



Advocacy Group

A Review of a White Paper on Residential Fire Sprinklers

The Advocacy Group has reviewed the white paper entitled “Residential Fire Sprinklers For Life Safety” by the National Fire Sprinkler Association.

Following this page is the review of this paper by our Construction Codes & Standards Area and by our Housing & Finance Policy Area. The first section entitled “Content Review” addresses several discrepancies in the research used, as well as, a misrepresentation of information cited from several of the referenced sources. The second section entitled “Economic Review” addresses the poor economic analysis of the paper and presents a cost benefit analysis for sprinkler systems.

Should you need further assistance with the review of this paper or on this issue in general, please do not hesitate to contact Steven Orłowski at 1-800-368-5242 X8303.

Thank you.

Section 1 Content Review

Overall, we believe the report misrepresents statistics/reports, information on other occupancies, and insurance costs because the data is being used to draw significant assumptions or conclusion about cost impacts and reductions in death and property damage realized by sprinkler use, yet the data is lacking in depth and scope. We found the paper to be extremely biased and inappropriate to support any mandatory requirements for the installation of fire sprinklers in one, two, and three-family residential construction.

In their paper, the National Fire Sprinkler Association makes two primary arguments that we believe to be inaccurate. They are:

- 1) The economic effect of the increase in costs is supposedly minimal.
- 2) The estimated 82% reduction in fire deaths should fire sprinklers be installed in residential occupancies based on a NIST technical report.

Increase in Construction Cost

The first bullet in the Executive Summary states that there is only a 1% increase in construction cost due to installation of sprinklers. The NFSA estimate is based on several surveys they have conducted in different regions of the U.S. finding the range of added cost of sprinkler installation to be: \$80 - \$1.25 per square foot (NFSA of Patterson, New York); \$.98 a square foot (Barrington, IL); \$1.35 per square foot (NFSA of Chicago, IL – Tinley Park); and, \$1.38 a square foot (NFSA of Chicago, IL – Tinley Park).

Benchmarking those figures against the 10-year Scottsdale study, NAHB's 1987 Residential Fire Survey, as well as, the referenced NIST Technical Notes, the noted installation costs are within an accurate range. However, based on current NAHB Economic Group data estimating average residential construction costs at \$72 per square foot, the cost increase is a minimum of 1.5% and realistically could be much higher based on more conservative installation costs.

Regardless of the disputed cost increase figures, the paper fails to recognize the significant impact that even a 1% or less increase construction costs has on housing affordability.

NIST Report

The paper references NBS (NIST) Technical Note 1203 (1984), *A Benefit-Cost Model of Residential Fire Sprinkler Systems*. The technical note provides valuable information, but is not conclusive. The technical note states that cost effectiveness of sprinklers relies on certain conditions including:

- The use of approved plastic pipe (i.e. NFPA 13D)
- Use in high risk situations, sprinklers may be uneconomical under low-to-average conditions of risk
- The whole community using sprinklers assuming they will be able to receive certain cost reduction or avoidance by the local government or home builder
- Communities which will not have additional typical “water standby fees” or not considered taxable similar to commercial uses
- And where this additional protection is needed when occupants are incapacitated and cannot respond to a smoke alarm.

While Table 7 of the technical note – “Estimated Percentage Reductions in Fire Deaths and Injuries Attributable to Residential Sprinkler Systems” shows a potential 63% reduction in deaths, the NFSA paper states that a potential 82% reduction could be realized, a 19% jump that we can find no substantiation. Furthermore, even with the inclusion of Table 7 in the NIST technical note, nowhere in the note’s conclusion is there an indication of how many deaths would be prevented by the use of this type of a sprinkler system, and the 63% the table notes is also subjective.

Regarding the cost effectiveness of sprinklers, there are clearly a few instances in which they could be considered cost effective, but in most low to average risk situations, we believe existing data, if viewed appropriately, continues to support our position that they are currently not cost-effective in most single family housing applications.

Finally, the NFSA paper was not intended as a technical note on the impact sprinklers could have in reducing residential fire deaths and therefore simply should not address the issue to the extent it has. The NFSA paper’s own conclusion states, “The model in its present form is not appropriate as a decision tool for the homeowner” and that, “Data is needed to support applications of the models to a variety of real-life situations.”

Additional Comments:

An International Perspective, USFA

The NFSA paper also references the United States Fire Administration (USFA (FEMA)) study, *An International Perspective*. The paper notes that the U.S. has shown remarkable improvement in reducing residential fire deaths, as have most other industrialized nations. However, the paper fails to note that the referenced study clearly shows the U.S. figures represent by far, the largest absolute and relative reduction in fire death rates of all the countries shown. While there is no adequate discussion of the reasons for the drop, the NFSA paper implies that based on the expenditures of other industrialized countries, the U.S. needs to focus more on fire prevention education initiatives, an implication which the paper uses to further support the need for fire sprinklers.

This study clearly shows to us that fire prevention education, not fire suppression, is the means by which other industrialized countries have been able to maintain lower fire death rates, counter implications made in the NFSA paper.

Failure of Smoke Detectors

The perspective references two reports concerning the performance of smoke detectors: The *Smoke Detector Operability Survey* (CPSC) and *Fire in the United States 1985 - 1994* (USFA).

The CPSC report shows that the performance of smoke detectors or lack of performance is mostly due to disconnected or failed power sources, primarily because of occupants experiencing problems with the alarms going off as a result of normal occupant activities such as, cooking. In some cases however, the report indicates that there is a failure of the detector even when connected to a functioning power source. The report also states that further study is needed to show what other factors were involved in these instances.

What the perspective fails to point out is that smoke detector technology and smoke detector requirements have improved dramatically since these reports were completed. Current location requirements in the building codes have increased, the use of hard-wired, battery backed-up detectors eliminates many of the power supply problems.

Additionally, the report fails to note the flaws in sprinkler technology such as those demonstrated by the recent recalls. Specifically, there have been three (3) major recalls:

- The 1998 10 million recall of Omega fire sprinklers,
- The 1999 1 million recall of Star sprinklers,
- The 2001 30 million recall of Central sprinklers.

Insurance

Regarding the report's statements about the reduction of residential insurance costs when sprinklers are installed, they are assumptions based on commercial applications. The only example of residential insurance cost reduction is based on one personal experience.

Content Conclusion

Residential Fire Sprinklers for Life Safety - An Economic and Insurance Perspective draws conclusions and makes statements that are unfounded. Much of the data the report cites is not accurate. Several written sections are irrelevant to fire sprinklers (i.e. *The International Perspective*). Finally, the conclusion is mostly opinion.

Section 2 Economic Review

The Paper “Residential Fire Sprinklers for Life Safety: An Economic and Insurance Perspective” is essentially void of economic analysis. It relies on anecdotal evidence, old data, a failure to grasp the concept of present value and elasticity, a poor understanding of the speculative housing market, and a total lack of any cost benefit analysis. This paper can best be described as an opinion piece.

Examples of Poor Analytical work

To show what the potential benefit of installing sprinklers in residential dwellings may be, the author reports the 10-year average of all fire deaths from 1985-1994, despite a substantial and steady decline in the annual number of fire deaths during that period, and since. By doing this, the benefit of installing sprinklers is made bigger than it really is. Elsewhere, the author writes that because the price elasticity of housing is less than one “the installation cost of the fire sprinkler system, will have a negligible impact, if even measurable, on sale of the new home, condominium, or townhouse.” A price elasticity of less than one suggests nothing of the sort. A \$2000 rise in the price of a home--the cost of installing sprinklers--will price out hundreds of thousands of households nationally. Collectively, these two errors alone render the conclusions extremely suspect.

Throughout the paper the perspective ignores the fact that existing housing, to the extent that it is a substitute for new safer housing with sprinklers will rise in price, if sprinklers become required equipment in all new houses, making much of the existing stock less affordable. The author also states that “it is the uncertainty of the future housing market that is the foundation of the developer’s resistance to adding fire sprinklers, not the fear that a simple 1% added cost will chase away potential buyers.” This statement suggests a poor understanding of the speculative housing market. The author also fails to present any sort of cost-benefit analysis to support his claim as to the value of sprinklers. In addition to the problems already highlighted, there are many other errors, oversights, and omissions that further weaken the central claim of the paper.

Major Oversight

The most recent issue of *Fire in the United States: 1987-1996*, published by the National Fire Data Center, which is part of the United States Fire Administration which is in the Federal Emergency Management Agency, mentions several times that existing data do not support the notion that the installation of sprinklers in non-residential properties offers significant protection against fire. They conclude their surprising findings with a call for “additional analysis as to the effectiveness of sprinklers where they are installed.” Furthermore since sprinklers are found in so few residential properties (2 %) no conclusions can currently be drawn as to their effectiveness.

Cost-Benefit Analysis

In an effort to better understand this issue, a simple cost-benefit analysis is performed. All data came from the National Fire Protection Association and is from 1999 or the most recent year for which data is available.

Rough estimates of the costs and benefits of installing sprinklers can be constructed using broad parameters. To estimate the number of fires and deaths in new homes, we must divide the number of residential fires and deaths between new and existing homes. Importantly, residential fire fatalities are much less likely to occur in newer homes than older ones. Based on data from the California Building Industry Association, the average fatality rate occurring in homes built after 1981 is eight times lower than for units of average age. Since no data is available concerning property damage we use the proportion of new homes to all homes as an approximation. As a result, our conclusions may overstate the benefits but not the costs.

Please note that the term residential includes one and two-unit dwellings, apartment buildings, manufactured housing, hotels, motels, rooming houses, and dormitories.

DATA:

Number of residential structures in the USA as of 2000: 116,000,000

New residential structures built in 2000: 1,500,000

New residential structures/All residential structures in USA in 2000: 1.3%

New home fatality rate/ average age home fatality rate: 1/8

Estimated cost of installing a residential sprinkler system according to the paper: \$2,000

Estimate of percentage of residential lives saved if sprinklers were installed in all residential dwellings according to N.I.S.T: 63%--not 82% as reported in the paper.

Residential civilian fire related deaths in 1999: 2,920

BENEFIT: (1.3% of homes are new) X (new home/average age home fatality rate of 1/8) X (63% of all residential deaths can be prevented) X (2,920 residential deaths) = 3 lives saved annually. However, sprinkler systems last a long time. Suppose they last 40 years before being totally replaced. Over their lifetime these sprinklers could save (3 people) X (40 years) = 120 persons.

COST: (1,500,000 houses) X (\$2,000/house) = \$3,000,000,000

COST/BENEFIT = \$3,000,000,000/120 = **\$25,000,000/life**

To install sprinklers we must value each life saved at \$25,000,000 or greater. If we present value the lives saved in the future, the benefits would be reduced, making this intervention less advantageous.

This perspective did not examine any issues beyond this point. However, let us extend the analysis to include residential property loss.

Residential fire related property damage in 1999: \$5,092,000,000

ADDED BENEFIT (1.3% of fires occur in new homes) X (63% of all residential damage can be prevented) X (\$5.092 billion of annual residential fire damage) = \$41,703,000 in annual property savings. The present value of this 40-year stream is **about \$1 billion**.

OVERALL RESULT \$3 billion in current residential sprinkler expenditures would save **\$1 billion in property damage and 120 lives**. The value of each life saved is implicitly valued at (\$2,000,000,000/120 lives) = **\$16,666,667/life**.

This analysis could be extended to cover civilian injuries, and fire fighter deaths and injuries. However, those totals are not that large. Two costs that are ignored in this analysis are the inability of many poorer households to buy any type of home, and that many buyers will necessarily purchase smaller houses than they would like to as a result of the price increases experienced by existing houses. These losses are likely to be very large, as they may be expected to conservatively impact hundreds of thousands of households per year.