ANNUAL MAINTENANCE LABOUR REQUIREMENT	0	PER YEAR
ANNUAL MAINTENANCE COST	\$0.000	

ECONOMIC INPUTS		
NOMINAL DISCOUNT RATE	14.4%	
INFLATION RATE	4.0%	
EFFECTIVE DISCOUNT RATE	10.00%	
STUDY PERIOD FOR PRESENT VALUE ANALYSIS	25	YEARS
PRESENT WORTH FACTOR	9.08	

PRESENT VALUE ANALYSIS		
TOTAL ANNUAL BENEFITS	\$94.932	
PRESENT WORTH FACTOR	9.08	
PRESENT WORTH OF BENEFITS	\$862	
SYSTEM PURCHASE AND INSTALLATION		\$1,500
ANNUAL MAINTENANCE COST	\$0.000	
PRESENT WORTH FACTOR	9.08	
PRESENT WORTH OF MAINTENANCE COSTS	\$0	\$0
PRESENT WORTH OF COSTS		\$1,500
PRESENT WORTH OF BENEFITS	\$862	
PRESENT WORTH OF COSTS	\$1,500	
NET LIFE-CYCLE BENEFIT OF SPRINKLERS		(\$638)

COST OF SAVING A LIFE BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$1,500
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$165.252
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED RISK OF OCCUPANT AND FIRE FIGHTER DEATHS	<u>\$73.040</u>
NET ANNUAL COST	<u>\$92.212 PER HOUSE</u>
	OR
	\$9,221,210.829 PER 100,000 HOUSES
 NUMBER OF OCCUPANT DEATHS DUE TO FIRE	0.0000240 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF OCCUPANT LIVES SAVED PER YEAR	0.00002160 PER HOUSE
	OR
	2.160 PER 100,000 HOUSES
 NUMBER OF FIREFIGHTER DEATHS DUE TO FIRE	0.0000003 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF FIREFIGHTER LIVES SAVED PER YEAR	0.00000029
	OR
	0.029 PER 100,000 HOUSES
 NET COST TO SOCIETY PER LIFE SAVED	\$4,212,158

COST OF PREVENTING PROPERTY DAMAGE BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$1,500
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$165.252
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED DIRECT AND INDIRECT PROPERTY DAMAGE	<u>\$56.772</u>
NET ANNUAL COST	<u>\$108.480 PER HOUSE</u>
	OR
	\$10,848,021.639 PER 100,000 HOUSES
 TOTAL DIRECT & INDIRECT PROPERTY DAMAGE	47.7000000 PER HOUSE
SPRINKLER REDUCTION	80% OF DEATHS
REDUCTION IN PROPERTY DAMAGE PER YEAR	\$38.1600000 PER HOUSE
	OR
	\$3,816,000.00 PER 100,000 HOUSES
 NET COST TO SOCIETY FOR PROPERTY DAMAGE PREVENTED	\$3 /DOLLAR

COST OF PREVENTING AN INJURY BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$1,500
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$165.252
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED RISK OF OCCUPANT AND FIRE FIGHTER INJURIES	<u>\$80.532</u>
NET ANNUAL COST	<u>\$84.720 PER HOUSE</u>
	OR
	\$8,472,021.639 PER 100,000 HOUSES
 NUMBER OF OCCUPANT INJURIES DUE TO FIRE	0.0002000 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF OCCUPANT LIVES SAVED PER YEAR	0.00018000 PER HOUSE
	OR
	18.000 PER 100,000 HOUSES
 NUMBER OF FIREFIGHTER INJURIES DUE TO FIRE	0.0000667 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF FIREFIGHTER LIVES SAVED PER YEAR	0.00006000
	OR
	6.000 PER 100,000 HOUSES
 NET COST TO SOCIETY PER INJURY PREVENTED	\$353,881

BENEFITS			
REDUCED PROBABILITY OF OCCUPANT DEATH			
NUMBER OF OCCUPANT DEATHS DUE TO FIRE	0.0000460	PER HOUSE	
SPRINKLER REDUCTION	90%	OF DEATHS	
VALUE OF LIFE SAVED	\$1,000,000		
ANNUAL BENEFIT	\$41.400	->	\$41.400
REDUCED PROBABILITY OF FIREFIGHTER DEATH			
NUMBER OF FIREFIGHTER DEATHS DUE TO FIRE	0.0000006	PER HOUSE	
SPRINKLER REDUCTION	90%	OF DEATHS	
VALUE OF LIFE SAVED	\$1,000,000		
ANNUAL BENEFIT	\$0.559	->	\$0.559
REDUCED PROBABILITY OF OCCUPANT INJURY			
NUMBER OF OCCUPANT INJURIES DUE TO FIRE	0.0002000	PER HOUSE	
SPRINKLER REDUCTION	90%	OF INJURIES	
VALUE OF OCCUPANT INJURIES AVOIDED	\$60,000		
ANNUAL BENEFIT	\$10.800	->	\$10.800
REDUCED PROBABILITY OF FIREFIGHTER INJURY			
NUMBER OF FIREFIGHTER INJURIES DUE TO FIRE	0.0000667	PER HOUSE	
SPRINKLER REDUCTION	90%	OF INJURIES	
VALUE OF FIREFIGHTER INJURIES AVOIDED	\$60,000		
ANNUAL BENEFIT	\$3.600	->	\$3.600
REDUCED PROBABILITY OF DIRECT PROPERTY DAMAGE			
AVERAGE LOSS PER HOUSE PER YEAR	\$44.80		
SPRINKLER REDUCTION IN PROPERTY DAMAGE	80%		
ANNUAL BENEFIT	\$35.840	->	\$35.840
REDUCED PROBABILITY OF INDIRECT PROPERTY DAMAGE			
AVERAGE LOSS PER HOUSE PER YEAR	\$2.90		
SPRINKLER REDUCTION IN PROPERTY DAMAGE	80%		
ANNUAL BENEFIT	\$2.320	->	\$2.320
REDUCTION IN HOMEOWNER SHARE OF FIRE PROTECTION			
COST PER RESIDENCE OF LOCAL FIRE SERVICE	\$204.80	PER YEAR	
OVERALL SPRINKLER REDUCTION	40%		
PORTION ACCRUING TO OWNERS OF SPRINKLERED HOMES	25%		
ANNUAL BENEFIT	\$20.480	->	\$20.480
TOTAL ANNUAL BENEFITS			\$114.999

COSTS		
INITIAL COST		
SYSTEM PURCHASE AND INSTALLATION	\$1,500	(1500 S.F.)
ONGOING MAINTENANCE		
"WAGE RATE" FOR OWNER MAINTENANCE	\$10.58	PER HOUR
ANNUAL MAINTENANCE LABOUR REQUIREMENT	0	PER YEAR
ANNUAL MAINTENANCE COST	\$0.000	

ECONOMIC INPUTS	
NOMINAL DISCOUNT RATE	14.4%
INFLATION RATE	4.0%
EFFECTIVE DISCOUNT RATE	10.00%
STUDY PERIOD FOR PRESENT VALUE ANALYSIS	25 YEARS
PRESENT WORTH FACTOR	9.08

PRESENT VALUE ANALYSIS		
TOTAL ANNUAL BENEFITS	\$114.999	
PRESENT WORTH FACTOR	9.08	
PRESENT WORTH OF BENEFITS	\$1,044	
SYSTEM PURCHASE AND INSTALLATION		\$1,500
ANNUAL MAINTENANCE COST	\$0.000	
PRESENT WORTH FACTOR	9.08	
PRESENT WORTH OF MAINTENANCE COSTS	\$0	\$0
PRESENT WORTH OF COSTS		\$1,500
PRESENT WORTH OF BENEFITS	\$1,044	
PRESENT WORTH OF COSTS	\$1,500	
NET LIFE-CYCLE BENEFIT OF SPRINKLERS		(\$456)

COST OF SAVING A LIFE BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$1,500
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$165.252
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED RISK OF OCCUPANT AND FIRE FIGHTER DEATHS	<u>\$73.040</u>
NET ANNUAL COST	<u>\$92.212 PER HOUSE</u>
	OR
	\$9,221,210.829 PER 100,000 HOUSES
NUMBER OF OCCUPANT DEATHS DUE TO FIRE	0.0000460 PERHOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF OCCUPANT LIVES SAVED PER YEAR	0.00004140 PERHOUSE
	OR
	4.140 PER 100,000 HOUSES
NUMBER OF FIREFIGHTER DEATHS DUE TO FIRE	0.0000006 PERHOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF FIREFIGHTER LIVES SAVED PER YEAR	0.00000056
	OR
	0.056 PER 100,000 HOUSES
NET COST TO SOCIETY PER LIFE SAVED	\$2,187,848

COST OF PREVENTING PROPERTY DAMAGE BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$1,500
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$165.252
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED DIRECT AND INDIRECT PROPERTY DAMAGE	<u>\$78.839</u>
NET ANNUAL COST	<u>\$88.413 PERHOUSE</u>
	OR
	\$8,841,264.883 PER 100,000 HOUSES
TOTAL DIRECT & INDIRECT PROPERTY DAMAGE	47.7000000 PERHOUSE
SPRINKLER REDUCTION	80% OF DEATHS
REDUCTION IN PROPERTY DAMAGE PER YEAR	\$38.1600000 PERHOUSE
	OR
	\$3,816,000.00 PER 100,000 HOUSES
NET COST TO SOCIETY FOR PROPERTY DAMAGE PREVENTED	\$2 /DOLLAR

COST OF PREVENTING AN INJURY BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$1,500
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$165.252
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED RISK OF OCCUPANT AND FIRE FIGHTER INJURIES	<u>\$100.599</u>
NET ANNUAL COST	<u>\$64.653 PERHOUSE</u>
	OR
	\$6,465,264.883 PER 100,000 HOUSES
NUMBER OF OCCUPANT INJURIES DUE TO FIRE	0.0002000 PERHOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF OCCUPANT LIVES SAVED PER YEAR	0.00018000 PERHOUSE
	OR
	18.000 PER 100,000 HOUSES
NUMBER OF FIREFIGHTER INJURIES DUE TO FIRE	0.0000667 PERHOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF FIREFIGHTER LIVES SAVED PER YEAR	0.00006000
	OR
	6.000 PER 100,000 HOUSES
NET COST TO SOCIETY PER INJURY PREVENTED	\$268,388

HOUSE TYPE: SINGLE-FAMILY HOME COMPLYING WITH NBC 113 (Inc. wired-In smoke detectors)

BENEFITS				
REDUCED PROBABILITY OF OCCUPANT DEATH				
NUMBER OF OCCUPANT DEATHS DUE TO FIRE	0.0000650	PER HOUSE		
SPRINKLER REDUCTION	90%	OF DEATHS		
VALUE OF LIFE SAVED	\$1,000,000			
ANNUAL BENEFIT	\$58,500	->		\$58,500
REDUCED PROBABILITY OF FIREFIGHTER DEATH				
NUMBER OF FIREFIGHTER DEATHS DUE TO FIRE	0.0000009	PER HOUSE		
SPRINKLER REDUCTION	90%	OF DEATHS		
VALUE OF LIFE SAVED	\$1,000,000			
ANNUAL BENEFIT	\$0.791	->		\$0.791
REDUCED PROBABILITY OF OCCUPANT INJURY				
NUMBER OF OCCUPANT INJURIES DUE TO FIRE	0.0002000	PER HOUSE		
SPRINKLER REDUCTION	90%	OF INJURIES		
VALUE OF OCCUPANT INJURIES AVOIDED	\$80,000			
ANNUAL BENEFIT	\$18,000	->		\$18,000
REDUCED PROBABILITY OF FIREFIGHTER INJURY				
NUMBER OF FIREFIGHTER INJURIES DUE TO FIRE	0.0000667	PER HOUSE		
SPRINKLER REDUCTION	90%	OF INJURIES		
VALUE OF FIREFIGHTER INJURIES AVOIDED	\$80,000			
ANNUAL BENEFIT	\$3,600	->		\$3,600
REDUCED PROBABILITY OF DIRECT PROPERTY DAMAGE				
AVERAGE LOSS PER HOUSE PER YEAR	\$44.80			
SPRINKLER REDUCTION IN PROPERTY DAMAGE	80%			
ANNUAL BENEFIT	\$35,840	->		\$35,840
REDUCED PROBABILITY OF INDIRECT PROPERTY DAMAGE				
AVERAGE LOSS PER HOUSE PER YEAR	\$2.90			
SPRINKLER REDUCTION IN PROPERTY DAMAGE	85%			
ANNUAL BENEFIT	\$1,885	->		\$1,885
REDUCTION IN HOMEOWNER SHARE OF FIRE PROTECTION				
ANNUAL BENEFIT	\$90,000			
		->		\$90,000
REDUCTION IN ANNUAL INSURANCE PREMIUM				
ANNUAL BENEFIT	\$38,000	->		\$38,000
TOTAL ANNUAL BENEFITS				\$239,416

COSTS		
INITIAL COST		
SYSTEM PURCHASE AND INSTALLATION	\$1,000	(1500 S.F.)
ONGOING MAINTENANCE		
"WAGE RATE" FOR OWNER MAINTENANCE	\$10.58	PER HOUR
ANNUAL MAINTENANCE LABOUR REQUIREMENT	0	PER YEAR
ANNUAL MAINTENANCE COST	\$0.000	

ECONOMIC INPUTS		
NOMINAL DISCOUNT RATE	14.4%	
INFLATION RATE	4.0%	
EFFECTIVE DISCOUNT RATE	10.00%	
STUDY PERIOD FOR PRESENT VALUE ANALYSIS	30	YEARS
PRESENT WORTH FACTOR	9.43	

PRESENT VALUE ANALYSIS		
TOTAL ANNUAL BENEFITS	\$239,416	
PRESENT WORTH FACTOR	9.43	
PRESENT WORTH OF BENEFITS	\$2,257	
SYSTEM PURCHASE AND INSTALLATION		\$1,000
ANNUAL MAINTENANCE COST	\$0.000	
PRESENT WORTH FACTOR	9.43	
PRESENT WORTH OF MAINTENANCE COSTS	\$0	\$0
PRESENT WORTH OF COSTS		\$1,000
PRESENT WORTH OF BENEFITS	\$2,257	
PRESENT WORTH OF COSTS	\$1,000	
NET LIFE-CYCLE BENEFIT OF SPRINKLERS		\$1,257

NOTE

- Figures in boxes are user inputs.
- Figures in italics are model outputs

22-Jan-90

COST OF SAVING A LIFE BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$1,000
PRESENT WORTH FACTOR	9.43
EQUIVALENT ANNUAL COST	\$106.079
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED RISK OF OCCUPANT AND FIRE FIGHTER DEATHS	<u>\$180.125</u>
NET ANNUAL COST	(\$74.05) PER HOUSE
	OR
	(\$7,404,575.17) PER 100,000 HOUSES
NUMBER OF OCCUPANT DEATHS DUE TO FIRE	0.0000650 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF OCCUPANT LIVES SAVED PER YEAR	0.00005850 PER HOUSE
	OR
	5.850 PER 100,000 HOUSES
NUMBER OF FIREFIGHTER DEATHS DUE TO FIRE	0.0000009 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF FIREFIGHTER LIVES SAVED PER YEAR	0.00000079
	OR
	0.079 PER 100,000 HOUSES
NET COST TO SOCIETY PER LIFE SAVED	(\$1,248,863)

COST OF PREVENTING AN INJURY BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$1,000
PRESENT WORTH FACTOR	9.43
EQUIVALENT ANNUAL COST	\$106.079
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED RISK OF OCCUPANT AND FIRE FIGHTER INJURIES	<u>\$225.018</u>
NET ANNUAL COST	(\$118.94) PER HOUSE
	OR
	(\$11,893,829.23) PER 100,000 HOUSES
NUMBER OF OCCUPANT INJURIES DUE TO FIRE	0.0002000 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF OCCUPANT LIVES SAVED PER YEAR	0.00018000 PER HOUSE
	OR
	18.000 PER 100,000 HOUSES
NUMBER OF FIREFIGHTER INJURIES DUE TO FIRE	0.0000667 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF FIREFIGHTER LIVES SAVED PER YEAR	0.00006000
	OR
	6.000 PER 100,000 HOUSES
NET COST TO SOCIETY PER INJURY PREVENTED	(\$485,568)

COST OF PREVENTING PROPERTY DAMAGE BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$1,000
PRESENT WORTH FACTOR	9.43
EQUIVALENT ANNUAL COST	\$106.079
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED DIRECT AND INDIRECT PROPERTY DAMAGE	<u>\$201.691</u>
NET ANNUAL COST	(\$95.61) PER HOUSE
	OR
	(\$9,561,129.23) PER 100,000 HOUSES
TOTAL DIRECT & INDIRECT PROPERTY DAMAGE	47.7000000 PER HOUSE
SPRINKLER REDUCTION	80% OF DEATHS
REDUCTION IN PROPERTY DAMAGE PER YEAR	\$38.1600000 PER HOUSE
	OR
	\$3,816,000.00 PER 100,000 HOUSES
NET COST TO SOCIETY FOR PROPERTY DAMAGE PREVENTED	(\$3) /DOLLAR

BENEFITS**REDUCED PROBABILITY OF OCCUPANT DEATH**

NUMBER OF OCCUPANT DEATHS DUE TO FIRE	0.0000240	PER HOUSE
SPRINKLER REDUCTION	90%	OF DEATHS
VALUE OF LIFE SAVED	\$1,000,000	
ANNUAL BENEFIT	\$21.600	-> \$21.600

REDUCED PROBABILITY OF FIREFIGHTER DEATH

NUMBER OF FIREFIGHTER DEATHS DUE TO FIRE	0.0000003	PER HOUSE
SPRINKLER REDUCTION	90%	OF DEATHS
VALUE OF LIFE SAVED	\$1,000,000	
ANNUAL BENEFIT	\$0.292	-> \$0.292

REDUCED PROBABILITY OF OCCUPANT INJURY

NUMBER OF OCCUPANT INJURIES DUE TO FIRE	0.0002000	PER HOUSE
SPRINKLER REDUCTION	90%	OF INJURIES
VALUE OF OCCUPANT INJURIES AVOIDED	\$60,000	
ANNUAL BENEFIT	\$10.800	-> \$10.800

REDUCED PROBABILITY OF FIREFIGHTER INJURY

NUMBER OF FIREFIGHTER INJURIES DUE TO FIRE	0.0000667	PER HOUSE
SPRINKLER REDUCTION	90%	OF INJURIES
VALUE OF FIREFIGHTER INJURIES AVOIDED	\$60,000	
ANNUAL BENEFIT	\$3.600	-> \$3.600

REDUCED PROBABILITY OF DIRECT PROPERTY DAMAGE

AVERAGE LOSS PER HOUSE PER YEAR	\$44.80	
SPRINKLER REDUCTION IN PROPERTY DAMAGE	80%	
ANNUAL BENEFIT	\$35.840	-> \$35.840

REDUCED PROBABILITY OF INDIRECT PROPERTY DAMAGE

AVERAGE LOSS PER HOUSE PER YEAR	\$2.90	
SPRINKLER REDUCTION IN PROPERTY DAMAGE	80%	
ANNUAL BENEFIT	\$2.320	-> \$2.320

REDUCTION IN HOMEOWNER SHARE OF FIRE PROTECTION

COST PER RESIDENCE OF LOCAL FIRE SERVICE	\$204.80	PER YEAR
OVERALL SPRINKLER REDUCTION	40%	
PORTION ACCRUING TO OWNERS OF SPRINKLERED HOMES	25%	
ANNUAL BENEFIT	\$20.480	-> \$20.480

TOTAL ANNUAL BENEFITS**\$94.932****COSTS****INITIAL COST**SYSTEM PURCHASE AND INSTALLATION **\$4,000** (1500 S.F.)**ONGOING MAINTENANCE**"WAGE RATE" FOR OWNER MAINTENANCE **\$10.58** PER HOURANNUAL MAINTENANCE LABOUR REQUIREMENT **1** PER YEARANNUAL MAINTENANCE COST **\$10.580****ECONOMIC INPUTS**NOMINAL DISCOUNT RATE **14.4%**INFLATION RATE **4.0%**EFFECTIVE DISCOUNT RATE **10.00%**STUDY PERIOD FOR PRESENT VALUE ANALYSIS **25** YEARSPRESENT WORTH FACTOR **9.08****PRESENT VALUE ANALYSIS**

TOTAL ANNUAL BENEFITS	\$94.932	
PRESENT WORTH FACTOR	9.08	
PRESENT WORTH OF BENEFITS	\$862	
SYSTEM PURCHASE AND INSTALLATION		\$4,000
ANNUAL MAINTENANCE COST	\$10.580	
PRESENT WORTH FACTOR	9.08	
PRESENT WORTH OF MAINTENANCE COSTS	\$96	\$96
PRESENT WORTH OF COSTS		\$4,096
PRESENT WORTH OF BENEFITS	\$862	
PRESENT WORTH OF COSTS	\$4,096	

NET LIFE-CYCLE BENEFIT OF SPRINKLERS (\$3,234)

COST OF SAVING A LIFE BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$4,098
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$451.252
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED RISK OF OCCUPANT AND FIRE FIGHTER DEATHS	<u>\$73,040</u>
NET ANNUAL COST	<u>\$378,212 PER HOUSE</u>
	OR
	\$37,821,228.876 PER 100,000 HOUSES
NUMBER OF OCCUPANT DEATHS DUE TO FIRE	0.0000240 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF OCCUPANT LIVES SAVED PER YEAR	0.00002160 PER HOUSE
	OR
	2.160 PER 100,000 HOUSES
NUMBER OF FIREFIGHTER DEATHS DUE TO FIRE	0.0000003 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF FIREFIGHTER LIVES SAVED PER YEAR	0.00000029
	OR
	0.029 PER 100,000 HOUSES
NET COST TO SOCIETY PER LIFE SAVED	\$17,278,364

COST OF PREVENTING PROPERTY DAMAGE BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$4,098
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$451.252
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED DIRECT AND INDIRECT PROPERTY DAMAGE	<u>\$58,772</u>
NET ANNUAL COST	<u>\$394,480 PER HOUSE</u>
	OR
	\$39,448,039.687 PER 100,000 HOUSES
TOTAL DIRECT & INDIRECT PROPERTY DAMAGE	47.7000000 PER HOUSE
SPRINKLER REDUCTION	80% OF DEATHS
REDUCTION IN PROPERTY DAMAGE PER YEAR	\$38.1600000 PER HOUSE
	OR
	\$3,816,000.00 PER 100,000 HOUSES
NET COST TO SOCIETY FOR PROPERTY DAMAGE PREVENTED	\$10 /DOLLAR

COST OF PREVENTING AN INJURY BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$4,098
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$451.252
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED RISK OF OCCUPANT AND FIRE FIGHTER INJURIES	<u>\$90,532</u>
NET ANNUAL COST	<u>\$370,720 PER HOUSE</u>
	OR
	\$37,072,039.687 PER 100,000 HOUSES
NUMBER OF OCCUPANT INJURIES DUE TO FIRE	0.0002000 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF OCCUPANT LIVES SAVED PER YEAR	0.00018000 PER HOUSE
	OR
	18.000 PER 100,000 HOUSES
NUMBER OF FIREFIGHTER INJURIES DUE TO FIRE	0.0000667 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF FIREFIGHTER LIVES SAVED PER YEAR	0.00006000
	OR
	6.000 PER 100,000 HOUSES
NET COST TO SOCIETY PER INJURY PREVENTED	\$1,544,668

BENEFITS			
REDUCED PROBABILITY OF OCCUPANT DEATH			
NUMBER OF OCCUPANT DEATHS DUE TO FIRE	0.0000240	PER HOUSE	
SPRINKLER REDUCTION	90%	OF DEATHS	
VALUE OF LIFE SAVED	\$1,000,000		
ANNUAL BENEFIT	\$21.600	->	\$21.600
REDUCED PROBABILITY OF FIREFIGHTER DEATH			
NUMBER OF FIREFIGHTER DEATHS DUE TO FIRE	0.0000003	PER HOUSE	
SPRINKLER REDUCTION	90%	OF DEATHS	
VALUE OF LIFE SAVED	\$1,000,000		
ANNUAL BENEFIT	\$0.292	->	\$0.292
REDUCED PROBABILITY OF OCCUPANT INJURY			
NUMBER OF OCCUPANT INJURIES DUE TO FIRE	0.0002000	PER HOUSE	
SPRINKLER REDUCTION	90%	OF INJURIES	
VALUE OF OCCUPANT INJURIES AVOIDED	\$60,000		
ANNUAL BENEFIT	\$10.800	->	\$10.800
REDUCED PROBABILITY OF FIREFIGHTER INJURY			
NUMBER OF FIREFIGHTER INJURIES DUE TO FIRE	0.0000667	PER HOUSE	
SPRINKLER REDUCTION	90%	OF INJURIES	
VALUE OF FIREFIGHTER INJURIES AVOIDED	\$60,000		
ANNUAL BENEFIT	\$3.600	->	\$3.600
REDUCED PROBABILITY OF DIRECT PROPERTY DAMAGE			
AVERAGE LOSS PER HOUSE PER YEAR	\$44.80		
SPRINKLER REDUCTION IN PROPERTY DAMAGE	80%		
ANNUAL BENEFIT	\$35.840	->	\$35.840
REDUCED PROBABILITY OF INDIRECT PROPERTY DAMAGE			
AVERAGE LOSS PER HOUSE PER YEAR	\$2.90		
SPRINKLER REDUCTION IN PROPERTY DAMAGE	80%		
ANNUAL BENEFIT	\$2.320	->	\$2.320
REDUCTION IN HOMEOWNER SHARE OF FIRE PROTECTION			
COST PER RESIDENCE OF LOCAL FIRE SERVICE	\$204.80	PER YEAR	
OVERALL SPRINKLER REDUCTION	40%		
PORTION ACCRUING TO OWNERS OF SPRINKLERED HOMES	25%		
ANNUAL BENEFIT	\$20.480	->	\$20.480
TOTAL ANNUAL BENEFITS			\$94.932

COSTS	
INITIAL COST	
SYSTEM PURCHASE AND INSTALLATION	\$7,000 (1500 S.F.)
ONGOING MAINTENANCE	
"WAGE RATE" FOR OWNER MAINTENANCE	\$10.58 PER HOUR
ANNUAL MAINTENANCE LABOUR REQUIREMENT	0 PER YEAR
ANNUAL MAINTENANCE COST	\$0.000

ECONOMIC INPUTS	
NOMINAL DISCOUNT RATE	14.4%
INFLATION RATE	4.0%
EFFECTIVE DISCOUNT RATE	10.00%
STUDY PERIOD FOR PRESENT VALUE ANALYSIS	25 YEARS
PRESENT WORTH FACTOR	9.08

PRESENT VALUE ANALYSIS	
TOTAL ANNUAL BENEFITS	\$94.932
PRESENT WORTH FACTOR	9.08
PRESENT WORTH OF BENEFITS	\$862
SYSTEM PURCHASE AND INSTALLATION	\$7,000
ANNUAL MAINTENANCE COST	\$0.000
PRESENT WORTH FACTOR	9.08
PRESENT WORTH OF MAINTENANCE COSTS	\$0
PRESENT WORTH OF COSTS	\$7,000
PRESENT WORTH OF BENEFITS	\$862
PRESENT WORTH OF COSTS	\$7,000
NET LIFE-CYCLE BENEFIT OF SPRINKLERS	(\$6,138)

COST OF SAVING A LIFE BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$7,000
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$771.177
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED RISK OF OCCUPANT AND FIRE FIGHTER DEATHS	<u>\$73,040</u>
NET ANNUAL COST	\$698.137 PER HOUSE
	OR
	\$69,813,650.533 PER 100,000 HOUSES
NUMBER OF OCCUPANT DEATHS DUE TO FIRE	0.0000240 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF OCCUPANT LIVES SAVED PER YEAR	0.00002160 PER HOUSE
	OR
	2.160 PER 100,000 HOUSES
NUMBER OF FIREFIGHTER DEATHS DUE TO FIRE	0.0000003 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF FIREFIGHTER LIVES SAVED PER YEAR	0.00000029
	OR
	0.029 PER 100,000 HOUSES
NET COST TO SOCIETY PER LIFE SAVED	\$31,899,188

COST OF PREVENTING PROPERTY DAMAGE BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$7,000
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$771.177
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED DIRECT AND INDIRECT PROPERTY DAMAGE	<u>\$56,772</u>
NET ANNUAL COST	\$714.405 PER HOUSE
	OR
	\$71,440,461.344 PER 100,000 HOUSES
TOTAL DIRECT & INDIRECT PROPERTY DAMAGE	47.7000000 PER HOUSE
SPRINKLER REDUCTION	80% OF DEATHS
REDUCTION IN PROPERTY DAMAGE PER YEAR	\$38.16000000 PER HOUSE
	OR
	\$3,816,000.00 PER 100,000 HOUSES
NET COST TO SOCIETY FOR PROPERTY DAMAGE PREVENTED	\$19 /DOLLAR

COST OF PREVENTING AN INJURY BY MAKING SPRINKLERS MANDATORY

PRESENT WORTH OF COSTS	\$7,000
PRESENT WORTH FACTOR	9.08
EQUIVALENT ANNUAL COST	\$771.177
TOTAL ANNUAL BENEFITS EXCLUSIVE OF REDUCED RISK OF OCCUPANT AND FIRE FIGHTER INJURIES	<u>\$80,532</u>
NET ANNUAL COST	\$690.645 PER HOUSE
	OR
	\$69,064,461.344 PER 100,000 HOUSES
NUMBER OF OCCUPANT INJURIES DUE TO FIRE	0.0002000 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF OCCUPANT LIVES SAVED PER YEAR	0.00018000 PER HOUSE
	OR
	18.000 PER 100,000 HOUSES
NUMBER OF FIREFIGHTER INJURIES DUE TO FIRE	0.0000667 PER HOUSE
SPRINKLER REDUCTION	90% OF DEATHS
NO OF FIREFIGHTER LIVES SAVED PER YEAR	0.00006000
	OR
	6.000 PER 100,000 HOUSES
NET COST TO SOCIETY PER INJURY PREVENTED	\$2,877,686

Appendix B

Recommended Revisions to Part 9 of the National Building Code of Canada 1990

REVISION ACTION SHEET

Document:	NBC 1990	Page 1
Reference:	9.7.1.3.	
Committee:	Standing Committee on Housing and Small Buildings	
Minute reference:		

EXISTING REQUIREMENT**9.7.1.3. Bedroom Windows**

(1) Except where a bedroom door provides access directly to the exterior, each bedroom shall have not less than one outside window openable from the inside without the use of tools or special knowledge.

PROPOSED CHANGE

Delete Sentence 9.7.1.3.(1) and substitute:

9.7.1.3. Bedroom Windows

(1) **Except where a bedroom door provides access directly to the exterior or where the *suite is sprinklered*, each bedroom shall have not less than one outside window openable from the inside without the use of tools or special knowledge.**

REASON

The additional level of life' safety provided by a residential sprinkler system should eliminate the need to provide an emergency exit through a window. The need to provide ventilation through the window would not be necessary if the suite is provided with a mechanical air handling system. However the ventilation aspect is treated elsewhere in Part 9.

Date:	90-01-31	Approved by Standing Committee:
For Public Review:	yes	Action after Public Review:
		Action by Associate Committee:
Issue as:	next edition	

REVISION ACTION SHEET

Document:	NBC 1990	Page 1
Reference:	9.10.1.10.	
Committee:	<i>Standing</i> Committee on Housing and Small Buildings	
Minute reference:		

EXISTING REQUIREMENT

9.10.1.10. Sprinkler, Standpipe and Hose Systems. Where sprinkler, standpipe and hose systems are installed, they shall be installed in *conformance* with Part 3.

PROPOSED CHANGE

Delete Article 9.10.1.10. and substitute:

9.10.1.10. Standpipe and Hose Systems. Where standpipe and hose systems are installed, they shall be installed in conformance with Part 3.

9.10.1.11. Sprinkler Systems.

(1) Except as provided in Sentences (2) and (3), where sprinkler systems are installed, they shall comply with Part 3.

(2) In *a building which contains one or two dwelling units* only, a sprinkler system is permitted to be designed, constructed, installed and tested in conformance with NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes."

(3) In *a building of residential occupancy* a sprinkler system is permitted to be designed, constructed, installed and tested in *conformance* with NFPA 13R, "Standard for the Installation of Sprinkler Systems in Residential Occupancies up to Four Storeys in Height."

REASON

To reference new sprinkler system standards intended specifically for small residential buildings.

Date: 90-01-31	Approved by Standing Committee:
For Public Review: yes	Action after Public Review:
	Action by Associate Committee:
Issue as: next edition	

REVISION ACTION SHEET

Document:	NBC 1990	Page 1
Reference:	9.10.9.14.	
Committee:	Standing Committee on Housing and Small	Buildings
Minute reference:		

EXISTING REQUIREMENT**9.10.9.14. Separation of Residential Suites**

(1) Except as provided in Sentences (2) and (3) and Article 9.10.20.2., *suites in residential occupancies* shall be separated from adjacent rooms and *suites* by *a fire separation* having *a fire-resistance rating* of not less than 45 min.

(2) Sleeping rooms in boarding and lodging houses where sleeping accommodation is provided for not more than 8 boarders or lodgers need not be separated from the remainder of the *floor area* as required in Sentence (1) where the sleeping rooms form part of the proprietor's residence and do not contain cooking facilities.

(3) *Dwelling units* that contain 2 or more *storeys* including *basements* shall be separated from the remainder of the *building* by *a fire separation* having *a fire-resistance rating* of not less than 1 h.
(See A-3.3.4.4.(1) in Appendix A.)

PROPOSED CHANGE

Delete Article 9.10.9.14. and substitute:

9.10.9.14. Separation of Residential Suites

(1) Except as provided in Sentences (2), (3) and (4), and Article 9.10.20.2., *suites of residential occupancy* shall be separated from adjacent rooms and *suites* by *a fire separation* having *a fire-resistance rating* of not less than 45 **min.**

(2) **Sleeping rooms in boarding and lodging houses where sleeping accommodation is provided for not more than 8 boarders or lodgers need not** be separated from the remainder *of the floor area* as required in Sentence (1) where the sleeping rooms form part *of* the proprietor's residence and do not contain cooking facilities.

RAS	Reference: 9.10.9.14.	90-01-31	Page 2
-----	-----------------------	----------	--------

(3) A *suite of residential occupancy* that contains not more than one *storey* in a *sprinklered building* is permitted to be separated from adjacent rooms and *suites* by *a fire separation* having a *fire-resistance rating* of not less than 30 min.

(4) In a *building* that is not *sprinklered*, a *dwelling unit* that contains 2 or more *storeys* including a *basement* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 1 h. (See A-3.3.4.4.(1) in Appendix A.)

REASON

The additional level of life safety provided by a residential sprinkler system justifies a reduction in the level of fire-resistance rating for the fire separations between suites to 30 minutes in the case of single level suites and to 45 minutes in the case of multi level suites.

Date: 90-01-31	Approved by Standing Committee:
For Public Review: yes	Action after Public Review:
Issue as:	Action by Associate Committee:
next edition	

REVISION ACTION SHEET

Document:	NBC 1990	Page 1
Reference:	9.10.9.16.	
Committee: .	Standing Committee on Housing and Small	Buildings
Minute reference:		

EXISTING REQUIREMENT

9.10.9.16. Separation of Storage Garages

(1) Except as provided in Sentences (2) and (3), a *storage garage* shall be separated from other *occupancies* by *afire separation* having not less than a 1.5 h *fire-resistance rating*.

(2) Except as permitted in Sentence (3), *storage garages* containing 5 cars or fewer shall be separated from other *occupancies* by a *fire separation* of not less than 1 h.

(3) Where a *storage garage* serves only the *dwelling unit* to which it is attached or built in, it shall be considered as part of that *dwelling unit* and the *fire separation* required in Sentence (2) need not be provided between the garage and the *dwelling unit* where

- (a) the construction between the garage and the *dwelling unit* provides an effective barrier to gas and exhaust fumes, and
- (b) every door between the garage and the *dwelling unit* conforms to Article 9.10.13.15.

(See Appendix A.)

PROPOSED CHANGE

Delete Article 9.10.9.16. and substitute:

9.10.9.16.' Separation of Storage Garages

(1) Except as provided in Sentences (2), (3) and (4), a *storage garage* shall be separated from other *occupancies* by *afire separation* having not less than a 1.5 h *fire-resistance rating*.

(2) Except as permitted in Sentences (3) and (4), *storage garages* containing 5 cars or fewer shall be separated from other *occupancies* by *afire separation* with a *fire-resistance rating* of not less than 1 h.

RA S

. Reference: 9.10.9.16.

.90-01-31 Page 2

(3) Where *a storage garage* containing 5 cars or fewer serves only *dwelling units* and the *storage garage* and the *dwelling units* are *sprinklered*, the *fire separation* required in Sentence (2) need not have *a fire-resistance rating*.

(4) Where *a storage garage* serves only the *dwelling unit* to which it is attached or built in, it shall be considered as part of that *dwelling unit* and the *fire separation* required in Sentence (2) need not be provided between the garage and the *dwelling unit* where

- (a) the construction between the garage and the *dwelling unit* provides an effective barrier to gas and exhaust fumes, and
- (b) every door between the garage and the *dwelling unit* conforms to Article 9.10.13.5.

(See Appendix A.)

REASON

The presence of a sprinkler system throughout the building makes it unlikely that a fire would attain sufficient **size** that it would spread in either direction between the garage and the dwelling units.

Date: 90-01-31

For Public Review: yes

Issue as:

next edition

Approved by Standing Committee:

Action after Public Review:

Action by Associate Committee:

REVISION ACTION SHEET

Document:	NBC 1990	Page 1
Reference:	9.10.11.2.	
Committee:	Standing Committee on Housing and Small Buildings	
Minute reference:		

EXISTING REQUIREMENT**9.10.11.2. Firewalls Not Required**

(1) **In a building of residential occupancy in which there is no dwelling unit above another dwelling unit, a party wall** on a property line between *dwelling units* need not be constructed as *a firewall* provided it is constructed as *a fire separation* having not less than a 1 h fire-resistance rating.

(2) The wall described in Sentence (1) shall provide continuous protection from the top of the footings to the underside of the roof deck.

(3) Any **space between the top of the wall described in Sentence (1)** and the roof deck shall be tightly sealed by caulking with mineral wool or *noncombustible* material.

PROPOSED CHANGE

Delete Article 9.10.11.2. and substitute:

9.10.11.2. Firewalls Not Required

(1) **Except as provided in Sentence (2), in a building of residential occupancy in which there is no dwelling unit above or below another dwelling unit, a party wall on a property line between dwelling units need** not be constructed as *a firewall* provided it is constructed as *a fire separation* having *a fire-resistance rating* of not less than 1 h.

(2) Where *a building is sprinklered*, the **party wall described in Sentence (1)** is permitted to be constructed as *a fire separation* having *a fire-resistance rating* of not less than 45 min.

(3) The *fire separation* described in Sentences (1) and (2) shall provide *continuous* protection from the top of the footings to the underside of the roof deck.

(4) Any space between the top of the *fire separation* described in Sentences (1) and (2) and the roof deck shall be tightly sealed by caulking with mineral wool or *noncombustible* material.

REASON

This option permitted when a residential sprinkler system is installed is expected to result in a higher level of safety than provided by the additional 15 minutes of fire-resistance rating.

Date: 90-01-31

For Public Review: yes

Issue as:

next edition

Approved by Standing Committee:

Action after Public Review:

Action by Associate Committee:

REVISION ACTION SHEET

Document:	NBC 1990	Page 1
Reference:	9.10.12.5.	
Committee:	Standing Committee on Housing and Small Buildings	
Minute reference:		

EXISTING REQUIREMENT

9.10.12.5. Protection of Soffits

(1) Except as provided in Sentence (2), where a common *attic or roof space* spans more than 2 *suites of residential occupanc* and projects beyond the exterior wall of the building, the portion of any soffit or other surface enclosing the projection which is less than 2.5 m vertically above a window or door and less than 1.2 m from either side of the window or door, shall have no unprotected openings and shall be protected by

- (a) *noncombustible* material having a minimum thickness of 0.38 mm and a melting point not below 650 C,
- (b) not less than 11-mm thick plywood,
- (c) not less than 12.5-mm thick waferboard or strandboard, or
- (d) not less than 11-mm thick lumber.

(2) Where such soffit or other surface is completely separated from the remainder of the *attic or roof space* by fire stopping, the requirements in Sentence (1) do not apply.
(See Appendix A.)

PROPOSED CHANGE

Delete Article 9.10.12.5. and substitute:

9.10.12.5. Protection of Soffits

(1) Except as provided in Sentences (2) and (3), where a common *attic or roof space* spans more than 2 *suites of residential occupanc* and projects beyond the exterior wall of the *building*, the portion of any soffit or other surface enclosing the projection which is less than 2.5 m vertically above a window or door and less than 1.2 m from either side of the window or door, shall have no *unprotected openings* and shall be protected by

- (a) *noncombustible* material having a minimum thickness of 0.38 mm and a melting point not below 650 C,
- (b) not less than 11-mm thick plywood,
- (c) not less than 12.5-mm thick waferboard or strandboard, or
- (d) not less than 11-mm thick lumber.

RA S Reference: 9.10.12.5.

90-01-31

5M

(2) Where the soffit or other surface referred to in Sentence (1) is completely separated from the remainder of the *attic or roof space* by fire stopping, the requirements in Sentence (1) do not apply.
(See Appendix A.)

(3) Where all *suites* spanned by a common *attic or roof space* are *sprinklered*, the requirements in Sentence (1) do not apply provided that all rooms that are adjacent to exterior walls below the soffit and have *unprotected openings* are *sprinklered*, notwithstanding any exemptions in the referenced sprinkler system standard.

REASON

The presence of a sprinkler system throughout the building makes it unlikely that a fire would reach a sufficient size to spread through the attic. However, NFPA Standard 13R allows certain rooms such as small bathrooms to remain unsprinklered in a sprinklered dwelling unit, presumably on the assumption of reduced probability of fire starting in these rooms. It is deemed appropriate that where these **rooms are located where they could expose the soffit and** thus the adjacent dwelling units to fire, they should not be exempted, because the subject of soffit protection is not addressed in the referenced standard.

Date: 90-01-31

For Public Review: yes

Issue as:

next edition

Approved by Standing Committee:

Action after Public Review:

Action by Associate Committee:

REVISION ACTION SHEET

Document:	NBC 1990	Page 1
Reference:	9.10.14.3.	
Committee:	Standing Committee on Housing and Small Buildings	
Minute reference:		

EXISTING REQUIREMENT

9.10.14.3. Inadequate Fire Fighting Facilities. Where there is no fire department or where a fire department is not organized, trained and equipped to meet the needs of the community, the *limiting distance* determined from Article 9.10.14.1. or required in Articles 9.10.14.12., 9.10.14.14. and 9.10.14.16., shall be doubled.

PROPOSED CHANGE

Delete Article 9.10.14.3. and substitute:

9.10.14.3. Inadequate Fire Fighting Facilities. Where there is no fire department or where a fire department is not organized, trained and equipped to meet the needs of the community, the *limiting distance* determined from Article 9.10.14.1. or required in Articles 9.10.14.12., 9.10.14.14. and 9.10.14.16., shall be **doubled for a building that is not sprinklered.**

REASON

It is considered that **the provision of a sprinkler system will delay or prevent** a fire from **reaching a sufficient size to enable it to spread beyond** normal limiting distances. Therefore, additional spatial separation is not required for a sprinklered building.

Date:	90-01-31	Approved by Standing Committee:
For Public Review:	yes	Action after Public Review:
Issue as:	next edition	Action by Associate Committee:

REVISION ACTION SHEET

Document:	NBC 1990	Page 1
Reference:	9.10.14.6.	
Committee:	Standing Committee on Housing and Small Buildings	
Minute reference:		

EXISTING REQUIREMENT

9.10.14.6. Allowance for Sprinklers and Wired Glass or Glass Block. The maximum area of *unprotected openings* may be doubled where the *building is sprinklered*, or where the *unprotected openings* are glazed with wired glass in steel frames or glass blocks as described in Articles 9.10.13.5. and 9.10.13.7. (See A-3.2.3.11. in Appendix A.)

PROPOSED CHANGE

Delete Article 9.10.14.6. and substitute:

9.10.14.6. Allowance for Sprinklers and Wired Glass or Glass Block.

(1) The maximum area of *unprotected openings* is permitted to be doubled where the *building is sprinklered* provided all spaces that are adjacent to the *exposing building face* and which have *unprotected openings* are *sprinklered*, notwithstanding any exemptions in the referenced sprinkler system standard.

(2) The maximum area of *unprotected openings* is permitted to be doubled where the *unprotected openings* are glazed with wired glass in steel frames or glass blocks as described in Articles 9.10.13.5. and 9.10.13.7. (See A-3.2.3.11. in Appendix A.)

REASON

Depends on recommended changes to Article 9.10.1.10. to recognize NFPA sprinkler system standards 13D and 13R. These standards permit certain rooms, such as small bathrooms, to remain unsprinklered in a sprinklered dwelling unit, presumably on the assumption of reduced probability of fire starting in these rooms. It is deemed appropriate that where these rooms are located with openings in the exposing building face that could expose adjacent buildings to fire, they should not be exempted, because the subject of percentage of unexposed openings in an exposing building face is not addressed in the recommended referenced standards.

Date: 90-01-31	Approved by Standing Committee:
For Public Review: yes	Action after Public Review:
	Action by Associate Committee:
Issue as: next edition	

REVISION ACTION SHEET

Document:	NBC 1990	Page 1
Reference:	9.10.14.12	
Committee:	Standing Committee on Housing and Small Buildings	
Minute reference:		

EXISTING REQUIREMENT

9.10.14.12. Exposing Building Face of Houses

(1) Except as required in Article 9.10.14.3., in *buildings* containing only *dwelling units* in which **there is no dwelling unit above another dwelling unit**, the requirements of Article 9.10.14.11. do not apply provided that the *exposing building face* has a *fire-resistance rating* of not less than 45 min where the *limiting distance* is less than 1.2 m, and when the *limiting distance* is less than 0.6 m, the *exposing building face* is clad with *noncombustible* material.

(2) Window openings in the *exposing building face* referred to in Sentence (1) shall not be permitted if the *limiting distance* is less than 1.2 m and shall be limited in conformance with the requirements for *unprotected openings* in Article 9.10.14.1. where the *limiting distance* is 1.2 m or greater.

PROPOSED CHANGE

Delete Article 9.10.14.12. and substitute:

9.10.14.12. Exposing Building Face of Houses

(1) Except as required in Article 9.10.14.3., in a *building* containing only *dwelling units* in which **there is no dwelling unit above or below another dwelling unit**, the requirements of Article 9.10.14.11. do not apply provided that

- (a) where the *limiting distance* is less than 1.2 m and the *building*
 - (i) is not *sprinklered*, the *exposing building face* has a *fire-resistance rating* of not less than 45 min, or
 - (ii) is *sprinklered*, the *exposing building face* has a *fire-resistance rating* of not less than 30 min, and,
- (b) where the *limiting distance* is less than 0.6 m, the *exposing building face* is clad with *noncombustible* material.

(2) Window openings in the *exposing building face* referred to in Sentence (1) shall not be permitted if the *limiting distance* is less than 1.2 m and shall be limited in conformance with the requirements for *unprotected openings* in Article 9.10.14.1. where the *limiting distance* is 1.2 m or greater.

REASON

This option permitted when a residential sprinkler system is installed is expected to result in a higher level of safety than provided by the additional 15 minutes of fire-resistance rating for the exterior wall.

Date: 90-01-31

For Public Review: yes

Issue as: next edition

Approved by Standing Committee:

Action after Public Review:

Action by Associate Committee:

REVISION ACTION SHEET

Document:	NBC 1990	Page 1
Reference:	A-9.10.19.3.(1)	
Committee:	Standing Committee on Housing and Small Buildings	
Minute reference:	■	

NO EXISTING REQUIREMENT

PROPOSED CHANGE

Add a new Note to Appendix A.:

A-9.10.19.3.(1) Fire Department Access Route Modification. In addition to other considerations taken into account in the planning of fire department access routes, special variations could be permitted for a house or residential building that is protected with an automatic sprinkler system. The sprinkler system must be designed in accordance with the-appropriate NFPA standard and there must be assurance that water supply pressure and quantity are unlikely to fail. These considerations could **apply** to buildings that are located on the sides of hills and are not conveniently accessible by roads designed for fire fighting equipment and also to infill housing units that are located behind other buildings on a given property.

REASON

This change arises out of studies undertaken by the joint Task Group on Mandatory Sprinklering of Houses. It was considered that the presence of an automatic sprinkler system in a' house or similar residential unit would control or extinguish a fire with sufficient reliability that there would be less need for prompt response by a fire department and also that the fire department would not require the same fire fighting vehicles and equipment at the fire scene. Accordingly it **would be reasonable to relax the normal requirements for access routes for fire fighting response in cases where** residential buildings are fully sprinklered.

Date: 90-01-31	Approved by Standing Committee:
For Public Review: yes	Action after Public Review:
	Action by Associate Committee:
Issue as: next edition	

Appendix C

References

Presentations to joint Task Group

Minute Reference	Presenter
2.7(1)	Mr. J. R. Mawhinney, Codes Section, IRC, NRC, Ottawa, Ontario.
2.7(2)	M. R. Michaud, Service d'incendie, Ville de Hull, Quebec.
2.7(3)	M. M. Beaulieu, Corporation des maitres mecaniciens en tuyauterie du Quebec.
2.7(4)	M. R. Laroche , Direction generale de la prevention des incendies, Gouvernement du Quebec, Quebec, Quebec.
2.7(5)	Mr. J. Dalton, Operation Life Safety, Washington, D.C.
2.7(6)	Mr. B. Coates, Westmount Fire Department, Westmount, Quebec.
2.7(7)	M. J. Denault, Service de protection contre les incendies, Ville de Sherbrooke, Quebec.
2.7(8)	M. D. Possa, Corporation of Master Fire Protection Contractors of the Province of Quebec.
2.7(9)	M. J. F. Halley, Les Cooperants, compagnie d'assurance generale, Trois-Rivieres, Quebec.
2.7(10)	M. R. Chevalier, Service de protection contre l'incendie, Ville de Quebec, Quebec.
2.7(11)	M. P. Houde, Service de protection contre dincendie, Ville de Quebec, Quebec.
2.7(12)	Mr. J. Woodburn, Ronmac Distributors Inc., Toronto, Ontario.
3.6(1)	Mr. R.W. Maki, City of Vancouver, Permits and Licensing Department, Vancouver, B.C.
3.6(2)	Mr. J. Ivison, Protection Engineering Inc., Vancouver, B.C.
3.6(3)	Mr. R.W. Rush, Private Citizen and Instructor on the NBC, Vancouver, B.C.
3.6(4)	Mr. A.A. Knapp, Canadian Copper & Brass Development Association, Don Mills, Ontario.
3.6(5)	Mr. D. Johnson and Mr. D. Dahr , Fire Fox Protection System Ltd., Calgary, Alberta.
3.6(6)	Mr. D. Driemel, Saanich Fire Department, Saanich, B.C.
3.6(7)	Mr. B. McGovern, Firesafe System, Saanich, B.C.
3.6(8)	Mr. C. Evans, The Corporation of the District of West Vancouver and The Greater Vancouver Regional District Fire Chief's Association, West Vancouver, B.C.
3.6(9)	Mr. J. Tapio, Chairman of Code Committee, British Columbia Fire Chiefs Association, Delta, B.C.
3.6(10)	Mr. R. Sloat, Canadian Home Builders Association, Ottawa, Ontario and Mr. L Nakatsui, Edmonton Homebuilder, Representative of the Canadian Home Builders Association.
3.6(11)	Mr. D. Reed, Universal Supply Co. Ltd. Vancouver, B.C.

- 3.6(12) Mr. Q. Methot, T.L.C. Home Fire Protection Inc, Vancouver. B.C.
3.6(13) Mr. L. MacKay and Mr. V. Shea, Public Works Canada,
Vancouver, B.C. and Mr. B.D. Cowing, T.R. Underwood
Engineering, Kamloops, B.C.
3.6(14) Mr. P. Seran, B.C. Fire Commissioners Office, Victoria, B.C.
3.6(15) Mr. R. Hepworth, Mechanical Contractors Assoc. of B.C.
3.6(16) Mr. J. McNight, United Association of Plumbers Local 170,
Vancouver, B.C.
- 4.5(1) Mr. A. Arlani and Mr. E. Sanderson, Ontario Ministry of
Housing, Toronto, Ontario.
4.5(2) Mr. J. McGuire, NRC Fire Research Section (Retired), Ottawa,
Ontario.
4.5(3) Mr. E.S. Hornby, E.S. Hornby and Associates, Ottawa, Ontario.
4.5(4) Mr. J. Rousseau, Canada Mortgage and Housing Corporation,
Ottawa, Ontario and Mr. R. Platts, Scanada Consultants Ltd.,
Ottawa, Ontario.
4.5(5) Mr. B. Darrah and Mr. J. Galt, Operation Life Safety Canada,
Toronto, Ontario.
4.5(6) Mr. I. Bazley and Mr. L. Holmen, Alberta Municipal Affairs,
Edmonton, Alberta.
4.5(7) Mr. G. Taylor, Taylor/Wagner Inc., Willowdale, Ontario.
4.5(8) Mr. D. Milley, Great Lakes Fire Protection Ltd., London, Ontario.
4.5(9) Mr. B. Clemmenson, Canadian Home Builders Association,
Ottawa, Ontario.
4.5(10) Mr. L. Parker, Task Force on Feasibility of Implementation of
Home Fire Sprinkler Systems for Future New Neighbourhoods,
Saskatoon, Saskatchewan.

List of publications and other documents reviewed by the Joint Task Group.

- 3 volume set of statistical information presented by Canadian Fire Life Safety
Committee.
NFPA 13R "Standard for the Installation of Sprinkler Systems in Residential
Occupancies", *National Fire Protection Association*.
NFPA 13D "Installation of Sprinkler Systems in One- and Two-Family
Dwellings and Mobile Homes", *National Fire Protection Association*.
Residential & Quick Response Sprinklers - You Need to Know the
Difference, *New Technology Update, National Fire Sprinkler Association*.
Concept and Development of The Residential and Fast Response Sprinklers,
New Technology Update, National Fire Sprinkler Association.
Use of Quick Response Sprinklers in Residential Occupancies - What You
Should Know, *New Technology Update, National Fire Sprinkler
Association*.

On the Economics of Mandatory Sprinklering of Dwellings, T. Z. Harmathy, IRC, National Research Council of Canada.

Guide to Automatic Sprinklers in the Uniform Building Code 1979, National Automatic Sprinkler and Fire Control Association, Inc.

Protection incendie pour petits bitiments dans la province de Quebec, Conseil de St.-Laurent, L'Association des Ingenieurs en Securite Incendie.

Building Control by Legislation, I. H. Garnham Wright.

Residential Fire Prevention, The Rockliff Group, A report submitted to Alberta Municipal Affairs.

A Closer Look at the NFPA Residential Sprinkler Standards, Fire Journal, National Fire Protection Association.

The Economics of Fast-Response Residential Sprinkler Systems, Fire Journal, National Fire Protection Association.

Why Were The Catastrophic Fires of 1987 So Deadly, Fire Journal, National Fire Protection Association.

What Residential Sprinklers Can Do, Fire Journal, National Fire Protection Association.

Residential Sprinklers, An Idea Whose Time Has Almost Come, Paul E. Teague, Fire Journal, National Fire Protection Association.

The Latest Statistics on U.S. Home Smoke Detectors, John R. Hall, Jr., Fire Journal, National Fire Protection Association.

Assessment of the Potential Impact of Fire Protection Systems on Actual Fire Incidents, Applied Physics Laboratory, Johns Hopkins University.

Remote Detection and Alarm for Residencies: The Woodland System, David A. Moore, United States Fire Administration.

Statement of the National Fire Protection Association at the International Conference of Building Officials Annual Meeting in Kansas City.

Summary Investigation Report, Successful Residential Sprinkler Activation, Cobb County, Georgia, Michael S. Isner, National Fire Protection Association.

Summary Report, Boarding Home Fire, Washington, D.C., Michael S. Isner, National Fire Protection Association.

Summary Investigation Report, Successful Residential Sprinkler Activation, Greenburgh, New York, and Dover, New Hampshire, Michael S. Isner, National Fire Protection Association.

The Most Recent Statistics on Smoke Detector Installation and Maintenance in U.S. Homes, Dr. John Hall, Director of Fire Analysis and Research Division of NFPA, Fire Prevention.

Mandatory Home Sprinkler Systems, Fire Safety and Cost : What Are Our Priorities, National Association of Home Builders.

Report on Fires in Ontario Houses, T. MacDonald, Ontario Ministry of Housing.

Analyse statistique des incendies et des pertes matdrielles dans les 1 ou 2 logements et les appartements au Quebec, Jacques Bedard, Direction generale de la prevention des incendies.

Why the City of Vancouver is Promoting Residential Fire Sprinklers.

**Mandatory Sprinkler Protection for New Residential Construction.
Public Hearing and Demonstration of a Quick Response Residential Sprinkler System.
Assessment of the Impact of Fire Protection Systems on Actual Fire Incidents.
Why We Need to Test Smoke Detectors, *Leon 'Cooper, Fire Journal, National Fire Protection Association.*
Extract of minutes of U.C Committee on Fire Alarm Equipment and Systems.**

Correspondence

**The following items of correspondence were considered by the joint Task .
Group:**

- 24 Aug 1987 Min. 2.12 J.C Hurlburt, J. C Hurlburt Ltd
Justification of Sprinklers in One and Two Family Dwellings**
- 15 Dec 1987 Min. 2.13 G. Lévesseur, Gouvernement du Quebec
Study on the Impact on Construction Costs When Automatic
Sprinklers are Installed**
- 13 Jan 1988 Min. 2.14 J. Harare, Canadian Concrete and Masonry Fire
Safety Committee
Executive Summary of the National Association of Home Builders
Survey 1987**
- 12 July 1988 Min. 2.15 J. Hamre, Canadian Portland Cement Association
Papers and Articles**
- 28 July 1988 Min. 2.16 D. Ockey, Calgary Home Builders Association
Concerns of the Calgary Home Builders Association**
- 5 Aug 1988 Min. 2.17 S. G. Harvey, N.B. Mutual Insurance Association
Information to joint Task Group**
- 12 Sept 1988 Min. 2.18 W. N. Miller, Yukon Housing Corporation
Concerns of the Yukon Housing Corp.**
- 23 Sept 1988 Min. 2.19 H. G. Angus, Association of Professional Engineers
of Ontario
Position of the Association of Professional Engineers of Ontario**
- 12 Dec. 1988 Min. 3.10 J. Morrison, Professional Loss Control
Sprinklering of Houses**
- 20 Dec. 1988 Min. 3.11 J. Morrison, Professional Loss Control
Information For Joint Task Group**

16 Feb. 1989 Min. 3.12 L. Morrison, Professional Loss Control
Information For Joint Task Group

10 Jan. 1989 Min. 4.9 L. Hamre, Canadian Portland Cement Association
Information For Joint Task Group

23 June 1989 Min. 5.5 J. C. Haysom, Codes Section, IRC, NRC
The Saskatoon Approach

20 July 1989 Min. 5.6 A. J. M. Aikman, Codes Section, IRC, NRC
Sprinkler Requirements in BOCA Code

4 Oct. 1989 G. Levasseur, Gouvernement du Quebec
Why We Need to Test Smoke Detectors