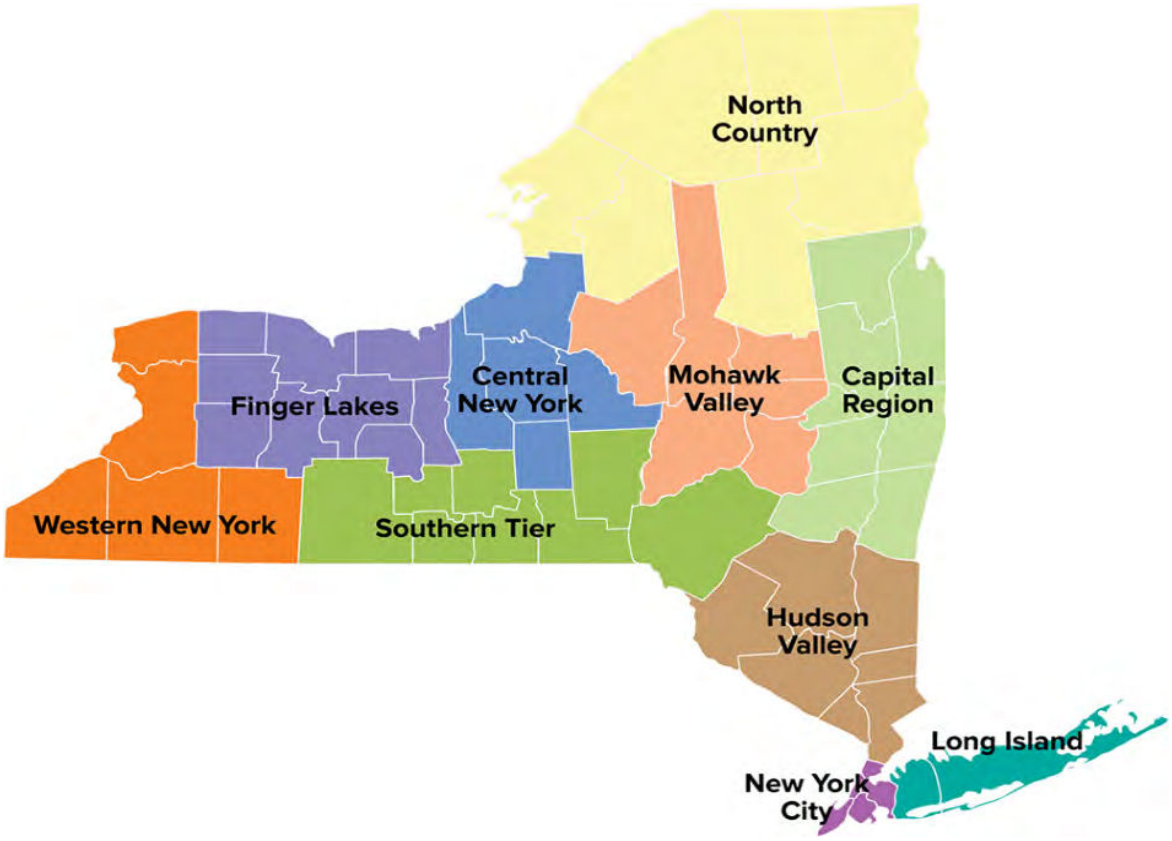
Housing and Feasibility of Residential Fire Sprinkler Systems Study



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ABSTRACT

New York State Builders Association (NYSBA) commissioned **Asterhill Research Company** to conduct a Housing Study to assess the feasibility and impact of requiring fire sprinkler systems in newly constructed one and two-unit residential dwellings in New York State (excluding New York City). This study analyzed population, housing, and economic trends along r with current market data to evaluate the practicality of mandating automatic fire sprinkler systems in new residential homes.

The National Fire Sprinkler Association (NFSA) and the U.S. Fire Administration (USFA) have promoted fire sprinkler systems in residential homes[61,62]. They state that residential fire sprinkler systems will save the lives of occupants and firefighters and reduce injuries. It is contended that property damages will be substantially reduced, and residential fire sprinkler systems are inexpensive to install during new construction. Fire sprinkler advocates continue to push for legislation to mandate automatic fire sprinklers in new one- and two-family structures.

In a review of fire fatalities between 2019 and 2023, the mean dwelling was built around 1932. No residential fire fatalities occurred between 2019 and 2023 in 1 and 2-unit homes built after 2000. There were an average of 64 fatalities (annually) or 3.0 fatalities per million in NYS. Cooking was the leading cause of residential fires, followed by heating and electrical malfunctions. Carbon monoxide poses the greatest threat to civilians and firefighters in residential structure fires, along with heat and oxygen deprivation[22]. FEMA reported in NYS that only 33% of dwellings in residential fire fatalities had smoke alarms, and not all of these smoke alarms were working.

The cost of residential fire sprinkler systems is not $1.30 to $3.00 per square foot, as represented by the advocates. The average cost in NYS is $8.42 to $10.47 per square foot, raising the cost of a new home by $20,000-$30,000 (3%-5%). This doesn't include the cost of annual maintenance and other service charges by local municipalities and water providers.

The cost of single-family homes in NYS has risen by more than 41% between 2019 and 2023. With mortgage rates increasing by 200% since 2020, the affordability of a new home has declined for most residents of New York State. With the median household income at $82,095 (2023) and the average cost of a new home exceeding $600,000, over 75% of families cannot afford a new home. The passing of any mandate requiring the new construction of 1 and 2-family dwellings to install a fire sprinkler system only contributes to making homeownership for new homes unattainable for the majority of New Yorkers.

Fire sprinkler systems do have system failures due to maintenance and environmental conditions. These systems cannot detect smoke or fire in walls, will not reduce carbon monoxide gas, and require maintenance.

Conclusion

Mandating residential fire sprinkler systems in the construction of new 1 and 2-family homes **will not reduce the number of residential fire fatalities in older existing dwellings**. The **high cost will make new homes more unaffordable and only favor the wealthiest.** If the goal is to save more lives, more effort should be made to make sure all residential dwellings have working smoke and carbon monoxide alarms.

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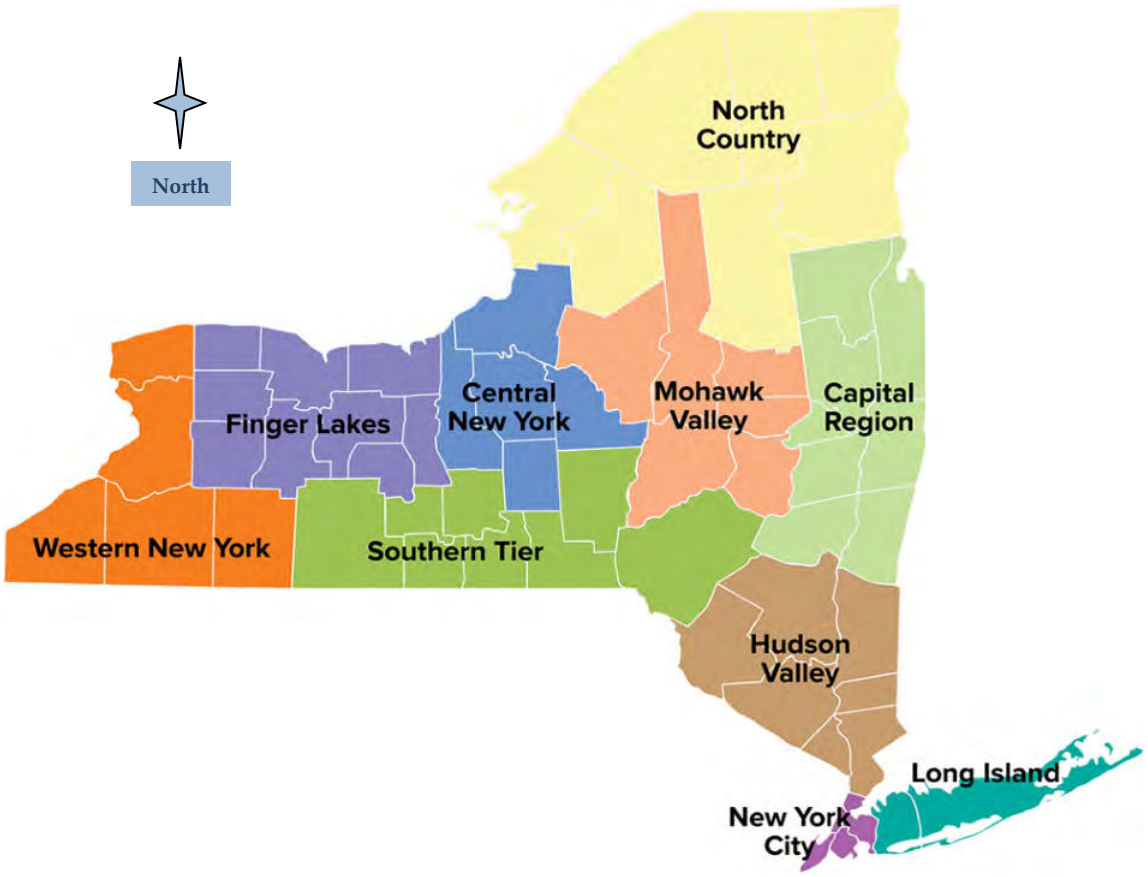
INTRODUCTION

INTRODUCTION

New York State Builders Association (NYSBA) has commissioned **Asterhill Research Company**, a *Research and Planning Consultant,* to compile a **Housing Market Study** to review and assess the feasibility and impact of requiring fire sprinkler systems in one and two-unit residential dwellings in NYS (excluding New York City).



PURPOSE OF THIS REPORT

The housing study will review and assess the feasibility and impact of requiring fire sprinkler systems in one and two-unit residential dwellings in NYS (excluding New York City). The material to be reviewed and examined includes but is not limited to:

- fire fatalities in New York State over the last ten years by location and dwelling type,
- The age of existing residential single-family homes, construction methods, and cross-reference with fire fatalities,
- Fire sprinkler costs and system requirements, maintenance and long-term needs,
- Construction materials and building code changes,
- Interviews with industry experts, including sprinkler manufacturers, architects, engineers, fire marshalls, fire departments, building inspectors, builders, developers, and

- Comparison to states that implemented mandatory fire sprinkler systems in one and two-unit residential dwellings.

The essential components addressed are system cost, market demand, and impact on owners, developers/builders, municipalities, and fire-safety providers. This is accomplished by testing the market to make an evaluation. This study evaluates the feasibility and impacts of the proposed fire sprinkler system requirements.

We intend to collect market data and utilize supplemental information and data from other prior studies for this verification. Additionally, we will interview manufacturers, distributors, builders, developers, municipalities, regional/county planners, fire protection professionals, and code enforcement officers. Key aspects of this study include defining geographically and demographically the number of clients likely to consider these systems, requirements, availability, and other associated costs.

BACKGROUND

Since the 2009 edition of the International Residential Code (IRC), the model code has required all new one and two-family dwellings and townhouses to include fire sprinkler systems. Nearly all states have removed the requirement from their residential building codes as they have adopted newer editions[58]. According to the National Association of Home Builders report on the Fire Sprinkler Mandate (2019), only California and Maryland have maintained this mandate. Below is a summary of the state's position on this mandate:

- 46 states have completely removed the sprinkler requirements for one- and two-family homes.
    - 20 of those states, local jurisdictions have the authority to adopt sprinkler requirements.
- 2 states have limited the requirement based on the size or height of the home.
- 42 states have also removed the sprinkler requirement for townhouses.
- 4 states require builders to give buyers an estimate to install a fire sprinkler system (mandatory option).
- California and Maryland have left the sprinkler mandate in place.
- States may avoid the sprinkler mandate in one of three ways.
    - Twenty-two states defeated the sprinkler mandate through legislation.
    - Twenty-two states defeated the sprinkler mandate through code adoption.
    - 4 states have not adopted a statewide residential code.

In New York State (UL1626), the standard for residential sprinklers for Fire-Protection Service requires that residential fire sprinklers activate quickly to suppress fires and prevent flashover in the room where the fire originates; provide sprinkler coverage during a fire for **10 minutes for multiple-story homes,** and **seven minutes for one story homes;** and perform in such a manner that the levels of carbon monoxide not exceed the lethal levels[59].

In November 2021, Governor Hochul of New York State signed into law a bill requiring builders to provide prospective purchasers an estimate for installing an automatic fire sprinkler system in one and two family units[57].

Governor Hochul proclaimed May 13-19, 2024, Home Fire Sprinkler Awareness Week in New York State. The Resolution states that 142 civilians died in home fires. However, only 73 fire fatalities occurred in 1 and 2 family dwellings, and the majority of those fatalities occurred in 1 and 2 family homes built before 2000[60]. Further, the Resolution claims that the composition of construction materials and furniture produces deadly toxic materials in less than 2 minutes. According to FEMA, the majority of fire fatalities are caused by carbon monoxide and smoke.

There is an on-going debate over mandating fire sprinkler systems in one and two-family homes. Among the issues being debated include but are not limited to:

Cost
Facts of impact
Affordability of homes
Unique Interest Lobby funding this mandate

METHODOLOGY

The report's organization follows the New York State Department of Housing and Community Renewal (NYSHCR) underwriting guidelines and the United States Department of Housing and Urban Development (HUD). Most of the information is presented in tables, maps, pictures, and statistics. These indicators include but are not limited to:

- Population changes
- Household characteristics
- Housing inventories
- Fire alarm and fire sprinkler systems cost
- Economic impact

The study reaches its conclusions after analyzing and reviewing the following topic areas. Additionally, the process assesses the demographics and housing conditions and compares them to county and state data.

DATA SOURCES

The U.S. Census is the primary source of **Secondary Data** used in this study. Data from the 2010 Census and Five-Year America Community Surveys from 2010 -Present were also used. The Census Data provides the most complete and reliable body of data. Third-party reports are collected, reviewed, and used to confirm the census data and provide any newer information. **Primary data** is collected from the primary market area through interviews, sampling, and observations. A list of data sources and references is provided in the Appendix.

ASSUMPTIONS AND LIMITATIONS

Use of this Report

- The possession of this report does not carry with it the right of publication.
- This document may not be used for any purpose or by any person or entity other than the party for whom it was prepared without the written permission of **Asterhill Research Company.**
- The information and opinions contained herein apply only to the time frame indicated in the report.

Findings

- The statements of fact contained herein are believed to be accurate and correct insofar as they have been derived from sources believed to be reliable and accurate. No responsibility is assumed for legal descriptions or matters that pertain to legal expertise.
- The findings of this market study are indicators of market trends. These findings do not guarantee project success but serve as a tool to supplement one's knowledge of the market.

Project Compliance

- No representations are made with regard to compliance with legal or regulating requirements applicable to this project, including zoning, environmental, or other local, state, or federal regulations, permits, and licenses.

Financial Analysis

- As part of this report, financial analyses are based upon estimates, assumptions, and other public or private information developed from actual market research, knowledge of the industry, or project-specific information provided and/or obtained.
- These analyses illustrate the financial expectations given the specific set of assumptions used. If any of the assumptions are altered, different financial expectations may result.

Data Required by State and Federal Agencies or Other Regulatory Agencies

- No finance or other regulatory agencies to which the study is addressed have additional data requirements.

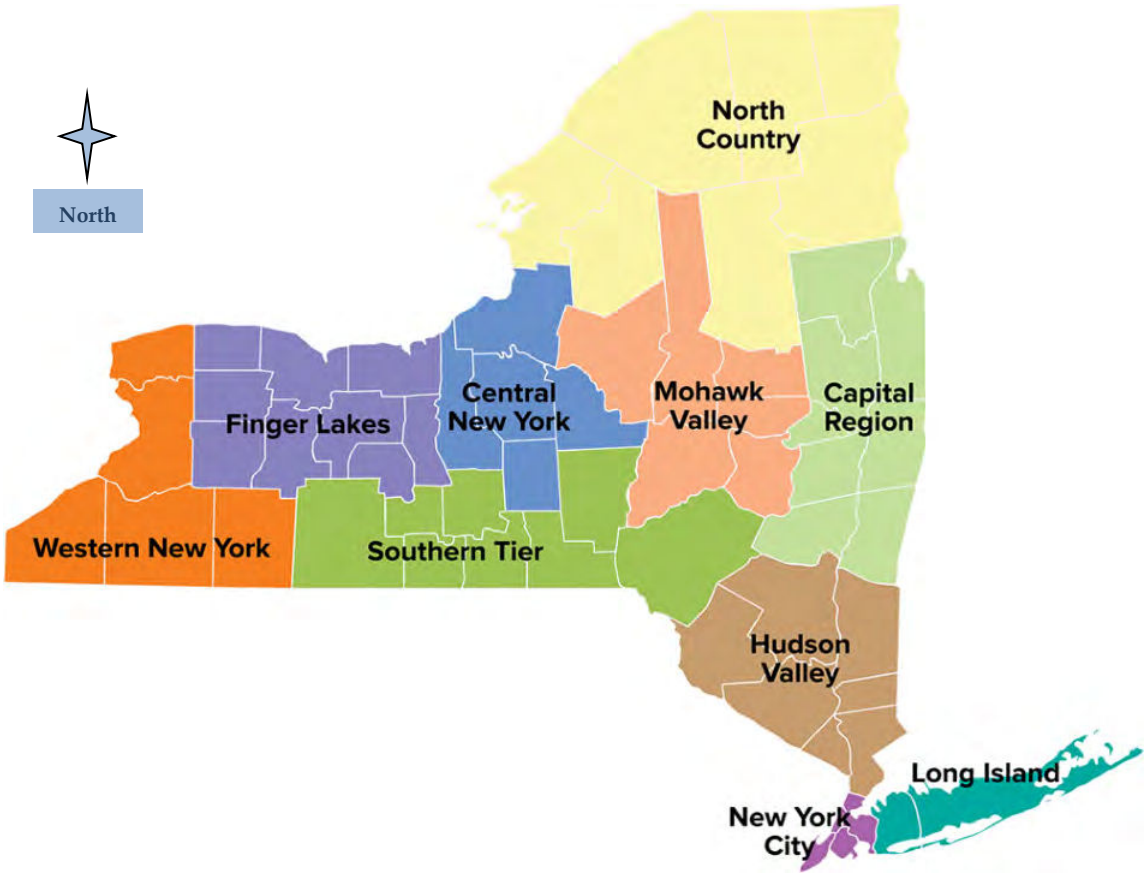
Additional Work

- No housing financial agencies, other regulatory agencies, or developers have asked for more work outside the scope of work defined. Any additional documentation or analysis beyond the scope of this study will be performed for additional compensation.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

New York State Builder Association (NYSBA) has commissioned **Asterhill Research Company**, a Research and Planning Consultant, to compile a Housing Study to review and assess the feasibility and impact of requiring fire sprinkler systems in one and two-unit residential dwellings in NYS (excluding New York City). This housing study reviewed population, housing, and economic trends, together with current market information, to assess the feasibility and practicality of making an automatic fire sprinkler mandatory in 1 and 2-unit residential homes. The map below illustrates the regional areas of New York State.



The housing and feasibility study reviewed and assessed the impact of requiring fire sprinkler systems in one and two-unit residential dwellings in NYS (excluding New York City). In the 2009 edition of the International Residential Code (IRC), the model code required all new one and two-family dwellings and townhouses to include fire sprinkler systems[58]. **Since its introduction, 48 of 50 States have removed the code from their residential building codes or limited its requirements.**

In New York State (UL1626), the standard for **residential** sprinklers for Fire-Protection Service requires that residential fire sprinklers activate quickly to suppress fires and prevent flashover in the room where the fire originates; provide sprinkler coverage during a fire for **10 minutes for multiple-story homes,** and **seven minutes for one story homes;** and perform in such a manner

that the levels of carbon monoxide do not exceed the lethal levels[59]. In November 2021, Governor Hochul of New York State signed into law a bill requiring builders to provide prospective purchasers an estimate for installing an automatic fire sprinkler system in one and two family units[57].

Governor Hochul proclaimed May 13-19, 2024, Home Fire Sprinkler Awareness Week in New York State. The Resolution states that 142 civilians died in home fires (2017). However, only 73 fire fatalities occurred in 1 and 2-family dwellings, and the majority of those fatalities occurred in 1 and 2-family homes built before 2000[60]. Additionally, when the NYC region was removed from this count, **there were only 50 fatalities or 2.5 fatalities per million in NYS**. Advocates continue to push for legislation to mandate automatic fire sprinklers in one and two-family structures. A strong lobby, including the National Fire Sprinkler Association (NFSA) and the U.S. Fire Administration (USFA), has promoted fire sprinkler systems in residential homes[61,62]. They state that residential fire sprinkler systems:

- Saves occupant's lives,
- Save firefighter lives and reduce injuries,
- Significantly reduces the risk of premature building collapse to firefighters by lightweight construction components when they are involved in a fire,
- Substantially reduce property loss caused by a fire, and is
- It is inexpensive to install on new construction.

It is always important to save lives in residential fires. Technological improvements, fire alarms, construction materials, and education are saving more lives.

The premise being used to justify the proposed mandate for **Automatic Fire Sprinklers Systems (AFSS)** is flawed and misrepresents the facts:

- It will cost 300% to 500% (+) more than represented,
- Will increase the cost of new homes by $20,000 to $30,000 more (3-5%)
- There may be additional costs from municipalities and water providers,
- System failures are due to environmental conditions and maintenance issues,
- The maintenance cost is 100% to 300% higher than represented,
- It will not reduce carbon monoxide gases,
- It will cause more smoke, making it difficult for residents to find exits,
- Cannot detect fires in walls and
- Insurance premiums will rise with the higher cost of homes.

The decision to install an automatic fire sprinkler system should remain with the buyer of a new one or two-family residential home.

The following discussion will review existing conditions and the claims and benefits stated by New York State, NFSA, and USFA.

1. POPULATION AND RESIDENTIAL STRUCTURES IN NYS

As of 2023, New York is the nation's fourth-most populous state, behind California, Texas, and Florida. Two-thirds of the state's population resides in the New York metropolitan area. New York City is the most populous city in the United States[2,10], with an estimated population of 8,622,467 in 2022[2]. See Table 2.1 below.

Table 2.1 Housing Data by Regions in New York State 2022[1]

NYS Regions	1 Western NY	2 Finger lakes	3 Southern Tier	4 Central NY	5 North Country	6 Mohawk Valley	7 Capital	8 Hudson Valley	9 New York City	10 Long Island
Population 2022	1,415,124	1,203,256	648,135	781,620	347,488	613,377	1,057,512	2,391,754	8,622,467	2,913,646
% Change 2010	-0.9%	0.6%	-3.6%	-0.9%	-2.3%	-1.1%	2.4%	5.3%	6.7%	3.6%
Occupied housing units	599,238	496,731	269,528	314,630	139,452	244,898	435,291	856,494	3,282,804	965,457
Owner-occupied housing units	**403,225**	**338,437**	**183,348**	**214,055**	**93,184**	**167,582**	**288,053**	**569,320**	**1,081,125**	**789,790**
% of all occupied housing units	67.3%	68.1%	66.8%	68.0%	66.8%	68.4%	66.2%	66.5%	32.9%	81.8%
% Change from 2010	-3.4%	3.3%	-1.3%	1.9%	0.0%	-1.5%	3.3%	3.7%	7.4%	3.0%
Avg household size owner unit	2.46	2.48	2.49	2.50	2.49	2.53	2.49	2.74	2.78	3.07
Renter-occupied housing units	**196,013**	**158,294**	**46,268**	**100,575**	**46,268**	**77,316**	**147,238**	**287,174**	**2,201,679**	**175,667**
% of all occupied housing units	32.7%	31.9%	33.2%	32.0%	33.2%	31.6%	33.8%	33.5%	67.1%	18.2%
% Change from 2010	-6.4%	13.7%	3.9%	4.7%	6.5%	2.9%	9.0%	10.0%	7.9%	2.3%
Avg household size rent unit	2.09	2.05	2.05	2.09	2.16	2.17	2.02	2.52	2.45	2.56
All Vacant Housing Units	**69,814**	**46,857**	**49,240**	**39,427**	**49,581**	**44,497**	**78,308**	**83,733**	**337,970**	**90,502**

1. *Source: U.S. Census 2010-2022*

In New York State, 56.7% of all structures are one- and two-units. See Table 2.2 below for a breakdown by region in New York State.

Table 2.2 Units in Housing Structures by Regions in New York State 2022[1]

NYS Regions	1 Western NY	2 Finger lakes	3 Southern Tier	4 Central NY	5 North Country	6 Mohawk Valley	7 Capital	8 Hudson Valley	9 New York City	10 Long Island
Housing Units	**669,052**	**543,588**	**318,768**	**354,057**	**189,033**	**289,395**	**513,599**	**940,227**	**3,620,774**	**1,055,959**
1-unit, detached	62.5%	65.7%	64.0%	65.2%	66.9%	63.9%	61.0%	55.9%	9.2%	78.3%
1-unit, attached	2.8%	5.0%	1.8%	3.0%	2.9%	1.6%	3.9%	6.2%	7.1%	4.5%
2 units	14.3%	6.1%	8.7%	7.3%	5.0%	12.3%	9.6%	6.7%	12.5%	4.3%
3 or 4 units	5.4%	5.7%	5.2%	5.1%	6.2%	6.1%	7.1%	6.6%	9.1%	2.0%
5 to 9 units	4.3%	5.4%	4.2%	4.3%	3.7%	3.4%	4.6%	5.2%	6.6%	2.0%
10 to 19 units	1.9%	2.2%	2.3%	3.5%	1.6%	2.0%	3.0%	3.9%	6.5%	2.3%
20 or more units	5.4%	6.1%	4.5%	6.7%	3.1%	4.9%	5.9%	13.5%	48.7%	5.8%
Mobile home	3.4%	3.7%	9.2%	4.7%	10.6%	5.7%	4.7%	1.9%	0.1%	0.8%
Boat, R.V., van, etc.	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% of 1-2 units	**79.6%**	**76.8%**	**74.5%**	**75.6%**	**74.8%**	**77.9%**	**74.6%**	**68.8%**	**28.9%**	**87.0%**

1. *Source: U.S. Census 2010-2022*

In New York State, 89% of all housing structures were built before 2000, 75.3% before 1980, and 65.5% built before 1970. Table 2.3 below compares the structures built by region in New York State.

According to the New York Association of Realtors, the median sale price of a single-family home in New York State in 2023 was $382,500, up 6.1% from 2022[11]. The average sale price in the first quarter of 2024 was $383,500, up 6.2% from 2022. The median home value in New York State in 2022 was $253,185, up 33% since 2010. (See Section 3 of this report).

Table 2.3 Housing Structure Year Built by Regions in New York State 2022[1]

NYS Regions	1 Western NY	2 Finger lakes	3 Southern Tier	4 Central NY	5 North Country	6 Mohawk Valley	7 Capital	8 Hudson Valley	9 New York City	10 Long Island
Specified units	669,052	543,588	318,768	354,057	189,033	289,395	513,599	940,227	3,620,774	1,055,959
Built 2010 or later	3.7%	4.7%	4.0%	4.1%	5.5%	3.7%	6.6%	4.5%	5.0%	3.3%
Built 2000 to 2009	5.1%	6.8%	6.1%	6.3%	10.1%	5.4%	8.9%	7.8%	5.4%	5.7%
Built 1990 to 1999	7.2%	9.1%	9.0%	8.4%	11.1%	7.1%	10.1%	7.4%	3.8%	6.2%
Built 1980 to 1989	7.3%	10.8%	11.1%	10.8%	11.6%	8.5%	11.5%	10.6%	5.0%	7.8%
Built 1970 to 1979	10.6%	12.7%	13.0%	12.5%	10.8%	8.9%	12.4%	12.5%	6.9%	12.5%
Built 1960 to 1969	10.7%	11.6%	10.4%	11.5%	7.7%	9.8%	9.4%	13.5%	12.4%	17.0%
Built 1950 to 1959	16.8%	10.9%	10.9%	13.7%	8.4%	13.4%	9.6%	14.5%	12.8%	25.2%
Built 1940 to 1949	7.8%	5.2%	5.9%	6.2%	4.8%	7.6%	4.9%	5.9%	9.5%	8.5%
Built 1939 or earlier	30.8%	28.2%	29.6%	26.5%	29.9%	35.7%	26.4%	23.2%	39.2%	13.9%
% Built before 2000	**91.2%**	**88.5%**	**89.9%**	**89.6%**	**84.4%**	**90.9%**	**84.4%**	**87.6%**	**89.5%**	**91.0%**
% Built before 1980	66.1%	55.9%	56.8%	58.0%	50.9%	66.4%	50.4%	57.1%	73.9%	64.5%
% Built before 1970	55.4%	44.3%	46.4%	46.4%	43.2%	56.7%	40.9%	43.6%	61.6%	47.6%

1. Source: U.S. Census 2010-2022

2. FIRE FATALITIES

Since 1980, the United States has made remarkable progress in all fire safety (residential and commercial), witnessing decreased fires and fire-related deaths. This positive trend can be attributed to various factors, including improved building codes, enhanced fire suppression systems, increased awareness, and better fire prevention strategies.

According to the NFPA report, the rate of injury and death in reported home fires is higher now than it was in 1980[15]. While improvements have been made in fire prevention and safety measures, the data reveals that these efforts have not been sufficient to control the rising casualties. The estimated total fires in 2021 were 55% lower than in 1980, while fire death and injury estimates were 42% and 44% lower, respectively, over the same period. In 2021, local fire departments, including departments protecting towns, townships, cities, and counties, responded to an estimated 1,353,500 fires in the U.S.[14] These fires caused an estimated 3,800 civilian deaths, 14,700 civilian injuries, and $15.9 billion in direct property damage. Meanwhile, direct property damage decreased by 30% compared to property damage in 2020[14]. 19% of all fires occurred in one- and two-family homes, and 5% of fires in apartments caused 16% of civilian fire deaths and 21% of injuries[15].

Cooking was the leading cause of residential building fires, and fires resulted in death and losses, at 52%. Heating (9%) and electrical malfunction (6%) were the next major causes[13]. There is a direct relationship between residential fires, older homes, and individuals and

families with lower incomes[23]. Research indicates that older houses are often associated with fire injuries and fatalities. **Older houses were built with more flammable and toxic materials, electric systems with lesser capacities than today's standards, and fewer original electrical outlets to handle greater loads.**

According to FEMA, older houses may have other features that put them at risk for fires, including substandard appliances, faulty heating systems that lead to the use of space heaters, lack of compliance with building and/or sanitation codes, and narrow stairwells that make escape more difficult[23].

In New York State, between 2019 and 2021, there were 13 firefighter fatalities. Four of these fatalities occurred at residential homes and were caused by cardiovascular events. The average age of these fatalities was 54 years old[23].

Carbon monoxide poses the greatest threat to civilians and firefighters in residential structure fires, along with heat and oxygen deprivation[15,22].

According to a study by Gilbert and Butry (2017), most fire fatalities are associated with frailty. **Older people and young children are more likely to die in a residential fire when compared to other population segments.**

According to NFPA and emergency medical professionals, most fire fatalities are caused by carbon monoxide, which poses a more significant threat to life than oxygen deprivation and heat in residential structure fires[22].

New York State

In 2023, New York State's number of fire deaths per million was 7.75; for single-family dwellings (1 and 2 units), it was 4.0; when excluding NYC, it dropped to 3.2. In 2023, there were 155 fire fatalities in NYS, and 51.6% occurred in 1 and 2-family units, while 48.4% occurred in multi-family units (3 or more), campers, R.V., and mobile homes (See Table 2.4 below.)

Table 2.4 New York State Fire Fatalities[1]

Description/Year	2024[2]	2023	2022	2021	2020	2019	2018	2017	2016	2015	Average
Total Fire Fatalities	48	155	144	122	114	126	142	142	120	129	124
Multi-family Unit 3+, Campers/R.V./Trailer	25	75	60	55	45	50	52	69	34	53	52
1- and 2-family	23	80	84	67	69	76	90	73	86	76	72
% of Total FF	*47.9%*	*51.6%*	*58.3%*	*54.9%*	*60.5%*	*60.3%*	*63.4%*	*51.4%*	*71.7%*	*58.9%*	*58.3%*
Fire Fatalities Excluding NYC Region 7	16	64	70	62	63						55.0
% of Total FF	*33.3%*	*41.3%*	*48.6%*	*50.8%*	*55.3%*						*44.3%*

1. *Source: FEMA (https://apps.usfa.fema.gov/civilian-fatalities/incident/reports)*
2. *2024-January through May 2024 (5 months)*

In Table 2.5, the fire fatalities are broken down by regions in NYS. The annual fire fatalities are 3.2 per million, excluding the NYC Region.

Table 2.5 NYS Fire Fatalities By Region and Year for 1 and 2 Family Dwellings[1]

	2024[2]	2023	2022	2021	2020	2019	Total	%
NYS Population	n/a	19,994,379	19,994,379	20,114,745	19,514,849	19,752,319		
Capital Region	1	7	4	4	5	3	**24**	6.0%
Central Region	3	4	9	5	2	6	**29**	7.3%
Finger Lakes Region	3	6	8	8	5	12	**42**	10.6%
Hudson Valley Region	2	10	5	1	19	7	**44**	11.1%
Long Island Region	1	12	13	17	8	8	**59**	14.8%
Mohawk Valley Region	0	4	5	4	9	5	**27**	6.8%
NYC Region	**7**	**16**	**14**	**5**	**6**	**14**	**62**	15.6%
North Country Region	0	1	2	1	1	10	**15**	3.8%
Southern Tier Region	1	4	6	6	5	4	**26**	6.5%
Western NY Region	5	16	18	15	9	7	**70**	17.6%
Total Annually	**23**	**80**	**84**	**66**	**69**	**76**	**398**	**100.0%**
% of Total	*5.8%*	*20.1%*	*21.1%*	*16.6%*	*17.3%*	*19.1%*	*100.0%*	
Deaths per Million NYS	*n/a*	*4.00*	*4.20*	*3.28*	*3.54*	*3.85*	*3.77*	
Deaths per Million NYS Excluding NYC	n/a	*3.20*	*3.50*	*3.03*	*3.23*	*3.14*	*3.22*	

1. *Source: FEMA (https://apps.usfa.fema.gov/civilian-fatalities/incident/reports)*
2. *January through April 2024*

A review of fire fatalities between 2019 and 2023 found that the **mean dwelling was built around 1932**. **No fire fatalities occurred between 2019 and 2023 in homes built after 2000**. Most firefighter fatalities and injuries occurred from roof and floor failures. Over 40% of the fatalities were elderly and/or children under 14 years of age, as they are the most vulnerable groups.

3. FIRE ALARM AND FIRE SPRINKLER SYSTEMS

The most common **fire detection device is a smoke detector**. A smoke detector senses smoke, heat, and carbon monoxide, typically as an indicator of fire[31]. According to FEMA, smoke alarms were reported as present in 33% of residential fatal fires and 44% of **residential non-fatal fires**[16]. In **25% of residential fatal fires, no smoke alarms were present**[16], and in 43% of these fire fatalities, firefighters could not determine if a smoke alarm was present[16].

About 65% of the time, working smoke alarms were absent or did not work in fatal residential fires.

Most modern smoke alarms utilize these different types of smoke alarm technologies. **Combination smoke alarms** utilize ionization, photoelectric, and

carbon monoxide detection. For best protection, smoke and fire detection technologies (ionization, photoelectric, and carbon monoxide) should be used in all homes, including existing and new residential structures.

Since the 1990s, the NFPA has recommended fire code standards nationwide. NFPA sets the standards for technical aspects of sprinklers installed in the USA. Building codes specifying which buildings require sprinklers are left to local jurisdictions[30].
A fire sprinkler system is an active fire protection method consisting of a water supply system providing adequate pressure and flow rate to a water distribution piping system to which fire sprinklers are connected[30].

A fire sprinkler system is an active fire protection process consisting of a water (or other alternative materials) supply providing sufficient pressure and flow rate to a distribution system (pipes) and fire sprinkler heads[30]. There are several fire sprinkler types, including wet pipe (the most common), dry pipe, deluge, pre-action, foam water, water spray, and water mist. Fire sprinkler heads are heat-activated when the ambient temperature rises from 135 to 175 degrees[63].

Smoke and carbon monoxide will not activate a fire sprinkler head.

In a dry sprinkler system, the activated sprinkler head causes the air pressure in the pipes to drop, opening a dry pipe valve near the system riser that holds back the water. **The water floods the pipes and sprays through the open sprinkler, which can take up to 60 seconds.**

4. COSTS

The cost of smoke alarms and residential fire sprinkler systems can vary depending on several factors. The average size of an existing single-family home in the United States is 2,014 square feet, with a mean price per square foot of $203.61 ($410,070), and in New York State, it is 1,490 square feet, with a mean price per square foot of $421.49[37]. According to the National Association of Home Builders, the average size of a new single-family home is 2,561 square feet (2021), and Statista reports the average size is 2,522 (2023). Table 2.6 below estimates the average cost of a new single-family home (2024) with and without a fire sprinkler system in the different regions of New York State.

Table 2.6 Estimated Cost of Building New Home in New York State												
		Albany	Syracuse	Rochester	White Plain	Hicksville	Utica	NYC	Watertown	Binghamton	Buffalo	NYS Average
New Single-Family SF		**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**
Sub-Total		533,514	533,514	537,606	628,052	653,647	511,584	731,518	529,094	529,094	576,290	576,391
Overhead (7%)		37,346	37,346	37,632	43,964	45,755	35,811	51,206	37,037	37,037	40,340	40,347
Profit (6%)		32,011	32,011	32,256	37,683	39,219	30,695	43,891	31,746	31,746	34,577	34,583
Grand Total[1]		**602,871**	**602,871**	**607,495**	**709,699**	**738,621**	**578,090**	**826,615**	**597,876**	**597,876**	**651,208**	**651,322**
With Sprinklers[2]		622,757	622,757	627,516	733,078	762,941	597,170	853,848	617,584	617,584	672,663	672,790

1. *The estimate for constructing a new home is based on information from Cost To Build.net for the select cities in the different regions of New York State. The assumptions for the proposed new home are 2550sf, 3 bedrooms, 2-story structure, full basement, 450sf garage, rear deck, 2 full bathrooms, average finishings and flooring, 6/12 roof, and smoke alarms included.*
2. *Fire Sprinkler Cost assumes water supply is available in the municipality with sufficient pressure.*

Smoke alarms are included in most new residential construction costs and are required by local building codes. Their costs will vary from $10 -$100 each, depending on the type, quantity, and functions, plus installation labor. Most new home construction for one and two-single-family homes have **hardwired systems with battery backups**. The cost ranges from $0.94 to $1.18 per square foot. Other features such as smart/wireless, voice, lights, and weather alerts are available on smoke alarms and may add $0.10 to $0.35 per square foot cost[45]. The typical cost to replace a battery in a smoke alarm is $2-3. NFPA and local building codes recommend installing smoke alarms in bedrooms, hallways, living areas, bathrooms, kitchens, attics, garages, and basements. See Table 2.7 for a breakdown of smoke alarms by type and estimated installation labor. It is generally assumed that a smoke detector will function for at least 10 years.

Table 2.7 Smoke Alarm Cost			
Type	Average price	Total installed cost* (per unit)	Details
Ionization	$10 – $40	$110 – $290	Detects flaming fires
Photoelectric	$20 – $70	$120 – $330	Detects smoldering fires
Dual sensor	$40 – $100+	$140 – $360+	Combines ionization and photoelectric detection
Smart	$50 – $150	$150 – $410+	Includes Wi-Fi, security service, & smart device connectivity
Combination smoke & CO Detector	$40 – $100+	$140 – $360+	Combine a smoke alarm with a carbon monoxide alarm
Source: homeguide.com			

According to the National Fire Sprinkler Association, wet residential fire sprinklers are estimated to cost $1-$3 per square foot in new construction. What is not clearly defined is what this includes and does not include. Table 2.8 below provides the cost of the components of a wet fire sprinkler system.

Table 2.8 Components of A Wet Fire Sprinkler System		
Component	**Description**	**Cost Range**
Sprinkler Heads	Mounted on pipes, these automatically release water when activated by heat, targeting the fire directly. The heads come in different types, such as pendant, upright, sidewall, and concealed.	$12-35 each
Pipes	The network of pipes distributes water throughout the building, connecting to the sprinkler heads.	Copper Pipe ½": $1.10 to $3.60/lf Ptec: $1.20-$2.30/lf
Water Supply	A reliable water supply source, such as a municipal water connection or a dedicated water storage tank, ensures an adequate water flow for the sprinkler system to operate effectively. In rural areas without public water, a tank/reservoir is needed to provide sufficient water supply to power the sprinkler head (1-2) for at least 10+ minutes.	Water Storage Tank 300+ gallon: $1,200-$3,000+ each
Water Pumps	A water pump is often needed to maintain sufficient water supply to sprinkler heads 15-25+ gpm.	$600-$1,200 each
Valves and Fittings	Control valves regulate water flow, and check valves prevent backflow in certain system designs. Fittings, such as elbows and tees, facilitate pipe connections and changes in direction.	n/a
Alarm Devices	Smoke or heat detectors trigger alarms when they sense a fire, alerting occupants and initiating the sprinkler system, providing an early warning.	Included in new construction
Control Panel	The control panel monitors the system's status, displays alarms, and manages water flow. It allows manual intervention and communicates with other fire safety systems in the building.	$1,000+
Water Motor Gong	An audible water motor gong sounds when water flows through the system, providing an additional alarm signal.	n/a
Pressure Gauges	Pressure gauges measure the water pressure in the system, enabling proper maintenance and ensuring the system is ready for operation.	$10-$15 each
Backflow Preventor	Backflow preventers prevent loss of water pressure in the sprinkle system	$500-$2,000 each
Waterflow Switches	Waterflow switches detect the flow of water in the system and activate alarms or alert monitoring services.	$150-$1,200each
Maintenance	Annual maintenance of the fire sprinkle system requires a visual inspection and testing.	$250-$1,000/Yr.
Source: Granger.com		

The cost of a fire sprinkler system will vary based on the type of sprinkler heads chosen, piping material and size, need for water tanks, operating pumps, backflow preventers, and other components. Table 2.9 reviews the cost of building a new residential home with and without a wet fire sprinkler system by region in New York State.

The **estimated cost to purchase and install a wet fire sprinkler system** in a new residential home in New York State will range from $7.73 to $9.17 (excluding NYC). Potential additional costs such as permits, storage tanks, pumps, and more will raise that cost **from $9.68 to $11.76**. Maintenance of the fire sprinkler system is estimated to cost at least **$250 or higher annually.**

Table 2.9 reviews the cost of building a new residential home with and without a wet fire sprinkler system by region in New York State.

In cold climates, **fire sprinkler systems become vulnerable to freezing**, making them less effective and responsive and increasing the risk of severe water damage from bursting pipes[46,47]. Winterizing these systems is critical, adding to the annual maintenance cost. **Cold weather can cause your fire protection system to cease functioning or cause significant water damage.**

Table 2.9 Estimated Cost to Build New Home and Fire Sprinkler System in New York State

		Albany	Syracuse	Rochester	White Plain	Hicksville	Utica	NYC	Watertown	Binghamton	Buffalo	NYS Average
New Single-Family SF		**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**
Grand Total[1]		**602,871**	**602,871**	**607,495**	**709,699**	**738,621**	**578,090**	**826,615**	**597,876**	**597,876**	**651,208**	**651,322**
With Sprinklers[2]		622,757	622,757	627,516	733,078	762,941	597,170	853,848	617,584	617,584	672,663	672,790
Sprinklers $$[2]		**19,886**	**19,886**	**20,021**	**23,379**	**24,320**	**19,080**	**27,233**	**19,708**	**19,708**	**21,455**	**21,468**
Cost per square foot (no-Sprinklers)		236.42	236.42	238.23	278.31	289.66	226.70	324.16	234.46	234.46	255.38	255.42
Cost per square foot (w/Sprinklers)		**244.22**	**244.22**	**246.08**	**287.48**	**299.19**	**234.18**	**334.84**	**242.19**	**242.19**	**263.79**	**263.84**
Sprinkler cost per SF		**7.80**	**7.80**	**7.85**	**9.17**	**9.54**	**7.48**	**10.68**	**7.73**	**7.73**	**8.41**	**8.42**
Other potential Sprinkler costs[3]												
Permits[4]	0.075%	467	467	471	550	572	448	640	463	463	504	505
Water Supply Storage[5]	12.50%	2,486	2,486	2,503	2,922	3,040	2,385	3,404	2,463	2,463	2,682	2,683
Water Pump[6]	700	700	700	700	700	700	700	700	700	700	700	700
Backflow Preventers	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350
Maintenance per Year	250-500											
Estimated Other Cost		**5,003**	**5,003**	**5,023**	**5,522**	**5,662**	**4,883**	**6,094**	**4,977**	**4,977**	**5,236**	**5,238**
$/sf		**1.96**	**1.96**	**1.97**	**2.17**	**2.22**	**1.91**	**2.39**	**1.95**	**1.95**	**2.05**	**2.05**
Estimated total cost of Sprinkler System		**24,889**	**24,889**	**25,045**	**28,901**	**29,982**	**23,963**	**33,327**	**24,684**	**24,684**	**26,692**	**26,706**
$/sf		**9.76**	**9.76**	**9.82**	**11.33**	**11.76**	**9.40**	**13.07**	**9.68**	**9.68**	**10.47**	**10.47**

1. *The estimate for the construction of a new home is based on information from Cost To Build.net for the select cities in the different regions of New York State. The assumptions for the proposed new home are 2550sf, 3 bedrooms, 2-story structure, full basement, 450sf garage, rear deck, 2 full bathrooms, average finishings and flooring, 6/12 roof, and smoke alarms included.*
2. *Fire Sprinkler Cost assumes water supply is available in the municipality with sufficient pressure.*
3. *Other Potential Costs are estimated costs.*
4. *Permits as required by a municipality*
5. *Water Supply Storage is for 300–400-gallon containers to provide 8-10 minutes of water to the fire sprinkler system.*
6. *Water Pump 15-40 gallons per minute to supply fire sprinkler system*

5. CONSTRUCTION MATERIALS AND BUILDING CODES

Construction materials and building codes have evolved over the past 100 years, impacting fire safety in the United States and New York State. This evolution has created safer, healthier, and more energy-efficient housing. Many of the fire risks associated with older housing have been mitigated, but new challenges have also emerged.

The use of lead paints, asbestos, and other toxins in housing has been stopped. Homes have become more energy-efficient with improved insulation, roofing, and windows. That effort to increase energy efficiency has led homes to need mechanical air exchangers to

maintain air quality. Greater use of engineered materials has strived to keep homes affordable and improve structural integrity. **The key takeaways are:**

- As material changes, risks such as asbestos and lead are limited, and new dangers emerge, such as toxic gases from plastic and other materials.
- Airtight buildings present risk and require air exchangers and ventilation.
- **Centralized heating systems offer the risk of carbon monoxide poisoning, which can be recognized with carbon monoxide detectors and not fire sprinkler systems.**

The history of building codes in the United States dates back to the 1600's in Boston. The "Building Acts" prohibited the use of combustible materials in building homes[55]. Modern building codes were developed with the creation of the National Board of Fire Underwriters (NBFU) in 1866[55]. In 1921, the Department of Commerce created the "Building Code Committee," with the International Conference of Building Officials (ICBO) publishing the first building codes.

The completed versions of the I-Codes are documents essentially lobbied to state and local governments for adoption as law. **Local jurisdictions have the authority to adopt the codes, reject specific provisions, or introduce more stringent versions.** The 2009 IRC included a controversial mandate for all new homes to include fire sprinkler systems. Many in the building industry saw this as an **expensive regulation not based on society's concerns or needs but on the desires of specific interested parties in the home building industry**. Over a decade later, most governments still reject this recommended mandate[55,56].

6. INTERVIEWS

Professionals connected with the review, design, construction, and building of new 1 and 2-family dwellings were contacted and interviewed. Participants were identified in all the regions of NYS except NYC. They were asked:

- What they thought about Automatic Fire Sprinkler Systems (AFSS),
- Were they aware that NYS State Law mandates builders to provide an estimate of installing an AFSS for all new construction,
- Do they know the costs of an ASFF,
- What they thought the impacts would be on communities and
- Do they know NYS potentially wants to make AFSS mandatory for all new 1 and 2-family dwellings?

Several new homeowners (constructing new homes) were interviewed, and they found the cost too high and unacceptable. They were unaware of the existing law and felt the choice should be theirs and not the State's.

Most architects and engineers are aware that the current state law requires quotes, but many of their clients reject AFSS when proposing new construction. They felt AFSS had merit, but it was a great overreach by the State to mandate it.
Municipalities varied by region. In more densely populated areas, AFSS could have a positive impact, but the cost of such systems would have a negative impact. They were unclear about the impact on them, water providers, and services. In the less populated areas of the State, there were questions of practicality, such as environmental concerns, water availability, and how such a mandate would impact them.

Fire departments understood the potential benefits but recognized the cost burden on homeowners and the water and environmental problems.

Builders and developers were the most outspoken group. They cite that the additional cost burden would drive potential purchasers to choose other avenues to bypass such a mandate. This mandate would harm their businesses.

When informed of the fire fatality facts, all the participants thought that more efforts should be made to ensure that there were working smoke and carbon monoxide alarms in one—and two-family dwellings, and that alone would save more lives.

7. ANALYSIS AND CONCLUSIONS

Residential fire sprinkler systems save lives in residential buildings[62]. This fact is well documented in multi-family structures. According to FEMA and USFA, fire sprinkler systems save firefighters' lives, reduce premature building collapse, and reduce property damage[62]. The **data supporting these conclusions is drawn primarily from multi-family properties**. Additionally, it is not mentioned that **most fire fatalities in 1 and 2-family units were structures built before 2000.**

Governor Hochul of New York State proclaimed May 13-19, 2024, as Home Fire Sprinkler Awareness Week in the State of New York[60]. The Resolution claims that 142 civilians died in home fires, the most in the nation; however, California and Texas had significantly more fatalities. In 2017, there were 142 fire fatalities; only 73 were in 1 and 2-family home structures, and when NYC is excluded, this drop to 50 fire fatalities, equal to 2.5 per million in New York State. Additionally, the majority of these fatalities were in residential structures built before 2000, and over 42% were seniors and children.

Any fire fatality is a tragedy. **Misrepresenting the facts creates a false premise for legislation and future building codes, ultimately costing consumers the right to homeownership and saddling them with higher taxes, fees, and building costs.**

Fire Fatality Facts in New York State:

- Between 2015 and 2019, there were **33 states with a higher rate of fire deaths per million people in the State than New York State**, including Maryland, Pennsylvania, North Carolina, and more (See Appendix for list)[65].
- Between 2019 and 2024, there was an average of 64 fire fatalities per year in NYS (excluding NYC) in 1 and 2-family units[15].
    - Averaging 3.2 fire fatalities per million people in NYS
- The majority of fire fatalities victims are the elderly, children, and low-income individuals and families.
    - **40% of the fatalities were seniors and children**
- All of the fire fatalities occurred in residential structures built before 2000, with an average dwelling built in 1932.
- **42% of residential fatal fires could not determine the presence of smoke alarms**[64].
- **33% of residential fatal fires reported smoke alarms**[64].
    - 16% present and operating
    - 7% present but didn't operate
- Fires in 1 and 2-family housing accounted for 87% of fatal residential fires in which no smoke alarm was present[64].
    - Multi-family housing accounted for just 7% of these fires because they are subject to more stringent code enforcement[64].

Cost of Residential Fire Sprinkler Systems

There is an ongoing debate over the cost of residential fire sprinkler systems. According to the NFPA cost assessment report (2023), the average cost of a fire sprinkler system per square foot ranges from **$1.35-1.61**. However, the report says it could be as high as $2.47 per square foot (for a dwelling with 8,500 square feet)[66]. Other sources such as the American Fire Sprinkler Association, NFSA, Homeguide.com, Angie, and more represent the cost of such a system to range between **$1.35 to $3.00** per square for a 1 and 2-unit residences.

The costs represented by NFSA, AFSA, and other sources do not explain what is included in the costs.

According to builders and national cost estimating databases, the average cost to install an automatic fire sprinkler system (in New York State and excluding New York City) will range from **$7.73 to $9.54** per square foot for a new single-family home with 2,550 square feet **($19,708 to $23,379)**. Subject to the location of the water supply and local fees, that cost can rise from **$9.68 to $11.76** per square foot **($24,684 to $29,982)**.

Consumers can expect to incur additional costs beyond the basic fire sprinkler system, including but not limited to:

- Permits for fire sprinkler systems by local municipalities and water supply entities,
- Water storage storage onsite to supply water for at least 10 minutes,
- Water pumps to deliver water to the fire sprinklers,
- Backflow preventers,
- Switching and monitoring devices,
- System maintenance and testing,
- And more.

Environment Factors

According to the National Weather Service, all of New York is subject to cold weather and temperatures below 40 degrees. Upstate New York will experience temperatures below 40 degrees for 6-8 months of the year and downstate for 3-4 months. Cold weather and temperature make fire sprinkler systems vulnerable.

Fire sprinkler systems are vulnerable to freezing conditions, making the system less effective and increasing the risk of severe water damage from bursting pipes.[46]

The areas of most concern for frozen sprinkler systems are entryways, attics, skylights, floors, and entryways where the temperatures drop below 40 degrees.

Inflation and Affordability

In 2013, Governor Hochu announced a statewide strategy to address the housing crisis and her plan to build 800,000 new homes[67]. The plan calls for more affordable housing, focusing on rental units, workforce, and first-time buyers housing[67]. According to the consumer price index, prices in New York State are 16.94% higher today since 2020, peaking at 6.1% in 2022[68]. That is an average of 4% per year.

In New York State, there was a shortage of one and two-family units for sale in 2023. In every county in the State, there was a decline in homes for sale. Overall, the "Home for Sale" supply declined by 20% between 2022 and 2023[70]. Sellers achieved an average of 101.3% of the asking price. Home prices (statewide) rose by 41.6% between 2019 and 2023[70]. Mortgage interest rates have risen by 293% since 2020[71]. In January 2021, mortgage interest rates were 2.65%, and they rose to a high of 7.79% in October 2023[71]. Based on the average cost of new homes in New York State, the rise in mortgage interest rates would increase the monthly payment by more than $1,800.

Inflation and the rise in mortgage interest rates are already making it difficult for buyers to purchase a new home. Requiring buyers of new homes to install fire sprinkler systems will mandate a 3-5% increase in the purchase price. Thus, purchasing a new home will be unattainable for many individuals and families.

As with other housing issues in New York State, these buyers will seek out other states to build their new homes.

Smoke Alarms

Since the 1970s, smoke alarm technologies have evolved and become widely used in residential homes. All building codes today require smoke alarms. Smoke alarms detect smoke and alert residents, and:

- Provide critical life safety in residential fire situations,
- Photoelectric smoke alarms are generally more responsive to fires that begin with a long period of smoldering,
- Combination smoke alarms can detect carbon monoxide (CO), the greatest threat to residents,
- Hardwire systems have battery backup and can be linked to 911, thus reducing response time,
- A wireless system is linked to the entire home and 911, and
- 33% of residential fatal fires reported smoke alarms. FEMA estimates saving 95%-98% of potential fire fatalities in residential homes with working smoke alarms.

Increasing the number of working smoke fire alarms in multi-family and single-family homes will save more lives.

Fire Sprinkler Systems

Fire sprinkler systems have a long history of use in industrial, commercial, and multi-family structures, especially when they work properly and are well-maintained. The use of these systems increased when the IRC became the only code from which municipalities could choose in 2000, and the three legacy organizations officially dissolved in 2002[55].

In **2009, the IRC included a controversial mandate for all new homes to include fire sprinkler systems. Many saw this as an expensive regulation not based on society's concerns or needs but on the desires of specific interested parties in the home building industry and politicians**. Over a decade later, most governments still reject this recommended mandate[55,56].

- Fire sprinkler systems are **expensive and add 3-5% to the cost of a new one and 2-family home**,
- **Fire sprinkler systems cannot detect smoke and carbon monoxide,**
- **Activated heads create more smoke**, making exits harder to find for occupants to exit the structure,
- **Fire sprinkler systems have system failures from:**
    - Inadequate water supplies in the systems
    - Insufficient pressure in the system:
        - Air
        - Water
    - Cold weather issues:
        - Freezing water in lines
        - Freezing valve openings
- **Requires annual maintenance servicing and system testing**

Conclusion

Mandating residential fire sprinkler systems for new one—and two-family homes is an unnecessary cost burden for individuals and families in New York State.

Buyers should have the right to choose and not to have New York State mandate residential fire sprinkler systems.

Special interest groups, the NFPA, and state leadership have used outdated information and inaccurately presented data to promote and mandate residential fire sprinkler systems. Tax credits, grants, and other financial incentives should be available to motivate new home buyers, as these are offered for commercial property owners as outlined in the CARES Act[72].

POPULATION AND HOUSING

POPULATION AND HOUSING

Identifying the population and housing characteristics in the New York State regions will provide essential data for this report.

POPULATION

As of 2023, New York is the nation's fourth-most populous state, behind California, Texas, and Florida. Growth has been distributed unevenly. The New York metropolitan area, Buffalo–Niagara Falls metropolitan area, Saratoga County, and Capital District are growing, while Rochester, Syracuse, and other population centers have been losing residents or have been stagnant for decades[10]. According to the United States Census Bureau (2020), the population of New York was 20,215,751, a 4.3% increase since 2010. A majority of the population (70%) lives around New York City, including the Hudson Valley and Long Island Regions[2].

Two-thirds of the state's population resides in the New York metropolitan area. New York City is the most populous city in the United States[2,10], with an estimated population of 8,622,467 in 2022[2]. More than twice as many people live in New York City as in the second-most populous city in the U.S. The map below shows the 10 economic regions of New York State.

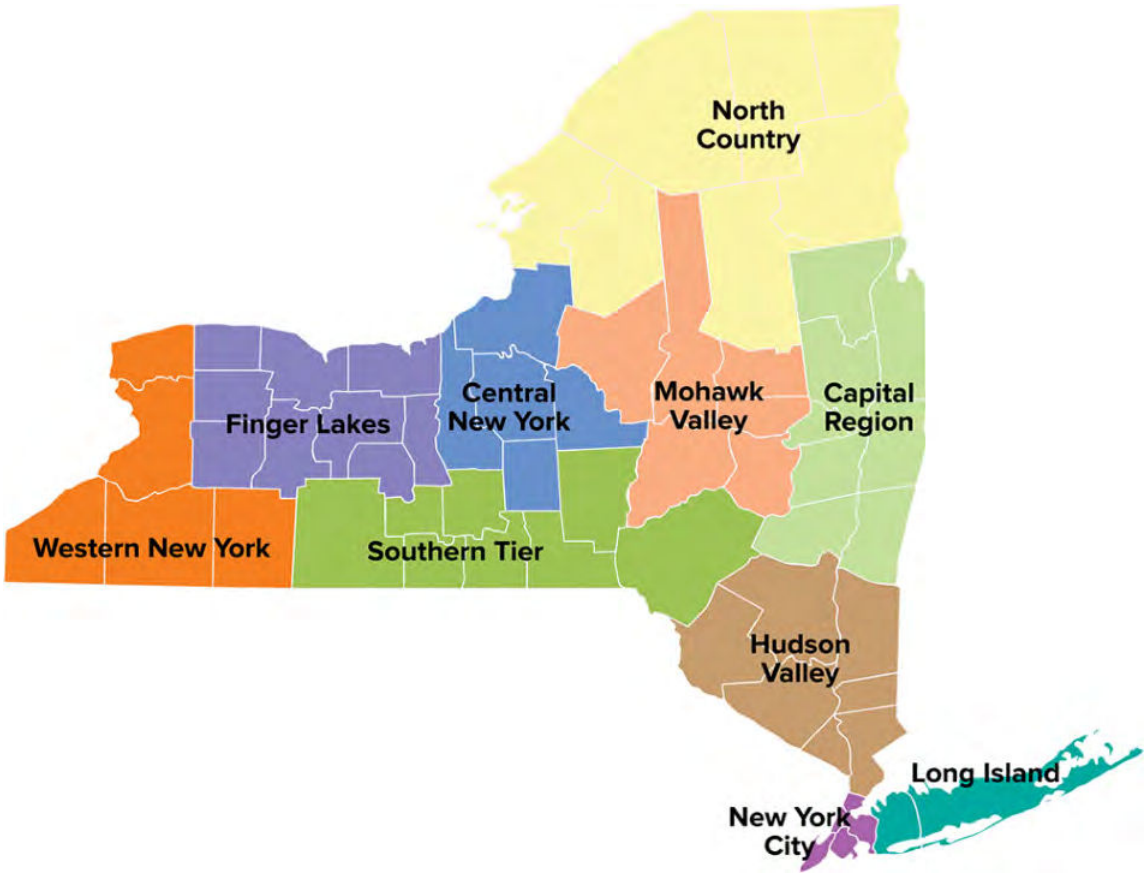


Table 3.1 New York State Economic Regions by Counties[1]										
Region		Counties								
1	**Western New York**	Allegany	Cattaraugus	Chautauqua	Erie	Niagara				
2	**Finger Lakes**	Genesee	Livingston	Monroe	Ontario	Orleans	Seneca	Wayne	Wyoming	Yates
3	**Southern Tier**	Broome	Chemung	Chenango	Delaware	Steuben	Tioga	Tompkins	Schuyler	
4	**Central New York**	Cayuga	Cortland	Madison	Onondaga	Oswego				
5	**North Country**	Clinton	Essex	Franklin	Hamilton	Jefferson	Lewis	St. Lawrence		
6	**Mohawk Valley**	Fulton	Herkimer	Montgomery	Oneida	Otsego	Schoharie			
7	**Capital**	Albany	Columbia	Greene	Rensselaer	Saratoga	Warren	Washington	Schenectady	
8	**Hudson Valley**	Dutchess	Orange	Putnam	Rockland	Sullivan	Ulster	Westchester		
9	**New York City**	Bronx	Kings	New York	Queens	Richmond	Nassau			
10	**Long Island**	Nassau	Suffolk							

1. Wikipedia: New York State (https://en.wikipedia.org/wiki/New_York_(state))

HOUSING

The total number of occupied housing units increased by 5.2% in New York State. Table 3.2 below compares the population, occupied, owner-occupied, and renter-occupied housing in the 10 economic regions of New York State.

Table 3.2 Housing Data by Regions in New York State 2022[1]										
NYS Regions	1 Western NY	2 Finger lakes	3 Southern Tier	4 Central NY	5 North Country	6 Mohawk Valley	7 Capital	8 Hudson Valley	9 New York City	10 Long Island
Population 2022	1,415,124	1,203,256	648,135	781,620	347,488	613,377	1,057,512	2,391,754	8,622,467	2,913,646
% Change 2010	-0.9%	0.6%	-3.6%	-0.9%	-2.3%	-1.1%	2.4%	5.3%	6.7%	3.6%
Occupied housing units	599,238	496,731	269,528	314,630	139,452	244,898	435,291	856,494	3,282,804	965,457
Owner-occupied housing units	**403,225**	**338,437**	**183,348**	**214,055**	**93,184**	**167,582**	**288,053**	**569,320**	**1,081,125**	**789,790**
% of all occupied housing units	67.3%	68.1%	66.8%	68.0%	66.8%	68.4%	66.2%	66.5%	32.9%	81.8%
% Change from 2010	-3.4%	3.3%	-1.3%	1.9%	0.0%	-1.5%	3.3%	3.7%	7.4%	3.0%
Avg household size owner unit	2.46	2.48	2.49	2.50	2.49	2.53	2.49	2.74	2.78	3.07
Renter-occupied housing units	**196,013**	**158,294**	**46,268**	**100,575**	**46,268**	**77,316**	**147,238**	**287,174**	**2,201,679**	**175,667**
% of All occupied housing units	32.7%	31.9%	33.2%	32.0%	33.2%	31.6%	33.8%	33.5%	67.1%	18.2%
% Change from 2010	-6.4%	13.7%	3.9%	4.7%	6.5%	2.9%	9.0%	10.0%	7.9%	2.3%
Avg household size renter unit	2.09	2.05	2.05	2.09	2.16	2.17	2.02	2.52	2.45	2.56
All Vacant Housing Units	**69,814**	**46,857**	**49,240**	**39,427**	**49,581**	**44,497**	**78,308**	**83,733**	**337,970**	**90,502**

1. Source: U.S. Census 2010-2022

A. Units in Housing Structure

This study focuses on one-unit (with and without detached garages) and two-unit structures. In New York State, 56.7% of all structures are one- and two-unit. See Table 3.3 below for a breakdown by region in New York State.

Table 3.3 Units in Housing Structures by Regions in New York State 2022[1]										
NYS Regions	1 Western NY	2 Finger lakes	3 Southern Tier	4 Central NY	5 North Country	6 Mohawk Valley	7 Capital	8 Hudson Valley	9 New York City	10 Long Island
Housing Units	**669,052**	**543,588**	**318,768**	**354,057**	**189,033**	**289,395**	**513,599**	**940,227**	**3,620,774**	**1,055,959**
1-unit, detached	62.5%	65.7%	64.0%	65.2%	66.9%	63.9%	61.0%	55.9%	9.2%	78.3%
1-unit, attached	2.8%	5.0%	1.8%	3.0%	2.9%	1.6%	3.9%	6.2%	7.1%	4.5%
2 units	14.3%	6.1%	8.7%	7.3%	5.0%	12.3%	9.6%	6.7%	12.5%	4.3%
3 or 4 units	5.4%	5.7%	5.2%	5.1%	6.2%	6.1%	7.1%	6.6%	9.1%	2.0%
5 to 9 units	4.3%	5.4%	4.2%	4.3%	3.7%	3.4%	4.6%	5.2%	6.6%	2.0%
10 to 19 units	1.9%	2.2%	2.3%	3.5%	1.6%	2.0%	3.0%	3.9%	6.5%	2.3%
20 or more units	5.4%	6.1%	4.5%	6.7%	3.1%	4.9%	5.9%	13.5%	48.7%	5.8%
Mobile home	3.4%	3.7%	9.2%	4.7%	10.6%	5.7%	4.7%	1.9%	0.1%	0.8%
Boat, RV, van, etc.	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% of 1-2 units	**79.6%**	**76.8%**	**74.5%**	**75.6%**	**74.8%**	**77.9%**	**74.6%**	**68.8%**	**28.9%**	**87.0%**

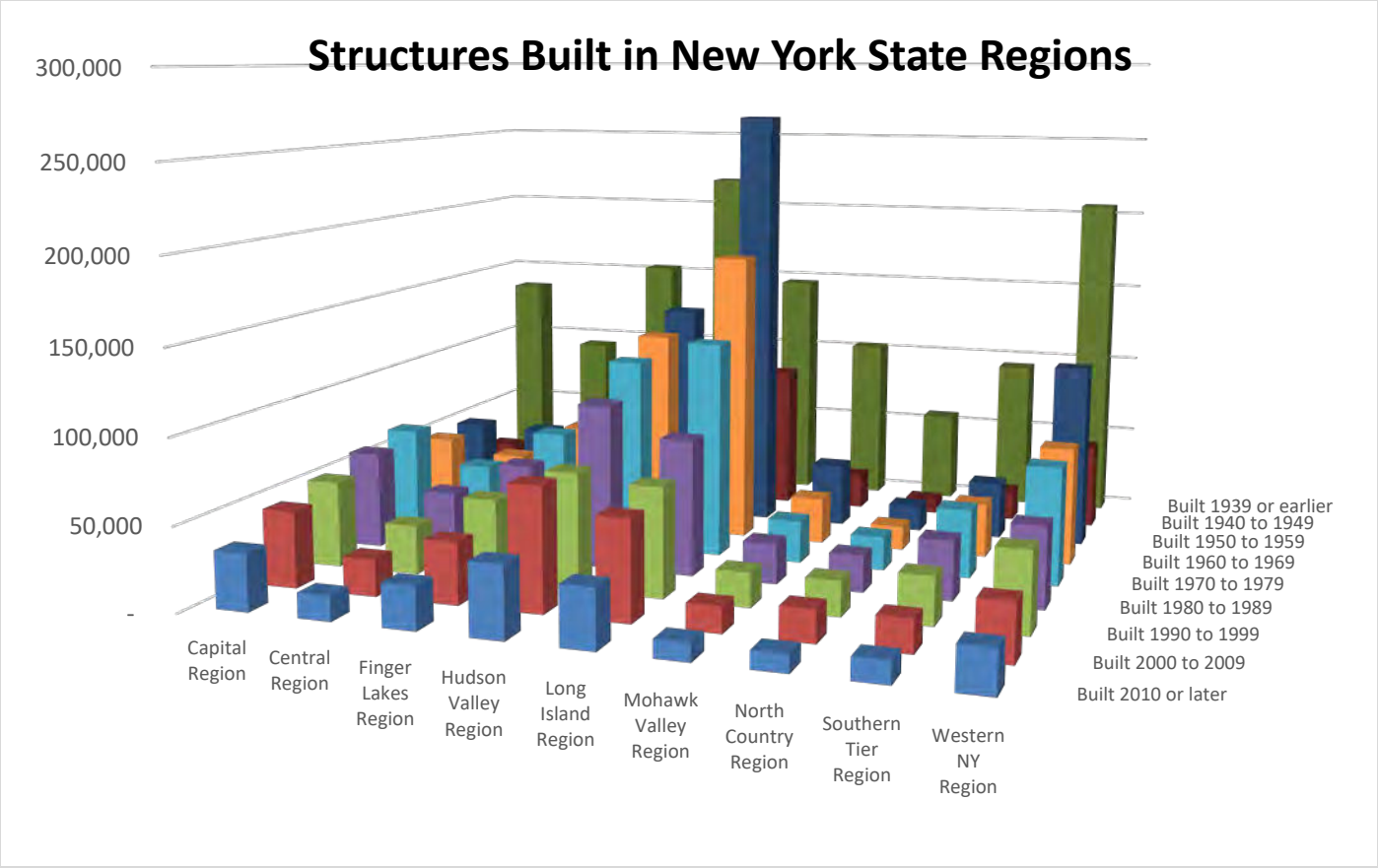
1. Source: U.S. Census 2010-2022

B. Year Housing Structure Built

In New York State, **89% of all housing structures were built before 2000,** 75.3% before 1980, and 65.5% built before 1970. Table 3.4 below compares the structures built by region in New York State.

Table 3.4 Housing Structure Year Built by Regions in New York State 2022[1]										
NYS Regions	1 Western NY	2 Finger lakes	3 Southern Tier	4 Central NY	5 North Country	6 Mohawk Valley	7 Capital	8 Hudson Valley	9 New York City	10 Long Island
Specified units	669,052	543,588	318,768	354,057	189,033	289,395	513,599	940,227	3,620,774	1,055,959
Built 2010 or later	3.7%	4.7%	4.0%	4.1%	5.5%	3.7%	6.6%	4.5%	5.0%	3.3%
Built 2000 to 2009	5.1%	6.8%	6.1%	6.3%	10.1%	5.4%	8.9%	7.8%	5.4%	5.7%
Built 1990 to 1999	7.2%	9.1%	9.0%	8.4%	11.1%	7.1%	10.1%	7.4%	3.8%	6.2%
Built 1980 to 1989	7.3%	10.8%	11.1%	10.8%	11.6%	8.5%	11.5%	10.6%	5.0%	7.8%
Built 1970 to 1979	10.6%	12.7%	13.0%	12.5%	10.8%	8.9%	12.4%	12.5%	6.9%	12.5%
Built 1960 to 1969	10.7%	11.6%	10.4%	11.5%	7.7%	9.8%	9.4%	13.5%	12.4%	17.0%
Built 1950 to 1959	16.8%	10.9%	10.9%	13.7%	8.4%	13.4%	9.6%	14.5%	12.8%	25.2%
Built 1940 to 1949	7.8%	5.2%	5.9%	6.2%	4.8%	7.6%	4.9%	5.9%	9.5%	8.5%
Built 1939 or earlier	30.8%	28.2%	29.6%	26.5%	29.9%	35.7%	26.4%	23.2%	39.2%	13.9%
% Built before 2000	**91.2%**	**88.5%**	**89.9%**	**89.6%**	**84.4%**	**90.9%**	**84.4%**	**87.6%**	**89.5%**	**91.0%**
% Built before 1980	66.1%	55.9%	56.8%	58.0%	50.9%	66.4%	50.4%	57.1%	73.9%	64.5%
% Built before 1970	55.4%	44.3%	46.4%	46.4%	43.2%	56.7%	40.9%	43.6%	61.6%	47.6%

1. Source: U.S. Census 2010-2022



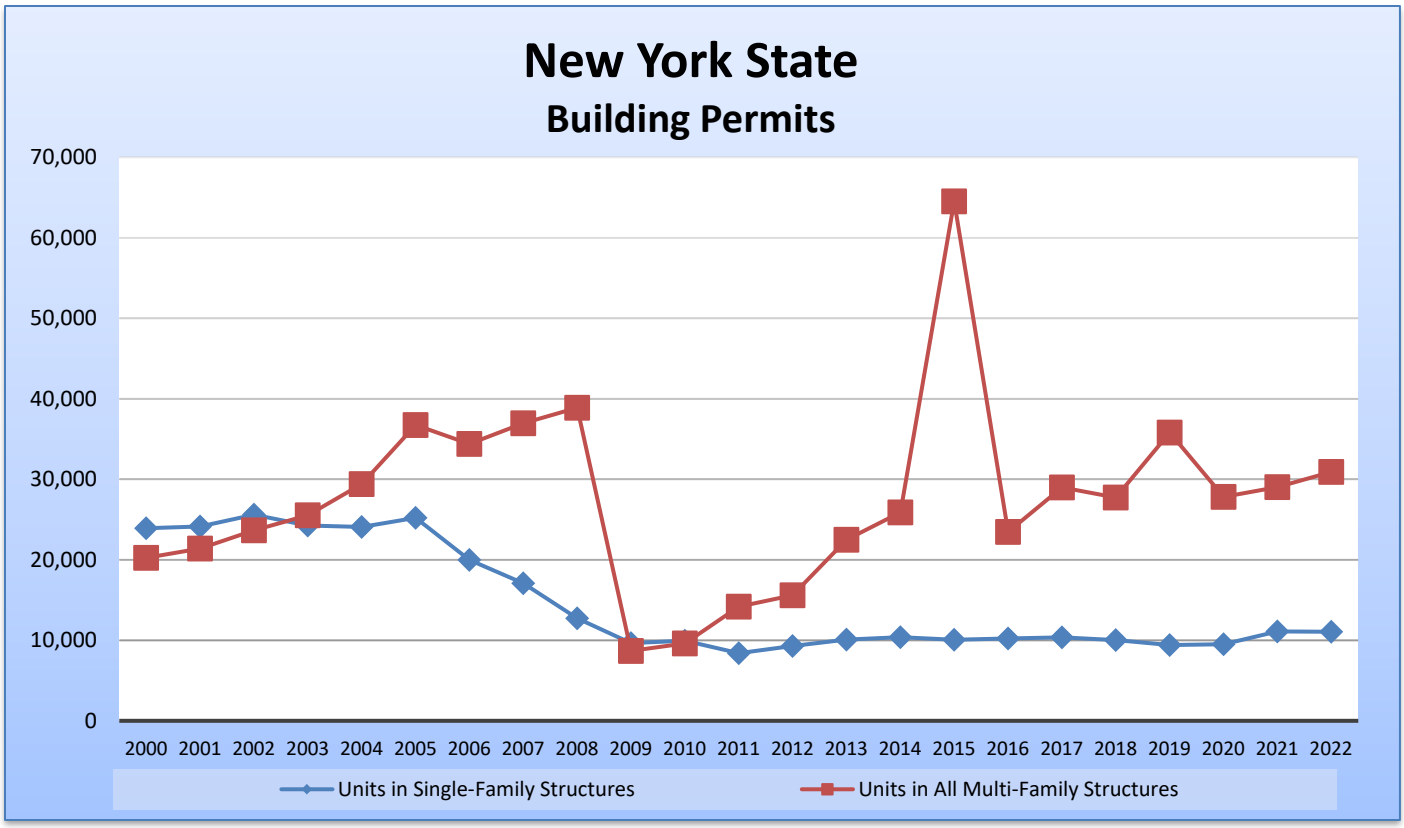
C. Building Permits

In New York State, single-family permits declined between 2005 and 2010, and since 2011, building permits have leveled off. Multi-family permits dropped in 2008 and grew to their highest level in 2015. They continue to outperform single-family permits through 2020. Table 3.5 shows building permits between 2013 and 2022 by structure type.

Table 3.5 Housing Unit Building Permits for New York State

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Units	32,593	36,297	74,597	33,701	39,348	37,776	45,217	37,324	40,135	41,972
Units in Single-Family Structures	10,090	10,397	10,061	10,233	10,359	10,031	9,410	9,510	11,099	11,057
Units in All Multi-Family Structures	22,503	25,900	64,536	23,468	28,989	27,745	35,807	27,814	29,036	30,915
Units in 2-unit Multi-Family Structures	1,196	1,138	1,244	1,256	1,392	1,136	1,086	958	908	728
Units in 3- and 4-unit Multi-Family Structures	896	1,052	1,186	1,055	923	795	705	489	618	529
Units in 5+ Unit Multi-Family Structures	20,411	23,710	62,106	21,157	26,674	25,814	34,016	26,367	27,510	29,658
Total SF and 2-unit MF units	11,286	11,535	11,305	11,489	11,751	11,167	10,496	10,468	12,007	11,785
% of total Permits	34.6%	31.8%	15.2%	34.1%	29.9%	29.6%	23.2%	28.0%	29.9%	28.1%

Source: HUD Building Permit Database



D. Residential Home Values

According to the New York Association of Realtors, the median sale price of a single-family home in New York State in 2023 was $382,500, up 6.1% from 2022[11]. The average sale price in the first quarter of 2024 was $383,500, up 6.2% from 2022. The median home value in New York State in 2022 was $253,185, up 33% since 2010. (See Section 3 of this report). Table 3.6 below shows the median values and median mortgages in the regions of New York.

Table 3.6 Home Values by Regions in New York State

	Region	1 Western New York Region	2 Finger Lakes Region	3 Southern Tier Region	4 Central New York Region	5 North Country Region	6 Mohawk Valley Region	7 Capital Region	8 Hudson Valley Region	9 New York City Region	10 Long Island Region
Median Home Values	2010	87,600	107,300	110,325	103,520	119,057	111,483	174,600	359,471	542,960	456,050
	2022	133,940	156,889	155,975	154,900	162,700	155,617	230,750	394,971	757,100	562,300
	% Change	52.9%	46.2%	41.4%	49.6%	36.7%	39.6%	32.2%	9.9%	39.4%	23.3%
Median Mortgage	2010	1,107	1,230	1,175	1,221	1,164	1,205	1,440	2,330	2,484	2,874
	2022	1,289	1,443	1,441	1,471	1,410	1,439	1,738	2,762	3,026	3,409
	% Change	16.5%	17.4%	22.6%	20.5%	21.1%	19.4%	20.7%	18.5%	21.8%	18.6%

Source: U.S. Census 2010-2022

FIRE FATALITIES

FIRE FATALITIES

Fire Fatalities in the United States

The United States has made remarkable progress in fire safety (residential and commercial) since 1980, witnessing decreased fires and fire-related deaths. This positive trend can be attributed to various factors, including improved building codes, enhanced fire suppression systems, increased awareness, and better fire prevention strategies.

The NFPA report, a crucial tool in understanding fire trends, was released to provide a comprehensive and reliable data source. It underscores the increase in reported home fire incidents and related fatalities, underscoring the need to promote fire prevention, education, and preparedness efforts. The report also brings to light the alarming increase in the rate of injuries and deaths in reported home fires since 1980[14].

> According to the report, the rate of injury and death in reported home fires is higher than in 1980. While improvements have been made in fire prevention and safety measures, the data reveals that these efforts have not been sufficient to control the rising casualties. The estimate of total fires in 2021 was 55% lower than in 1980, while fire death and injury estimates were 42% and 44% lower, respectively, over the same period. In 2021, local fire departments, including departments protecting towns, townships, cities, and counties, responded to an estimated 1,353,500 fires in the U.S.[14] These fires caused an estimated 3,800 civilian deaths, 14,700 civilian injuries, and $15.9 billion in direct property damage. Meanwhile, direct property damage decreased by 30 percent compared to the property damage in 2020[14]. 19% of all fires occurred in one- and two-family homes, and 5% of fires in apartments caused 16% of civilian fire deaths and 21% of injuries[15].

The fire issues are not uniform across the United States, with significant variations from region to region and state to state. These differences are influenced by climate, socioeconomic status, education, and demographic conditions. In 2017, for example, Alaska, Arkansas, South Dakota, and West Virginia had fire death rates that exceeded 20 deaths per million population. 23 states, primarily in the Southeast and Midwest, had death rates between 11.3 and 20 deaths per million population, and 21 states had fire death rates at or below the national fire death rate — 11.2 deaths per million population. Ten states with large populations accounted for 49% of the national total fire deaths[13]. This regional data is crucial for understanding the specific fire safety needs of different areas[13].

Cooking was the leading cause of residential building fires, and fires resulted in death and losses, at 52%. Heating (9%) and electrical malfunctions (6%) were the next major causes[13]. All three account for approximately 67% of residential fires. The other leading causes of residential fatal fires were other unintentional or careless actions, at 7%; causes under investigation, at 14%; intentional actions, at 4%; and smoking, at 2%[13].

There is a direct relationship between residential fires, older homes, and individuals and families with lower incomes[23]. Research indicates that older houses are often associated with fire injuries and fatalities. Older houses were built with more flammable and toxic materials, electric systems with lesser

capacities than today's standards, and fewer original electrical outlets. Thus, occupants compensate by overloading outlets and creating a potential fire hazard[23]. The fire literature reports that residential dwellings have a limited life span that decreases with time and maintenance. Electric system failures caused by deteriorating wiring and equipment in older buildings increase the fire risk by 200%. Older houses may have other features placing them at risk for fires, including substandard appliances, faulty heating systems leading to using space heaters, lack of compliance with building and/or sanitary codes, and narrow stairwells, making escape more difficult[23]. Carbon monoxide poses the greatest threat to civilians and firefighters in residential structure fires, along with heat and oxygen deprivation[22].

According to FEMA, between 2018 and 2020, 79% of fatal fires occurred in residential buildings, both one- and two-family dwellings[16]. Smoke alarms were reported as present in 33% of residential fatal fires, and 44% were present in residential non-fatal fires[16]. In 25% of residential fatal fires, there were no smoke alarms present[16,] and in 43% of these fire fatalities, firefighters could not determine if a smoke alarm was present[16].

According to a study by Gilbert and Butry (2017), most fire fatalities are associated with frailty. Older people and young children are more likely to die in a residential fire when compared to other population segments. Seniors 65 years and older make up 32% of fire fatalities and only represent 13% of the population, and young children under 5 years represent 7% of fire deaths and 6% of the population[17].

Fire Fatalities in New York State

In 2023, New York State's number of fire deaths per million (*FDM*) was 7.75; for single-family dwellings (1 and 2 units), it was 4.0; excluding NYC, it dropped to 3.2. See the Table 4.1 below for fatalities in NYS.

Table 4.1 New York State Fire Fatalities[1]

Description/Year	2024[2]	2023	2022	2021	2020	2019	2018	2017	2016	2015	Average
Total Fire Fatalities	48	155	144	122	114	126	142	142	120	129	124
Multi-family Unit 3+, Campers/R.V./Trailer	25	75	60	55	45	50	52	69	34	53	52
1- and 2-family	23	80	84	67	69	76	90	73	86	76	72
% of Total FF	*47.9%*	*51.6%*	*58.3%*	*54.9%*	*60.5%*	*60.3%*	*63.4%*	*51.4%*	*71.7%*	*58.9%*	*58.3%*
Fire Fatalities Excluding NYC Region 7	16	64	70	62	63						55.0
% of Total FF	*33.3%*	*41.3%*	*48.6%*	*50.8%*	*55.3%*						*44.3%*

1. *Source: FEMA (https://apps.usfa.fema.gov/civilian-fatalities/incident/reports)*
2. *2024-January through May 2024 (5 months)*

In 2023, there were 155 fire fatalities in NYS, and 51.6% (80) occurred in 1 and 2-family units, while 48.4% occurred in multi-family units (3 or more), campers, R.V.'s, and mobile homes (See Table 4.2 below). When NYC is excluded from the fire fatalities count, the total drops to 64 (41.3%).

Most fire fatalities in NYS's one- and two-family structures occurred in dwellings built before 2000. Over 40% of the fatalities were elderly and/or children under 14 years of age. Among the regions in NYS (excluding NYC), 89% of all structures in NYS were built before 2000, and 72% were built before 1980. There is a correlation between fire fatalities and the age of the residential structure. Seniors and lower-income individuals and families tend to live in older homes and are more vulnerable to home fires.

Table 4.2 NYS Fire Fatalities By Region and Year for 1 and 2 Family Dwellings[1]								
	2024[2]	**2023**	**2022**	**2021**	**2020**	**2019**	**Total**	**%**
NYS Population	**n/a**	19,994,379	19,994,379	20,114,745	19,514,849	19,752,319		
Capital Region	1	7	4	4	5	3	**24**	6.0%
Central Region	3	4	9	5	2	6	**29**	7.3%
Finger Lakes Region	3	6	8	8	5	12	**42**	10.6%
Hudson Valley Region	2	10	5	1	19	7	**44**	11.1%
Long Island Region	1	12	13	17	8	8	**59**	14.8%
Mohawk Valley Region	0	4	5	4	9	5	**27**	6.8%
NYC Region	**7**	**16**	**14**	**5**	**6**	**14**	**62**	15.6%
North Country Region	0	1	2	1	1	10	**15**	3.8%
Southern Tier Region	1	4	6	6	5	4	**26**	6.5%
Western NY Region	5	16	18	15	9	7	**70**	17.6%
Total Annually	**23**	**80**	**84**	**66**	**69**	**76**	**398**	**100.0%**
% of Total	*5.8%*	*20.1%*	*21.1%*	*16.6%*	*17.3%*	*19.1%*	*100.0%*	
Deaths per Million NYS	*n/a*	*4.00*	*4.20*	*3.28*	*3.54*	*3.85*	*3.77*	
Deaths per Million NYS Excluding NYC		*3.20*	*3.50*	*3.03*	*3.23*	*3.14*	*3.22*	

1. *Source: FEMA (https://apps.usfa.fema.gov/civilian-fatalities/incident/reports)*
2. *January through April 2024*

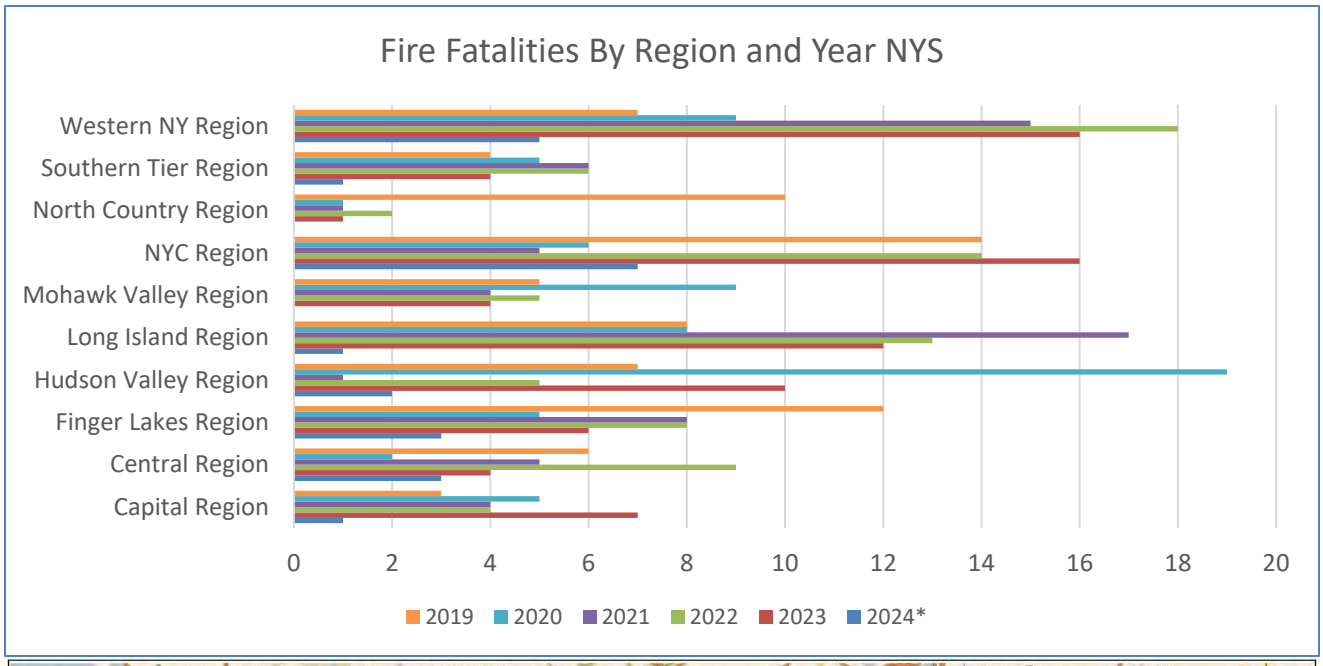
In NYS (except New York City), the identified causes of fires with fire fatalities are:

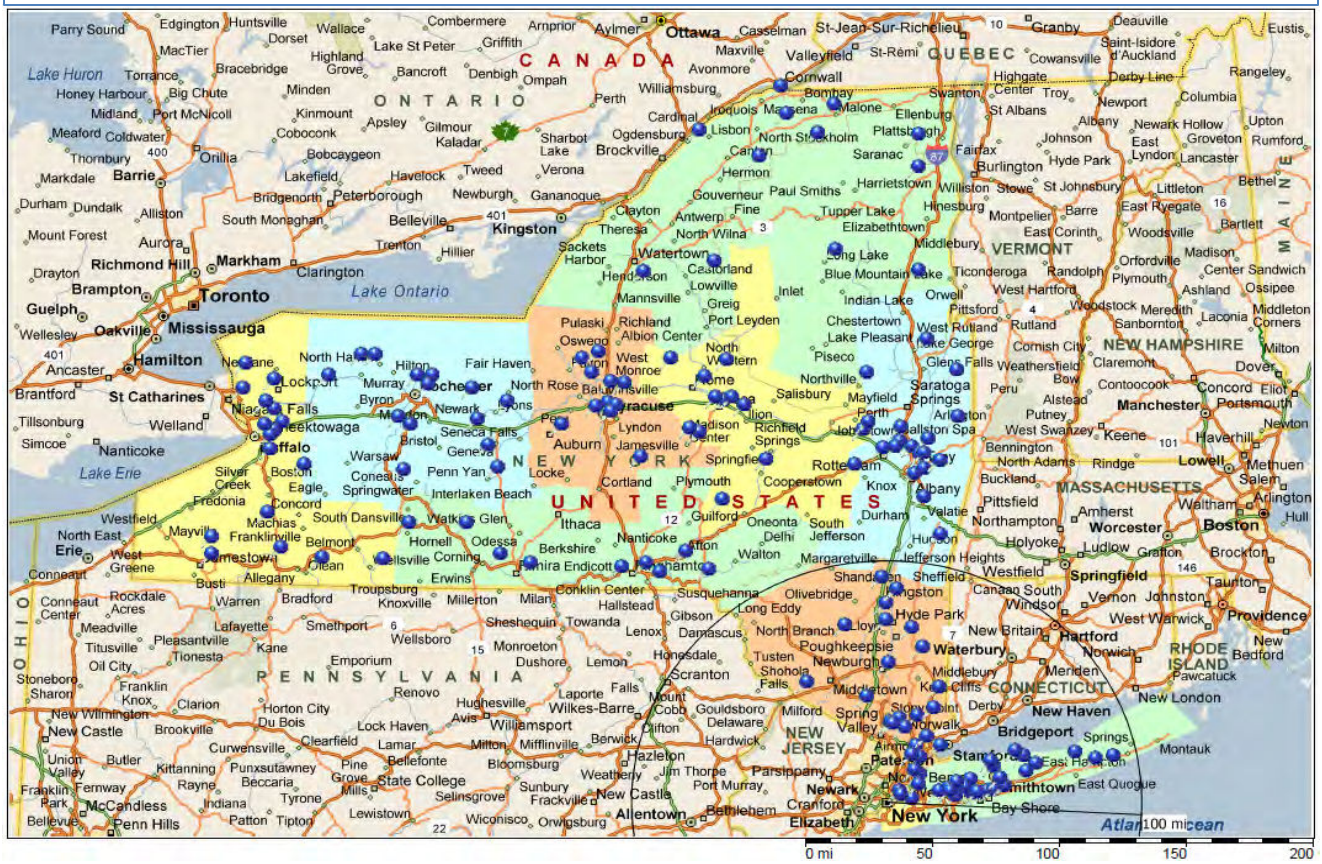
- 39.6% - Electrical malfunctions
- 33.3% - Smoking
- 14.6% - Heating/open flames
- 12.6% - Cooking

Fire Fatality Facts in New York State:

- Between 2015 and 2019, there were **33 states with a higher rate of fire deaths per million people in the state than New York State**, including Maryland, Pennsylvania, North Carolina, and more (See Appendix for list)[65].
- Between 2019 and 2024, there was an average of 64 fire fatalities per year in NYS (excluding NYC) in 1 and 2-family units[15].
    - Averaging 3.2 fire fatalities per million people in NYS
- The majority of fire fatality victims are the elderly, children, and low-income individuals and families
    - **40% of the fatalities were seniors and children**
- The majority of fire fatalities occurred in residential structures built before 2000.
- Fires in one- and two-family housing accounted for 87% of fatal residential fires in which no smoke alarm was present[64].
    - Multi-family housing accounted for just 7% of these fires because they are subject to more stringent code enforcement[64].

The chart and map below show fire fatalities by region and year (2019-2024).





RESIDENTIAL FIRE ALARM and PROTECTION SYSTEMS

RESIDENTIAL FIRE ALARM AND PROTECTION SYSTEMS

For the purpose of this study, the discussion will focus on smoke detectors and sprinkler systems and technologies. A smoke detector is a device that senses smoke, heat, and carbon monoxide, typically as an indicator of fire[31]. A fire sprinkler system is an active fire protection method consisting of a water supply system providing adequate pressure and flow rate to a water distribution piping system to which fire sprinklers are connected[30].

HISTORY

The history of automatic fire alarms dates back to 1890, when Francis Upton (an associate of Thomas Edison) patented the first automatic electric fire alarm. Since then, technology for detecting heat and smoke has continuously improved, providing homeowners with increasingly reliable and adequate safety measures. This continuous improvement, which includes the development of a simple heat detector in 1955 and a stand-alone smoke detector in 1971, should instill confidence in readers about the safety measures available. These advancements have made fire alarm technology more effective and accessible, ensuring the safety of homeowners.

Donald Steele and Robert Emmark from Electro Signal Lab invented and patented the photoelectric (optical) smoke detector with light sensing in 1972. In 1995, the 10-year lithium-battery--powered smoke alarm was introduced, and the requirement to replace electronic smoke detectors every ten years was implemented. Between 1971 and 1976, there were several significant developments, including the replacement of cold-cathode tubes with solid-state electronics. This significantly reduced the detectors' cost and size and made it possible to monitor battery life. These detectors could also function with smaller amounts of radioactive source material in the ionization chamber, and the sensing chamber, and smoke detector enclosures were redesigned to make the operation more effective. Manufacturers often replace rechargeable batteries with 9V batteries and a plastic shell encasing the batteries for easy replacement[29].

The risk of dying in a residential fire is cut in half in houses with working smoke alarms and detectors. The NFPA reports 0.53 deaths per 100 fires in homes with working smoke detectors, compared to 1.18 deaths without them. Commercial and industrial installations usually have lower statistics since people are not sleeping there[29].

Fire sprinklers date back to the 1800s when Frederick Grinnell patented the automatic sprinkler system[30]. In the 1940s, sprinklers were used in commercial buildings, whose owners experienced less physical damage and reduced insurance costs. Over the years, fire sprinkler systems have become mandatory safety equipment for newly constructed commercial, multi-family, hospitals, schools, hotels, and other public spaces, as required by local building codes and enforcement. Sprinklers are now commonly installed in non-industrial buildings, including schools and multi-family residential premises[30]. National Fire Sprinkler Network has lobbied for greater use of this fire protection system[30].

The National Fire Protection Association (NFPA) recommends fire code standards nationwide. NFPA sets **the standards for technical aspects of sprinklers installed in the USA. Building codes specifying which buildings require sprinklers are left to local jurisdictions[30].**

However, some exceptions exist: 1990, the U.S. passed PL-101-391, better known as the Hotel and Motel Fire Safety Act of 1990. This law requires that any hotel, meeting hall, or similar institution that receives federal funds must meet fire and other safety requirements[30]. If building codes do not explicitly **mandate fire sprinklers, the code often makes installing them as an optional system highly advantageous. Most U.S. building codes allow for less expensive construction materials, larger floor area limitations, longer egress paths, and fewer fire-rated construction requirements in structures protected by fire sprinklers**. Thus, the cost of fire sprinkle materials is often decreased, saving money in the other aspects of the project compared to building a non-sprinklered structure[30]. However, other costs associated with these systems rise.

2011, Pennsylvania and California became the first U.S. states to require sprinkler systems in all new residential construction. However, **Pennsylvania repealed the law later that same year**. Many municipalities now require residential sprinklers, even if they are not needed at the state level.

SMOKE ALARMS

The two most common smoke alarm technologies are ionization and photoelectric. Since the 1970s, smoke alarm technologies have saved millions of lives in the U.S. Smoke alarms have provided a means to increase fire safety in all residential dwellings nationwide at an affordable price. All smoke alarm types are designed to alert people to fire in time to get out safely. Here are some of the types of smoke alarm systems.

Ionization smoke alarms are generally more responsive to flaming fires. Ionization-type smoke alarms have a small amount of radioactive material between two electrically charged plates, which ionizes the air and causes current to flow between the plates. When smoke enters the chamber, it disrupts the flow of ions, thus reducing the flow of current and activating the alarm[33].

Photoelectric smoke alarms are generally more responsive to fires that begin with a long period of smoldering. How they work: Photoelectric-type alarms aim a light source into a sensing chamber at an angle away from the sensor. Smoke enters the chamber, reflecting light onto the light sensor and triggering the alarm[33].

Combination smoke alarms utilize ionization, photoelectric, and carbon monoxide detection. However, because house fires can be flaming or smoldering and one can't know beforehand what type of fire may start, the NFPA recommends buying combination smoke alarms. These employ the

latest technologies, including ionization, photoelectric, and carbon monoxide detection, in one device[32,33].

Hard Wire Smoke Alarms
These use the same technology as those with batteries, but they're powered by a circuit fed from your electrical panel. That means you don't have to worry about dead batteries as long as you have electricity. If you lose power, hard-wired smoke alarms have a backup battery that will beep if it ever needs replacing.

Hard-wired smoke detectors are more challenging to install in existing homes because each needs to be connected to the electrical circuit using a wiring system like Romex. However, they have an advantage over traditional battery-operated alarms because if one goes off, they all go off, alerting the entire home of danger.

Smart/Wireless Smoke Alarms.
Smart smoke detectors also exist; like hard-wired ones, they're interconnected to alert your entire home. Some systems, like Google Nest Protect, can send alerts to your phone and connect to an external monitoring system. Smart protection is affordable. These smart alarms (on the market) detect smoke, heat, carbon monoxide (CO), and other issues in one system[32]. Simple wireless smoke detectors use wireless tech to interconnect. They're easy to install and provide great protection at a reasonable price.

Each type of smoke alarm can provide critical life safety in residential fire situations. Home fatal fires, day or night, include a large number of smoldering fires and a large number of flaming fires. One cannot predict the type of fire in a residential home or when it will occur. Any smoke alarm technology must perform acceptably for both types of fire to provide early warning of fire at all times of the day or night, whether occupants are asleep or awake[33].

Most modern smoke alarms utilize these different types of smoke alarm technologies. For best protection, smoke and fire detection technologies (ionization, photoelectric, and carbon monoxide) should be used in homes.

SPRINKLER SYSTEMS
A fire sprinkler system is an active fire protection process consisting of water (or other alternative materials) supply providing sufficient pressure and flow rate to a distribution system (pipes) and fire sprinkler heads[30]. These systems are designed to protect lives and property from the damaging effects of fires[35].

Each sprinkler head is held closed by either a heat-sensitive glass bulb or a two-part metal link held together with fusible alloy. The sprinkler heads are heat-activated to prevent water from flowing unless the temperature around the sprinkler reaches the individual sprinkler head's design activation setting. In most wet-pipe sprinkler systems, each sprinkler activates independently[30].

A sprinkler activation will usually do less water damage than a fire department hose stream (which provides approximately 900 liters/min (250 U.S. gallons/min). A typical sprinkler used for industrial manufacturing occupancies discharges about 75–150 liters/min (20–40 U.S. gallons/min). However, a typical Early Suppression Fast Response (ESFR) sprinkler at a pressure of 50 psi (340 kPa) will discharge approximately 380 liters per minute (100 U.S. gal/min)[30].

Water in a fire sprinkler system must be pressurized, giving it enough force to spray outward in an arc so it can thoroughly douse a fire and prevent flames from reigniting. The 2019 edition of NFPA 13: Standard for the Installation of Sprinkler Systems requires a minimum operating pressure of 7 psi, or pounds per square inch (0.5 bar) for any sprinkler head (27.2.4.11.1).

In a dry sprinkler system, the activated sprinkler head causes the air pressure in the pipes to drop, opening a dry pipe valve near the system riser that holds back the water. The water floods the pipes and sprays through the open sprinkler, which can take up to 60 seconds.

TYPES

There are several types of fire sprinkler systems. Wet systems are the most common in industrial, commercial, retail, and residential structures.

Wet Pipe

Wet pipe systems are the most reliable because they are simple. The only operating components are the automatic sprinklers and (commonly, but not consistently) the automatic alarm check valve. An automatic water supply provides water under pressure to the system piping. Cold weather-tolerant sprinkler systems are more expensive[30].

Dry Pipe

Dry pipe systems are the second most common sprinkler system type. They are installed in spaces where the ambient temperature may be cold enough to freeze the water in a wet pipe system, making the system inoperable. In regions using NFPA regulations, wet pipe systems cannot be installed unless the ambient temperature range remains above 40 °F (4 °C)[30].

Water is not present in the piping until the system operates; instead, the piping is filled with dry air at a pressure below the water supply pressure. To prevent the larger water supply pressure from prematurely forcing water into the piping, the design of the dry pipe valve (a specialized type of check valve) results in a greater force on top of the check valve clapper by the use of a larger valve clapper area exposed to the piping air pressure, as compared to the higher water pressure but smaller clapper surface area[30]. Some property owners and building occupants may view dry pipe sprinklers as advantageous for protecting valuable collections and other water-sensitive areas. This perceived benefit is due to a fear that wet system piping may slowly leak water without attracting notice, while dry pipe systems should not fail in this manner[30].

Disadvantages of using dry pipe fire sprinkler systems include:

- Increased complexity: Dry pipe systems require additional control equipment and air pressure supply components, which increases system complexity. This puts a premium on proper maintenance, as this increase in system complexity results in an inherently less-reliable overall system as compared to a wet pipe system.
- Higher installation and maintenance costs: The added complexity impacts the overall dry-pipe installation cost and increases maintenance expenditure primarily due to added service labor costs.
- Lower design flexibility: Regulatory requirements limit individual dry-pipe systems' maximum permitted size (i.e., 750 gallons) unless additional components and design efforts are provided to limit the time from sprinkler activation to water discharge to under 60 seconds.
- Increased fire response time: Because the piping is empty when the sprinkler operates, there is an inherent time delay in delivering water to the sprinklers that have operated while the water travels from the riser to the sprinkler, partially filling the piping in the process.
- Increased corrosion potential: Following operation or testing, dry-pipe sprinkler system piping should be drained, but residual water collects in piping low spots, and moisture is retained in the atmosphere within the piping.

Deluge

Deluge systems are systems in which all sprinklers connected to the water piping system are open to remove the heat-sensing operating element. These systems are used for special hazards where rapid fire spread is a concern, as they simultaneously apply water over the entire hazard. Water is not present in the piping until the system operates. Because the sprinkler orifices are open, the piping is at atmospheric pressure. A "deluge valve" (a mechanically latched valve) is used in the water supply

connection to prevent the water supply pressure from forcing water into the piping. It is a non-resetting valve and stays open once tripped[30].

Pre-Action

Pre-action sprinkler systems are specialized for use in locations where accidental activation is especially undesirable, such as museums with rare artworks, manuscripts, books, and data centers for protecting computer equipment from accidental water discharge[30].

Foam Water

A foam water fire sprinkler system is a unique application system that discharges a mixture of water and low-expansion foam concentrate, resulting in a foam spray from the sprinkler. These systems are usually used in special hazard occupancies associated with high-challenge fires, such as flammable liquids or aircraft hangars[30].

Water Spray

"Water spray" systems are operationally identical to a deluge system, but the piping and discharge nozzle spray patterns are designed to protect a uniquely configured hazard, usually being three-dimensional components or equipment (i.e., as opposed to a deluge system, which is intended to cover the horizontal floor area of a room). The nozzles used may not be listed fire sprinklers and are usually selected for a specific spray pattern to conform to the three-dimensional nature of the hazard (e.g., typical spray patterns being oval, fan, full circle, narrow jet). Examples of hazards protected by water spray systems are electrical transformers containing oil for cooling or turbo-generator bearings. Water spray systems can also be used externally on the surfaces of tanks containing flammable liquids or gases (such as hydrogen). The water spray is intended to cool the tank and its contents to prevent tank rupture/explosion (BLEVE) and fire spread[30].

Water Mist

Water mist systems are used for special hazard applications. This type of system is typically used where water damage may be a concern or where water supplies are limited. NFPA 750 defines water mist as a water spray with a droplet size of "less than 1000 microns at the minimum operation pressure of the discharge nozzle". The droplet size can be controlled by adjusting the discharge pressure through a nozzle of a fixed orifice size. Water mist systems provide fire suppression mechanisms, including cooling, local flame oxygen reduction, and radiation blocking[30].

COST OF FIRE ALARM SYSTEMS

COST OF FIRE ALARM SYSTEMS

What is the cost of installing and maintaining smoke alarms and fire sprinkler systems?

The average size of an existing single-family home in the United States is 2,014 square feet, with a mean price per square foot of $203.61 ($410,070), and in New York State, it is 1,490 square feet, with a mean price per square foot of $421.49[37]. According to the National Association of Home Builders, the average size of a new single-family home in New York State is 2,561 square feet (2021), and Statista reports the average size is 2,522 (2023). Table 6.1 below estimates the average cost of a new single-family home (2024) with and without a fire sprinkler system.

Table 6.1 Cost to Build New Home in New York State

		Albany	Syracuse	Rochester	White Plain	Hicksville	Utica	NYC	Watertown	Binghamton	Buffalo	NYS Average
New Single-Family SF		**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**
Sub-Total		533,514	533,514	537,606	628,052	653,647	511,584	731,518	529,094	529,094	576,290	576,391
Overhead (7%)		37,346	37,346	37,632	43,964	45,755	35,811	51,206	37,037	37,037	40,340	40,347
Profit (6%)		32,011	32,011	32,256	37,683	39,219	30,695	43,891	31,746	31,746	34,577	34,583
Grand Total[1]		**602,871**	**602,871**	**607,495**	**709,699**	**738,621**	**578,090**	**826,615**	**597,876**	**597,876**	**651,208**	**651,322**
With Sprinklers[2]		622,757	622,757	627,516	733,078	762,941	597,170	853,848	617,584	617,584	672,663	672,790

1. *The estimate for constructing a new home is based on information from Cost To Build.net for the select cities in the different regions of New York State. The assumptions for the proposed new home are 2550sf, 3 bedrooms, 2-story structure, full basement, 450sf garage, rear deck, 2 full bathrooms, average finishings and flooring, 6/12 roof, and smoke alarms included.*
2. *Fire Sprinkler Cost assumes water supply is available in the municipality with sufficient pressure.*

SMOKE ALARMS

The National Fire Protection Association (NFPA) recommends at least one smoke alarm on each floor and every bedroom for one and two single-family dwellings. Keep in mind, new construction for one and two-unit homes isn't required by law to have smoke alarms in every room. When installing smoke detectors, it is important to make sure no obstruction is in front of the smoke detector, which could prevent the smoke from reaching its sensors[41]. For complete coverage of new construction starts, it is recommended to install smoke alarms on:

- On every level
- Inside every bedroom
- In every hall near sleeping areas (1 detector for every 40 feet)
- At the top of floor stairways
- At the bottom of basement stairways

Table 6.2 below shows the range of smoke alarms by type.

Table 6.2 Smoke Alarm Cost			
Type	Average price	Total installed cost* (per unit)	Details
Ionization	$10 – $40	$110 – $290	Detects flaming fires
Photoelectric	$20 – $70	$120 – $330	Detects smoldering fires
Dual sensor	$40 – $100+	$140 – $360+	Combines ionization and photoelectric detection
Smart	$50 – $150	$150 – $410+	Includes Wi-Fi, security service, & smart device connectivity
Combination smoke & CO detector	$40 – $100+	$140 – $360+	Combine a smoke alarm with a carbon monoxide alarm
Source: homeguide.com			

Most home builders surveyed follow these NFPA recommendations. The Table below estimates the cost of smoke alarms by type.

Table 6.3 Cost of Smoke Alarms For New Construction One and Two-Unit Homes						
	Smoke Alarms	Ionization	Photoelectric	Dual sensor	Smart	Combination smoke & CO detector
Floor	2	400	450	500	560	500
Bedroom	3	600	675	750	840	750
Hallways	2	400	450	500	560	500
Bathrooms	2	400	450	500	560	500
Attic	1	200	225	250	280	250
Basement	1	200	225	250	280	250
Garage	1	200	225	250	280	250
Total	**12**	**2,400**	**2,700**	**3,000**	**3,360**	**3,000**
Per Square Foot Cost		0.94	1.06	1.18	1.32	1.18
Sources: Smokedetectorexpertcom, homeguide.com, and nfpa.org						

Most new home construction for one and two-single-family homes have hard-wired systems with battery backups. The cost ranges from $0.94 to $1.18 per square foot. Other features such as smart/wireless, voice, lights, and weather alerts are available on smoke alarms and may add $0.10 to $0.35 per square foot cost[45]. The typical cost to replace a battery in a smoke alarm is $2-3. It is recommended that smoke alarms be upgraded or replaced every 10 years.

SPRINKLER SYSTEMS

According to the National Fire Sprinkler Association, wet residential fire sprinklers are estimated to cost **$1-$2** per square foot in new construction. What is not clearly defined is what this includes and does not include. According to several home builders and other national websites, including "Cost-To-Build," the estimated cost of fire sprinkler systems in new one- and two-unit single-family homes is **$7.73 to $13.07** per square foot in New York State.

See Table 6.4 below for a list of components for a wet fire sprinkle system.

Table 6.4 Components of A Wet Fire Sprinkler System

Component	Description	Cost Range
Sprinkler Heads	Mounted on pipes, these automatically release water when activated by heat, targeting the fire directly. The heads come in different types, such as pendant, upright, sidewall, and concealed.	$12-35 each
Pipes	The network of pipes distributes water throughout the building, connecting to the sprinkler heads.	Copper Pipe ½": $1.10 to $3.60/lf Ptec: $1.20-$2.30/lf
Water Supply	A reliable water supply source, such as a municipal water connection or a dedicated water storage tank, ensures an adequate water flow for the sprinkler system to operate effectively. In rural areas without public water supplies, a tank/reservoir is needed to provide sufficient water supply to power the sprinkler head (1-2) for at least 10+ minutes.	Water Storage Tank 300+ gallon: $1,200-$3,000+ each
Water Pumps	A water pump is often needed to maintain sufficient water supply to sprinkler heads 15-25+ gpm.	$600-$1,200 each
Valves and Fittings	Control valves regulate water flow, and check valves prevent backflow in certain system designs. Fittings, such as elbows and tees, facilitate pipe connections and changes in direction.	n/a
Alarm Devices	Smoke or heat detectors trigger alarms when they sense a fire, alerting occupants and initiating the sprinkler system, providing an early warning.	Included in new construction
Control Panel	The control panel monitors the system's status, displays alarms, and manages water flow. It allows manual intervention and communicates with other fire safety systems in the building.	$1,000+
Water Motor Gong	An audible water motor gong sounds when water flows through the system, providing an additional alarm signal.	n/a
Pressure Gauges	Pressure gauges measure the water pressure in the system, enabling proper maintenance and ensuring the system is ready for operation.	$10-$15 each
Backflow Preventor	Backflow preventers prevent loss of water pressure in the sprinkle system	$500-$2,000 each
Waterflow Switches	Waterflow switches detect the flow of water in the system and activate alarms or alert monitoring services.	$150-$1,200each
Maintenance	Annual maintenance of the fire sprinkle system requires a visual inspection and testing.	$250-$1,000/Yr.
Source: Granger.com		

The cost of a fire sprinkler system can vary based on the type of sprinkler heads chosen, such as traditional ceiling units or flush (no-show) units[41,42]. Some system maintenance for wet fire sprinkler systems can vary but is necessary for optimum performance. It costs $250-$1,200 per year, or 3¢-22¢ per square foot[35,42]. The essential maintenance program should included[48]:

- Visual inspection
- Inspect all valves
- Test waterflow devices
- Test all alarm systems
- Operate pumps
- Check water tank levels (if applicable)
- Check sprinkler heads

The majority of fire sprinkler systems use a public water main as the source of water supply. In rural and suburban areas without public

mains, fire sprinklers must rely on an on-site water source, such as an elevated tank, well, or storage tank with a pump[48]. In rural communities, where fire departments are farther away, and response times are often affected by the number of volunteers that can be assembled, a fire can destroy most of a residential home before the fire department ever arrives. Once the fire department arrives, water must be obtained from somewhere to fight the fire. Calculating the needed water depends on the installed residential unit size, use, contents, and fire protection systems[48]. These water storage facilities are an additional cost for residential fire sprinkler systems. Water connection to public water mains may require stand-by fees; this will vary by municipalities and public water providers[48].

Table 6.5 below estimates the cost of a new single-family homes with and without a fire sprinkler system. Other potential costs include permits, water supply storage, water pumps, and other potential costs.

Table 6.5 Estimated Cost to Build New Home and Fire Sprinkler System in New York State

		Albany	Syracuse	Rochester	White Plain	Hicksville	Utica	NYC	Watertown	Binghamton	Buffalo	NYS Average
New Single-Family SF		**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**	**2,550**
Grand Total[1]		**602,871**	**602,871**	**607,495**	**709,699**	**738,621**	**578,090**	**826,615**	**597,876**	**597,876**	**651,208**	**651,322**
With Sprinklers[2]		622,757	622,757	627,516	733,078	762,941	597,170	853,848	617,584	617,584	672,663	672,790
Sprinklers $$[2]		**19,886**	**19,886**	**20,021**	**23,379**	**24,320**	**19,080**	**27,233**	**19,708**	**19,708**	**21,455**	**21,468**
Cost per square foot (no-Sprinklers)		236.42	236.42	238.23	278.31	289.66	226.70	324.16	234.46	234.46	255.38	255.42
Cost per square foot (w/Sprinklers)		**244.22**	**244.22**	**246.08**	**287.48**	**299.19**	**234.18**	**334.84**	**242.19**	**242.19**	**263.79**	**263.84**
Sprinkler cost per SF		**7.80**	**7.80**	**7.85**	**9.17**	**9.54**	**7.48**	**10.68**	**7.73**	**7.73**	**8.41**	**8.42**
Other potential Sprinkler costs[3]												
Permits[4]	0.075%	467	467	471	550	572	448	640	463	463	504	505
Water Supply Storage[5]	12.50%	2,486	2,486	2,503	2,922	3,040	2,385	3,404	2,463	2,463	2,682	2,683
Water Pump[6]	700	700	700	700	700	700	700	700	700	700	700	700
Backflow Preventers	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350
Maintenance per Year	250-500											
Estimated Other Cost		**5,003**	**5,003**	**5,023**	**5,522**	**5,662**	**4,883**	**6,094**	**4,977**	**4,977**	**5,236**	**5,238**
$/sf		**1.96**	**1.96**	**1.97**	**2.17**	**2.22**	**1.91**	**2.39**	**1.95**	**1.95**	**2.05**	**2.05**
Estimated total cost Sprinkler System		**24,889**	**24,889**	**25,045**	**28,901**	**29,982**	**23,963**	**33,327**	**24,684**	**24,684**	**26,692**	**26,706**
$/sf		**9.76**	**9.76**	**9.82**	**11.33**	**11.76**	**9.40**	**13.07**	**9.68**	**9.68**	**10.47**	**10.47**

1. *The estimate for constructing a new home is based on information from Cost To Build.net for the select cities in the different regions of New York State. The assumptions for the proposed new home are 2550sf, 3 bedrooms, 2-story structure, full basement, 450sf garage, rear deck, 2 full bathrooms, average finishings and flooring, 6/12 roof, and smoke alarms included.*
2. *Fire Sprinkler Cost assumes water supply is available in the municipality with sufficient pressure.*
3. *Other Potential Costs are estimated costs.*
4. *Permits as required by a municipality*
5. *Water Supply Storage is for 300–400-gallon containers to provide 8-10 minutes of water to the fire sprinkler system.*
6. *Water Pump 15-40 gallons per minute to supply fire sprinkler system*

Environmental Factors

In cold climates, fire sprinkler systems become increasingly vulnerable to freezing. This makes fire protection systems less effective and responsive and increases the risk of severe water damage from bursting pipes[46,47]. Winterizing fire sprinkler systems is a critical service needed to reduce the chance of issues associated with damage to piping caused by freezing. Without checking your system, cold weather can cause your fire protection system to cease to function or fail and cause significant water damage.

The areas of most concern for frozen sprinkler systems are entryways, attics, skylights, floors, and entryways where temperatures drop below 40 degrees Fahrenheit. To prevent damage, it is important to have your heating system serviced annually and the insulation inspected, ensuring that it remains intact and that there are no leaks or blocked ventilation openings in the residence[47]. In order to mitigate cold weather, additional measures may include heating cold spaces, electronic monitoring, and additional inspection.

Life Span

Generally, a residential fire sprinkler system can last about 20 years or more. After 5 years, inspecting the system and its components is recommended. Sprinkler heads can fail from debris, corrosion, and painted cover plates [63]. Additionally, pipelines, connections, switches, pumps, and water tanks must be checked, and annual testing is necessary to protect the system from failure when needed.

CONSTRUCTION MATERIALS & BUILDING CODES

CONSTRUCTION MATERIALS AND BUILDING CODES

Construction materials and building codes have evolved and changed over the past 100 years, impacting fire safety in the United States and New York State. This evolution has created safer, healthier, and more energy-efficient housing. Many of the fire risks associated with older housing have been mitigated and, at the same time, have created new challenges. The following is a review of this evolution.

Residential Construction Materials

Buildings from the beginning of the 20th century are very different from those after World War II, as considerable changes in the style of houses and their construction took place. The very brief timeline below outlines the characteristics of buildings and how their construction has changed in the last century.

1900-1930s:

Residential houses often use local materials. These homes were not energy efficient by today's standards. Framing standards permitted balloon framing with no fire stops. Gas lighting and heating with coal were typical[50]. Finishing materials such as lead paint were used.

Walls: Most houses were built with solid external walls, on shallow brick or no foundations, typically using lime-based mortar. Damp courses were non-existent only gradually introduced during the 1920s.

Roofs: Pitched timber roofs were most common, sheltered with slates or clay tiles and no underfelt. No sarking felt or insulation and nail fatigue. Guttering and downpipes were usually made from cast iron.

Windows: Sash windows were the norm until the 1920s.

Ground Floor: Solid flooring were used for the kitchen and storage areas, and suspended timber flooring were used for further rooms and upper floors. Few working-class houses had separate bathrooms, relying on outside WCs instead. Coal fires throughout, no electrical installations, and gas lighting.

1930s-1940s:

Residential housing saw improved materiasl used in the construction of homes. Most homes were wood-framed with tongue and grove planks used for siding and roofs. Most homes had electrical services utilizing a ball and knob method. Heating was evolving from coal boilers to oil fuel boiler systems with radiators.

Walls: Cavity external walls became more common and were erected on wood or concrete foundations.

Roofs: Some houses had sarking felt or torching but no roof insulation and no ventilation—breathable roof membranes from 1930. Guttering and downpipes were usually cast iron.

Windows: Timber-hinged casement windows often had leaded/stained glass in top lights. Windows became larger, offering more light.

Ground Floor: timber flooring on concrete slab of truss strip foundations. Bathrooms were primarily on the ground floor, usually directly off the kitchen. Cast iron piping was used for water and sewer.

1945-1960s:

Post-World War II saw a housing boom and the growth of suburbia in the United States to meet the demand for inexpensive homes. Many of the home improvements resulted from improved technologies and materials developed during WWII.

Walls: Ceilings were often asbestos composition boards, fiberboards, and plasterboards from the 1960s. Non-traditional frame construction is clad with a variety of materials, including asbestos, steel, aluminum, concrete, and traditional brickwork. Fibre and plasterboards were used for walls and ceilings.

Roofs: No significant change, constructed from either timber or concrete, felt or asphalt covered, with parapet walls to the edges. Trussed roofs become more common, with pitches used in non-traditional constructions. Guttering and downpipes started using aluminum with plastic accessible by the late 1960s.

Windows: Galvanised metal windows had become very popular, as had timber casement windows and horizontal sliding sashes in aluminum towards the end of the period. Most windows were single-glazed.

Services: By the 1960s, municipal authorities, and energy companies started to offer water, sewer, and gas services to homes. Central heating systems used coal, gas, storage radiators, or warm air systems. While lead was still used for gas and water delivery, copper

pipework became more common—electrical services transitioned to plastic-coated wire and electric boxes capable of carrying greater loads.

1970s

In the 1970s, builders embraced a mix of traditional materials like wood paneling, brick, and stone alongside innovative solutions. The size of new homes grew in square footage, and more engineered wood products and precast concrete panels were integrated to enhance homes' structural integrity and durability. While there were some compromises on materials to achieve cost savings, the overall quality remained high.

Walls: The use of plywood on exterior walls and roofs grew. Fiberglass insulation in the wall and ceiling improved heating and cooling retention.

Roofs: Trussed roofs had become more common, with pitches used in non-traditional constructions. Asphalt shingles with felt papers increased. Gutters and downpipes used aluminum with plastic.

Windows: Double-glazed windows had become more popular, reducing heat loss from the environmental elements. The introduction of plastic window casing and features made windows more affordable.

Services: As housing starts rise, the availability of services increased.

These advancements enhanced the quality of construction and ensured homes were more sustainable in the long run, showcasing a balance between cost-effectiveness and environmental consciousness. Architects and builders employed robust construction methods and innovative material combinations to enhance the structural integrity of these homes. Communities began to mandate mitigation of asbestos and lead paint:

- Asbestos removal by professionals to prevent health hazards and ensure safety, and
- Lead-based paint encapsulation or removal to avoid lead exposure risks and maintain health

Residential stand-alone smoke alarms are widely used in homes and saved lives.

1980s

The residential architecture of the 1980s represents a unique period in the annals of housing construction, often marked by distinctive trends such as the spread of open-concept designs and the prevalence of split-level homes. However, the quality of houses built during this era is debated

among homeowners, builders, and architects[51]. After the oil crisis of the 1970s, there was much focus on energy conservation, improving insulation, and designing windows and doors to minimize drafts and heat loss.

Walls: The use of plywood on exterior walls and roofs grew. Fiberglass insulation in the wall and ceiling improved heating and cooling retention. Wall construction was designed for high insulation valuation and less air exchange. Vinyl Side was used widely.

Roofs: Trussed roofs had become more innovative and offer features such as vaulted ceilings and skylights. Asphalt shingles with felt papers increased. Gutters and downpipes used aluminum with plastic. Roof ventilation improved.

Windows: Double and triple-glazed windows had become more popular, reducing heat loss from the environmental elements. The introduction of plastic window casing and features made windows more affordable.

Energy-efficient features incorporated into 1980s homes included improved insulation materials, windows and doors designed to minimize drafts and heat loss, and central heating systems that gained popularity. Potential issues with 1980s homes included foundation problems, plumbing and electrical issues, and roofing and siding troubles, which are common issues that often arise with 1980s properties. Electrical services grew to meet the demands of homeowners for appliances and lighting with electric boxes capable of carrying greater loads (i.e., 200 AMP).

1990s-2000s

The residential architecture of the 1990s was a mix of new and older architectural styles and improved construction materials. New synthetic materials were being introduced, including ptech piping, foam insulations, and much more. Home sizes continued to grow, and so did the demand for services.

Walls: The use of particle plywood on exterior walls and roofs grew. Insulation in the wall and ceiling improved heating and cooling retention. Vinyl Side was used widely.

Roofs: Trussed roofs have become more innovative and offer vaulted ceilings, skylights, and venting features. Asphalt shingles with felt papers increased. Gutters and downpipes used aluminum with plastic.

Windows: Window sizes grew in response to changes in energy needs and building codes.

Residential Fire Sprinklers started being installed in homes with smoke alarms, which saved lives and reduced fire damage. These systems are costly.

2000-Present

The residential architecture of 2000 to the present reflects new technologies, materials, and a rapid rise in the cost of construction materials. This period is noted for larger kitchens and bathrooms with many amenities. Smart technologies have emerged in residential home building, including home security, energy management, home offices, and entertainment. As a result, electrical needs, coaxial cable, and other energy-demanding technologies drive the demand for services. Engineered construction materials continue to evolve, including metal studs, heated floors, LED lighting, finishing materials, and more.

Walls: The use of particle plywood on exterior walls and roofs grows. Insulation in the wall and ceiling improves heating and cooling retention. Vinyl Side and other synthetic materials are being widely used.

Roofs: Trussed roofs have become more innovative and offer vaulted ceilings, skylights, and venting features. Metals roofing materials are becoming more prevalent.

Windows: Window sizes grow in response to changes in energy needs and building codes.

Take-Aways

- Construction materials and technologies present an ever-changing fire risk.
- As material changes, risks such as asbestos and lead are limited, and new dangers emerge, such as toxic gases from plastic and other materials.
- Airtight buildings present risks and require air exchangers and ventilation.
- Centralized heating systems offer the risk of carbon monoxide poisoning, which can be recognized with CO detectors and not fire sprinkler systems.

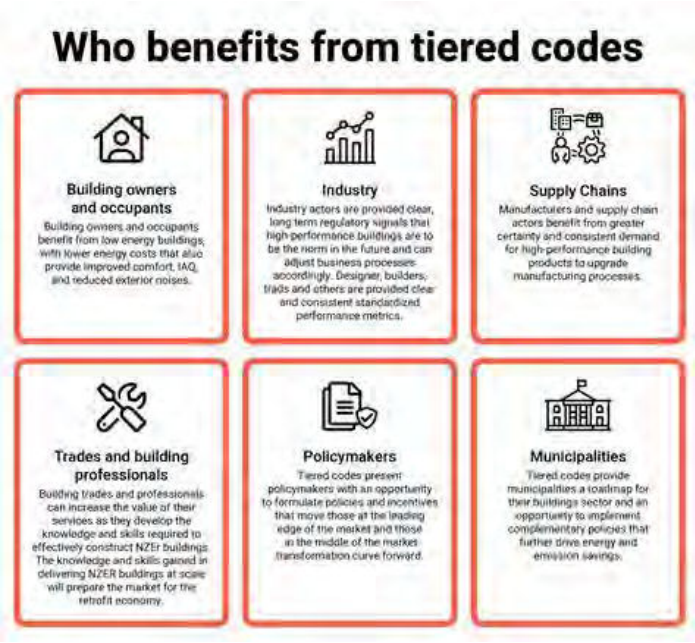
Building Codes

The history of building codes in the United States dates back to the 1600's in Boston. The "Building Acts" prohibited the use of combustible materials in building homes[55]. Modern building codes were developed with the creation of the National Board of Fire Underwriters (NBFU) in 1866[55]. In 1921, the Department of Commerce created the "Building Code Committee," with the International Conference of Building Officials (ICBO) publishing the first building code. Between 1930 and 1940, building codes became more efficient, including lumber span, nailing schedules, and more[55]. In 1942, the National Association of Home Builders was created.

The housing boom following WWII drove the demand for building codes and varied by state and community. The formation of the Council of American Building Officials (CABO) was perfect timing for the federal government to again play a significant role in influencing how homes would be constructed in the United States. With the energy crisis underway, the 1975 Energy Policy and Conservation Act enabled the Department of Energy to provide the necessary funding for CABO to develop a model energy code. By 1977, the Model Code for Energy Conservation was published. While some jurisdictions across the country did adopt it, this early energy code was not widely accepted. Energy provisions were not included in the CABO dwelling code directly, so a local government would have had to actively adopt the model energy code individually. **CABO continued to publish its One- and Two-Family Dwelling Code every three years, and in the 1995 edition**, an agreement was made to include the electrical provisions from the National Fire Protection Association's 1993 National Electrical Code (NEC)[55].

From 1971 to 1998, individual jurisdictions could still choose between codes published by ICBO, SBCCI, and BOCA or adopt CABO's One- and Two-Family Dwelling Code. However, by 2000, the International Residential Code (IRC) was the only code publication to choose from, and widespread adoption followed. In 2002, the three legacy organizations officially dissolved[55]. **The federal**

government still does not have direct authority over building codes, but it does influence the form of providing or withholding federal grants to states that reach or fail to reach certain thresholds of energy code adoption.



The completed versions of the I-Codes are documents essentially lobbied to state and local governments for adoption as law. **Local jurisdictions have the authority to adopt the codes, reject specific provisions, or introduce more stringent versions**, depending on the authority granted by the state government above them. Shortly after the publication of the first IRC, many municipalities began to believe that special interest groups were dominating the direction the codes. For example, the **2009 IRC included a controversial mandate for all new homes to include fire sprinkler systems. Many in the industry saw this as an expensive regulation not based on society's concerns or needs but on the desires of specific interested parties in the home building industry**. Over a decade later, most governments still reject this recommended mandate[55,56].

The construction industry is also complex and is constantly changing with new materials, economics, societal expectations, and human creativity. Building codes are intended to change alongside these variables. However, as stated in the preface of the original 1927 Uniform Building Code, "The code is not, and never will be, perfect."

Take-Aways

- Building Codes aim to create safe housing and improve public health.
  - Reduce fire risk and save lives
  - Manage housing growth
  - Set standard building quality

INTERVIEWS

INTERVIEWS

Interviews were conducted with homeowners, Architects, Engineers, Municipal, Builders/Develpers, and other professionals connected with new home construction. 63 respondents were contacted to be interviewed, and 32 actually responded. Anonymity was maintained with the respondents. The respondents were asked the following questions:

Q1. What are your thoughts on the use of fire sprinkler systems in new single-family construction today?

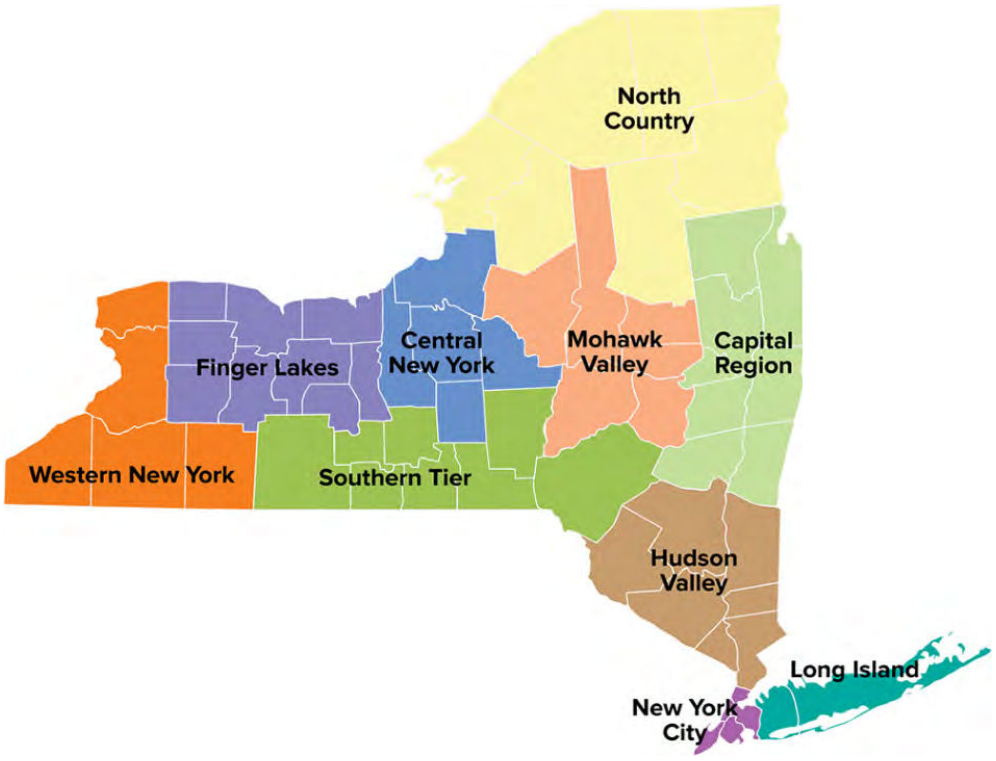
Q2. Are you aware that State Law (Bill 1381), approved by the governor in December 2021, requires builders to provide an estimate of the cost of installing an Automatic Fire Sprinkle System (AFSS) in 1 and 2-unit family dwellings?

Q3. Do you think AFSS should be mandated for 1 and 2-unit family dwellings?

Q4. Who do you think benefits from making AFSS mandatory? State, community, or homeowner?

Q5. Are you aware of the costs of an AFSS?

Q6. What do you believe would impact the home-builders, homeowners, and communities?



The respondents were randomly chosen from the different regions of New York State. The following is a summary of the interviews.

Homeowners

Several new homeowners (constructing new homes) were interviewed, and they found the cost too high and unacceptable. They were unaware of the existing law and felt the choice should be theirs and not the State's.

Architects and Engineers

Most architects and engineers are aware that the current state law requires quotes, but many of their clients rejected AFSS when proposing new construction. They felt AFSS had merit, but it was a great overreach by the State to mandate it.

Architects involved with residential construction saw value in fire sprinkler systems when there is high-density housing. However, in 1 and 2 units, the opinions were split. They inquired whether these systems would be a stand-alone system or incorporated into the main water supply. They noted that each approach has costs and design impacts. They were aware of the IRC code from 2006 to 2009, and many were not in favor of mandates by the state.

Many engineers spoke about water supply availability, different system types, maintenance, and repairs. They also spoke about the impact of environmental conditions such as the cold and the mitigating solutions. While these complexities can be resolved, is the homeowner going to accept the costs?

Municipalities

Municipalities varied by region. In more densely populated areas, AFSS could have a positive impact, but the cost of such systems would have a negative impact. They were unclear about the impact on them, water providers, and services. In the less populated areas of the State, there were questions of practicality, such as environmental concerns, water availability, and how such a mandate would impact them. When asked whether permitting should be mandated, a minority of code enforcement officers were in favor, and the majority were not. In more rural areas, they felt it would be a negative impact. All were unsure about requiring permits and whether there would be a need for an annual inspection, who would do it, and what it would cost.

Fire Departments

Fire departments understood the potential benefits but recognized the cost burden on homeowners and the water and environmental problems. Some firefighters have expressed concerns about residential fire sprinkler systems. Some opposed sprinkler mandates as too costly and more complex

than they purported to be. While the reasons some firefighters oppose the widespread adoption of residential sprinkler systems are not clear, one possibility is a concern that residential sprinkler mandates could make firefighters and the fire service less needed, thus reducing their tax-funded budgets. Firefighters spend a significant portion of their time responding to motor vehicle crashes and other emergency and non-emergency incidents unrelated to residential fires.

Builders and Developers

Builders and developers were the most outspoken group. They cite that the additional cost burden would drive potential purchasers to choose other avenues to bypass such a mandate. This mandate would harm their businesses.

Other

Professionals connected with the review, design, construction, and building of new 1 and 2-family dwellings were contacted and interviewed. Participants were identified in all the regions of NYS except NYC. They were asked:

- What they thought about Automatic Fire Sprinkler Systems (AFSS),
- Were they aware that NYS State Law mandates builders to provide an estimate of installing an AFSS for all new construction,
- Do they know the costs of an ASFF,
- What they thought the impacts would be on communities and
- Do they know NYS potentially wants to make AFSS mandatory for all new 1 and 2-family dwellings?

When informed of the fire fatality facts, all the participants thought that more efforts should be made to ensure that there were working smoke and carbon monoxide alarms in one—and two-family dwellings, and that alone would save more lives.

APPENDICES

Appendices

A1. Census Data

A2. Fire Fatality Data

A3. Cost of Fire Alarms and Residential Fire Sprinkler Systems

A4. Supporting Data

A5. Reference and Data

A6. Credentials

A1. Census Data

Regions of New York State

Demographic Profile 2022	Capital Region		Central Region		Finger Lakes Region		Hudson Valley Region		Long Island Region		Mohawk Valley Region		NYC Region		North Country Region		Southern Tier Region		Western NY Region		New York State	
Total	**1,057,512**		**781,620**		**1,203,256**		**2,391,754**		**2,913,646**		**613,377**		**8,622,467**		**347,488**		**648,135**		**1,415,124**		**19,994,379**	
Under 5 years	49,264	4.7%	41,483	5.3%	61,940	5.1%	137,688	5.8%	153,183	5.3%	32,945	5.4%	520,467	6.0%	19,862	5.7%	30,647	4.7%	74,393	5.3%	1,121,872	5.6%
5 to 9 years	53,989	5.1%	43,312	5.5%	65,475	5.4%	142,272	5.9%	163,374	5.6%	33,946	5.5%	469,186	5.4%	19,535	5.6%	32,830	5.1%	81,072	5.7%	1,104,991	5.5%
10 to 14 years	56,916	5.4%	46,564	6.0%	72,020	6.0%	157,318	6.6%	182,364	6.3%	37,527	6.1%	501,922	5.8%	19,997	5.8%	36,662	5.7%	79,079	5.6%	1,190,369	6.0%
15 to 19 years	71,183	6.7%	58,696	7.5%	80,861	6.7%	166,263	7.0%	189,995	6.5%	41,485	6.8%	467,114	5.4%	21,281	6.1%	49,917	7.7%	91,355	6.5%	1,238,150	6.2%
20 to 24 years	80,344	7.6%	56,026	7.2%	79,518	6.6%	156,987	6.6%	187,645	6.4%	42,558	6.9%	537,168	6.2%	27,236	7.8%	56,916	8.8%	92,791	6.6%	1,317,189	6.6%
25 to 34 years	132,024	12.5%	97,636	12.5%	156,799	13.0%	278,991	11.7%	345,178	11.8%	73,658	12.0%	1,480,349	17.2%	47,237	13.6%	73,892	11.4%	186,650	13.2%	2,872,414	14.4%
35 to 44 years	126,370	11.9%	89,992	11.5%	141,307	11.7%	294,361	12.3%	351,325	12.1%	71,561	11.7%	1,192,645	13.8%	40,820	11.7%	71,119	11.0%	164,959	11.7%	2,544,459	12.7%
45 to 54 years	133,086	12.6%	94,618	12.1%	147,655	12.3%	319,599	13.4%	400,156	13.7%	75,230	12.3%	1,072,881	12.4%	40,524	11.7%	74,620	11.5%	170,298	12.0%	2,528,667	12.6%
55 to 59 years	77,079	7.3%	54,629	7.0%	87,089	7.2%	167,244	7.0%	220,937	7.6%	42,524	6.9%	546,121	6.3%	23,884	6.9%	45,291	7.0%	102,499	7.2%	1,367,297	6.8%
60 to 64 years	75,365	7.1%	58,160	7.4%	86,131	7.2%	162,549	6.8%	205,632	7.1%	44,239	7.2%	498,975	5.8%	24,539	7.1%	47,664	7.4%	103,433	7.3%	1,306,687	6.5%
65 to 74 years	119,386	11.3%	82,252	10.5%	131,036	10.9%	231,382	9.7%	292,100	10.0%	67,655	11.0%	763,022	8.8%	37,140	10.7%	73,193	11.3%	156,145	11.0%	1,953,311	9.8%
75 to 84 years	56,882	5.4%	39,763	5.1%	63,911	5.3%	120,466	5.0%	148,762	5.1%	34,183	5.6%	398,657	4.6%	18,299	5.3%	37,913	5.8%	75,779	5.4%	994,615	5.0%
85 years and over	25,624	2.4%	18,489	2.4%	29,514	2.5%	56,634	2.4%	72,995	2.5%	15,866	2.6%	173,960	2.0%	7,134	2.1%	17,471	2.7%	36,671	2.6%	454,358	2.3%
Median Age	43.5		40.4		42.9		40.9		41.7		41.8		37.9		43.7		42.6		41.5		41.9	
HOUSING TENURE																						
Occupied housing units	**435,291**		**314,630**		**496,731**		**856,494**		**965,457**		**244,898**		**3,282,804**		**139,452**		**269,528**		**599,238**		**7,604,523**	
units	288,053	66.2%	214,055	68.0%	338,437	68.1%	569,320	66.5%	789,790	81.8%	167,582	68.4%	1,081,125	32.9%	93,184	66.8%	183,348	68.0%	403,225	67.3%	4,128,119	54.3%
units	147,238	33.8%	100,575	32.0%	158,294	31.9%	287,174	33.5%	175,667	18.2%	77,316	31.6%	2,201,679	67.1%	46,268	33.2%	86,180	32.0%	196,013	32.7%	3,476,404	45.7%
All Vacant Housing Units	78,308		39,427		46,857		83,733		90,502		44,497		337,970		49,581		49,240		69,814		889,929	
Owner Vacancy Rate	1.4%		1.2%		0.8%		1.1%		0.9%		1.6%		1.9%		1.8%		1.3%		1.2%		1.4%	
Built 2010 or later	34,055	6.6%	14,672	4.1%	25,450	4.7%	42,470	4.5%	34,872	3.3%	10,728	3.7%	181,514	5.0%	10,332	5.5%	12,823	4.0%	25,045	3.7%	408,791	4.8%
Built 2000 to 2009	45,950	8.9%	22,157	6.3%	36,946	6.8%	73,751	7.8%	59,855	5.7%	15,538	5.4%	197,066	5.4%	19,124	10.1%	19,400	6.1%	33,839	5.1%	523,626	6.2%
Built 1990 to 1999	52,010	10.1%	29,607	8.4%	49,643	9.1%	69,688	7.4%	65,629	6.2%	20,667	7.1%	136,566	3.8%	20,968	11.1%	28,591	9.0%	48,032	7.2%	521,401	6.1%
Built 1980 to 1989	58,968	11.5%	38,127	10.8%	58,979	10.8%	99,837	10.6%	82,410	7.8%	24,469	8.5%	179,634	5.0%	21,950	11.6%	35,452	11.1%	48,682	7.3%	648,508	7.6%
Built 1970 to 1979	63,933	12.4%	44,245	12.5%	68,949	12.7%	117,791	12.5%	131,815	12.5%	25,735	8.9%	249,846	6.9%	20,397	10.8%	41,361	13.0%	70,924	10.6%	834,996	9.8%
Built 1960 to 1969	48,492	9.4%	40,852	11.5%	63,015	11.6%	126,562	13.5%	179,079	17.0%	28,249	9.8%	447,374	12.4%	14,603	7.7%	33,220	10.4%	71,601	10.7%	1,053,047	12.4%
Built 1950 to 1959	49,305	9.6%	48,470	13.7%	59,339	10.9%	136,731	14.5%	266,021	25.2%	38,915	13.4%	464,867	12.8%	15,937	8.4%	34,803	10.9%	112,339	16.8%	1,226,727	14.4%
Built 1940 to 1949	25,116	4.9%	22,123	6.2%	28,098	5.2%	55,456	5.9%	89,861	8.5%	21,907	7.6%	343,383	9.5%	9,143	4.8%	18,874	5.9%	52,351	7.8%	666,312	7.8%
Built 1939 or earlier	135,770	26.4%	93,804	26.5%	153,169	28.2%	217,941	23.2%	146,417	13.9%	103,187	35.7%	1,420,524	39.2%	56,579	29.9%	94,244	29.6%	206,239	30.8%	2,627,874	30.9%
% Built before 2000		84.4%		89.6%		88.5%		87.6%		91.0%		90.9%		89.5%		84.4%		89.9%		91.2%		89.0%

Regions of New York State

NYS Regions Populations and Housing											
NYS Regions	1	2	3	4	5	6	7	8	9	10	
	Western NY	Finger lakes	Southern Tier	Central NY	North Country	Mohawk Valley	Capital	Hudson Valley	New York City	Long Island	New York State
Population 2022	1,415,124	1,203,256	648,135	781,620	347,488	613,377	1,057,512	2,391,754	8,622,467	2,913,646	19,994,379
% Change 2010	-0.9%	0.6%	-3.6%	-0.9%	-2.3%	-1.1%	2.4%	5.3%	6.7%	3.6%	4.0%
Occupied housing units	599,238	496,731	269,528	314,630	139,452	244,898	435,291	856,494	3,282,804	965,457	7,604,523
Owner-occupied housing units	403,225	338,437	183,348	214,055	93,184	167,582	288,053	569,320	1,081,125	789,790	4,128,119
% of all occupied housing units	67.3%	68.1%	66.8%	68.0%	66.8%	68.4%	66.2%	66.5%	32.9%	81.8%	54.3%
% Change from 2010	-3.4%	3.3%	-1.3%	1.9%	0.0%	-1.5%	3.3%	3.7%	7.4%	3.0%	3.8%
Ave household size owner unit	2.46	2.48	2.49	2.50	2.49	2.53	2.49	2.74	2.78	3.07	2.55
Renter-occupied housing units	196,013	158,294	46,268	100,575	46,268	77,316	147,238	287,174	2,201,679	175,667	3,476,404.00
% of All occupied housing units	32.7%	31.9%	33.2%	32.0%	33.2%	31.6%	33.8%	33.5%	67.1%	18.2%	45.7%
% Change from 2010	-6.4%	13.7%	3.9%	4.7%	6.5%	2.9%	9.0%	10.0%	7.9%	2.3%	7.7%
Ave household size rent unit	2.09	2.05	2.05	2.09	2.16	2.17	2.02	2.52	2.45	2.56	2.18
All Vacant Housing Units	69,814	46,857	49,240	39,427	49,581	44,497	78,308	83,733	337,970	90,502	889,929

NYS Regions - Occupied Housing Unit by Type											
	1	2	3	4	5	6	7	8	9	10	
	Western NY	Finger lakes	Southern Tier	Central NY	North Country	Mohawk Valley	Capital	Hudson Valley	New York City	Long Island	New York State
Occupied Housing Units	669,052	543,588	318,768	354,057	189,033	289,395	513,599	940,227	3,620,774	1,055,959	8,494,452
1-unit, detached	62.5%	65.7%	64.0%	65.2%	66.9%	63.9%	61.0%	55.9%	9.2%	78.3%	41.5%
1-unit, attached	2.8%	5.0%	1.8%	3.0%	2.9%	1.6%	3.9%	6.2%	7.1%	4.5%	5.4%
2 units	14.3%	6.1%	8.7%	7.3%	5.0%	12.3%	9.6%	6.7%	12.5%	4.3%	9.9%
3 or 4 units	5.4%	5.7%	5.2%	5.1%	6.2%	6.1%	7.1%	6.6%	9.1%	2.0%	6.8%
5 to 9 units	4.3%	5.4%	4.2%	4.3%	3.7%	3.4%	4.6%	5.2%	6.6%	2.0%	5.2%
10 to 19 units	1.9%	2.2%	2.3%	3.5%	1.6%	2.0%	3.0%	3.9%	6.5%	2.3%	4.3%
20 or more units	5.4%	6.1%	4.5%	6.7%	3.1%	4.9%	5.9%	13.5%	48.7%	5.8%	24.8%
Mobile home	3.4%	3.7%	9.2%	4.7%	10.6%	5.7%	4.7%	1.9%	0.1%	0.8%	2.1%
Boat, RV, van, etc.	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% of 1-2 units	**79.6%**	**76.8%**	**74.5%**	**75.6%**	**74.8%**	**77.9%**	**74.6%**	**68.8%**	**28.9%**	**87.0%**	**56.7%**

NYS Regions - Year Structure Built											
	1	2	3	4	5	6	7	8	9	10	
	Western NY	Finger lakes	Southern Tier	Central NY	North Country	Mohawk Valley	Capital	Hudson Valley	New York City	Long Island	New York State
Specified units	669,052	543,588	318,768	354,057	189,033	289,395	513,599	940,227	3,620,774	1,055,959	8,511,282
Built 2010 or later	3.7%	4.7%	4.0%	4.1%	5.5%	3.7%	6.6%	4.5%	5.0%	3.3%	4.8%
Built 2000 to 2009	5.1%	6.8%	6.1%	6.3%	10.1%	5.4%	8.9%	7.8%	5.4%	5.7%	6.2%
Built 1990 to 1999	7.2%	9.1%	9.0%	8.4%	11.1%	7.1%	10.1%	7.4%	3.8%	6.2%	6.1%
Built 1980 to 1989	7.3%	10.8%	11.1%	10.8%	11.6%	8.5%	11.5%	10.6%	5.0%	7.8%	7.6%
Built 1970 to 1979	10.6%	12.7%	13.0%	12.5%	10.8%	8.9%	12.4%	12.5%	6.9%	12.5%	9.8%
Built 1960 to 1969	10.7%	11.6%	10.4%	11.5%	7.7%	9.8%	9.4%	13.5%	12.4%	17.0%	12.4%
Built 1950 to 1959	16.8%	10.9%	10.9%	13.7%	8.4%	13.4%	9.6%	14.5%	12.8%	25.2%	14.4%
Built 1940 to 1949	7.8%	5.2%	5.9%	6.2%	4.8%	7.6%	4.9%	5.9%	9.5%	8.5%	7.8%
Built 1939 or earlier	30.8%	28.2%	29.6%	26.5%	29.9%	35.7%	26.4%	23.2%	39.2%	13.9%	30.9%
% Built before 2000	**91.2%**	**88.5%**	**89.9%**	**89.6%**	**84.4%**	**90.9%**	**84.4%**	**87.6%**	**89.5%**	**91.0%**	**89.0%**
% Built before 1980	76.7%	68.5%	69.8%	70.5%	61.7%	75.3%	62.8%	69.6%	80.8%	77.0%	75.3%
% Built before 1970	66.1%	55.9%	56.8%	58.0%	50.9%	66.4%	50.4%	57.1%	73.9%	64.5%	65.5%
% Built before 1960	55.4%	44.3%	46.4%	46.4%	43.2%	56.7%	40.9%	43.6%	61.6%	47.6%	53.1%

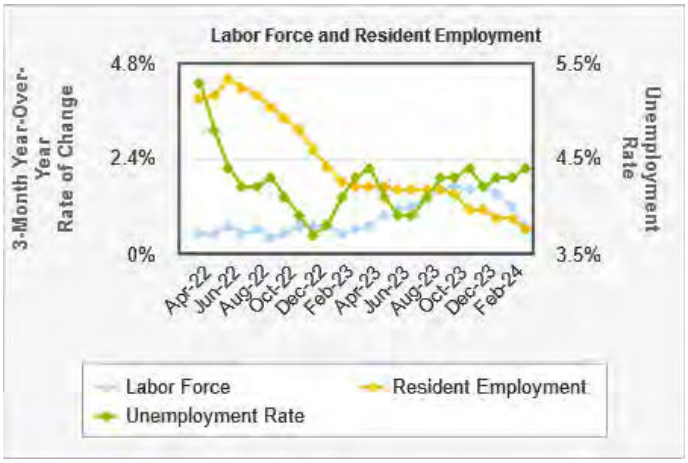
Market at a Glance

New York

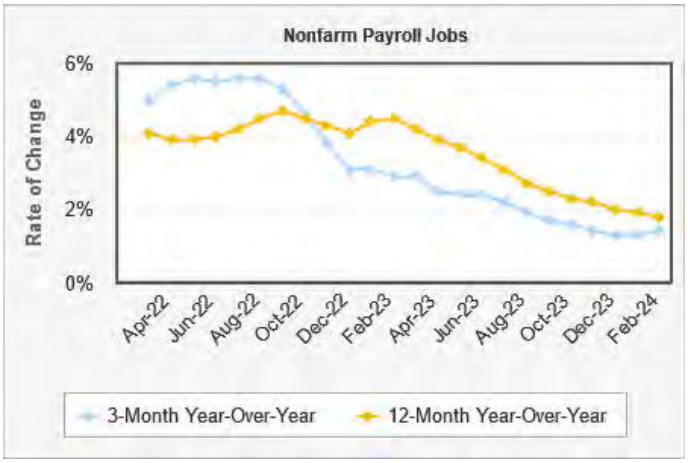
Prepared by: PD&R / Economic & Market Analysis Division (EMAD)
New York/New Jersey Regional Office

Created on: 13 May 2024

ECONOMIC CONDITIONS



Data Source: U.S. Bureau of Labor Statistics



Data Source: U.S. Bureau of Labor Statistics

	3-Month Average			3-Month Year-Over-Year Change			
	February 2022	February 2023	February 2024	February 2022 to February 2023		February 2023 to February 2024	
				Number	Percent	Number	Percent
Labor Force	9,541,096	9,601,321	9,672,583	60,225	0.6	71,262	0.7
Resident Employment	9,031,650	9,187,207	9,243,128	155,557	1.7	55,921	0.6
Unemployment Rate (%)	5.3	4.3	4.4	n/a	n/a	n/a	n/a
Nonfarm Payroll Jobs	9,308,067	9,580,167	9,710,700	272,100	2.9	130,533	1.4

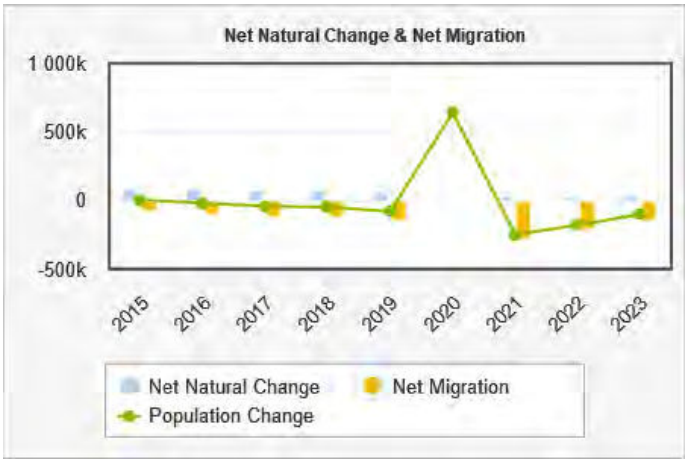
Data Source: U.S. Bureau of Labor Statistics

POPULATION & HOUSEHOLDS

	Decennial Census				ACS & Population Estimates Program						
	April 2010	April 2020	Average Annual Change 2010 to 2020		July 2021	July 2022	July 2023	2021 to 2022		2022 to 2023	
			Number	Percent				Number	Percent	Number	Percent
Population	19,378,102	20,201,249	82,315	0.4	19,854,526	19,673,200	19,571,216	-181,326	-0.9	-101,984	-0.5
Households	7,317,755	7,715,172	39,742	0.5	7,652,666	7,774,308	n/a	121,642	1.6	n/a	n/a

Data Source: 1 - 2010 Census; 2020 Census; U.S. Census Bureau Population Estimates
2 - 2010 Census; 2020 Census; 2021, 2022 and 2021 American Community Surveys (1 - Year)

Note: 1 - Population estimates data shown here may not match those found on the Census website due to their use of the updated September 2018 OMB metro area definitions.
2 - 2019 ACS 1-Year data may not be available for some metro areas due to being dropped from the September 2018 OMB metro area definitions.



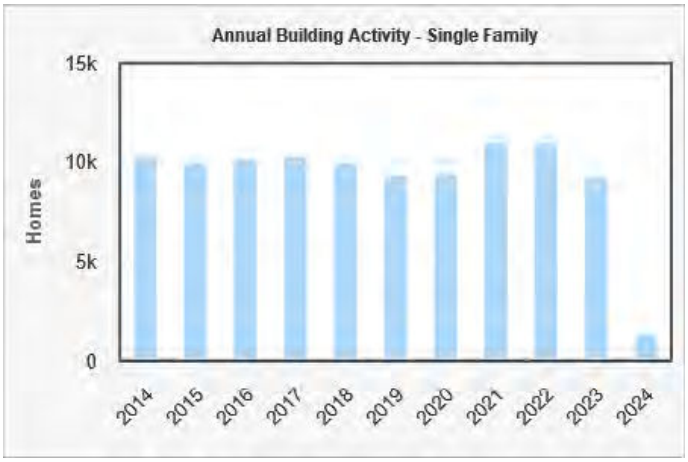
Data Source: U.S. Census Bureau Population Estimates

Notes: 1 - Values in chart reflect July year-to-year changes
2 - Net Migration includes residual population change
3 - Annual components of population change are not available for 2020
4 - Population estimates data shown here may not match those found on the Census website due to their use of the updated September 2018 OMB metro definitions.

HOUSING MARKET CONDITIONS

Data Source: 2020 Census; 2020, 2021 and 2022 American Community Surveys (1 - Year)

Note: 2019 ACS 1-Year data may not be available for some metro areas due to being dropped from the September 2018 OMB metro area definitions



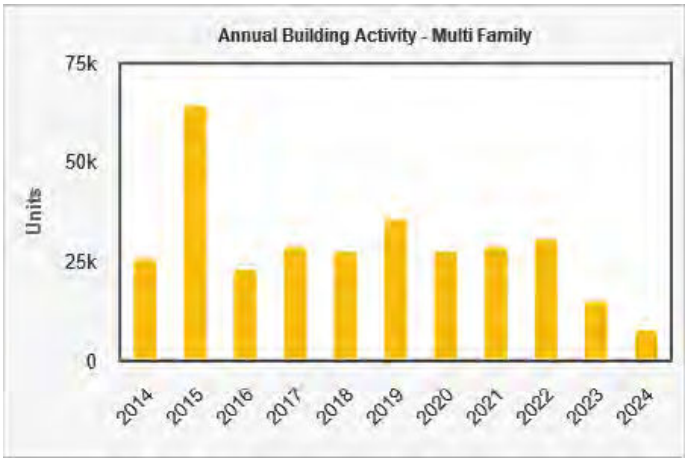
Data Source: U.S. Census Bureau, Building Permits Survey

Note: Data for 2023 and 2024 is preliminary, through Februray 2024

Housing Inventory by Tenure				
	2020 Decennial	2020 ACS	2021 ACS	2022 ACS
Total Housing Units	8,488,066	n/a	8,530,561	8,585,784
Occupied	7,715,172	n/a	7,652,666	7,774,308
Owners	3,954,978	n/a	4,239,037	4,204,337
% Owners	51.3	n/a	55.4	54.1
Renters	3,760,194	n/a	3,413,629	3,569,971
% Renters	48.7	n/a	44.6	45.9
Total Vacant	772,894	n/a	877,895	811,476
Available for Sale	61,694	n/a	41,493	42,388
Available for Rent	201,546	n/a	150,909	129,650
Other Vacant	509,654	n/a	685,493	639,438

Data Source: 2020 Census; 2020, 2021 and 2022 American Community Surveys (1 - Year)

Note: 2019 ACS 1-Year data may not be available for some metro areas due to being dropped from the September 2018 OMB metro area definitions

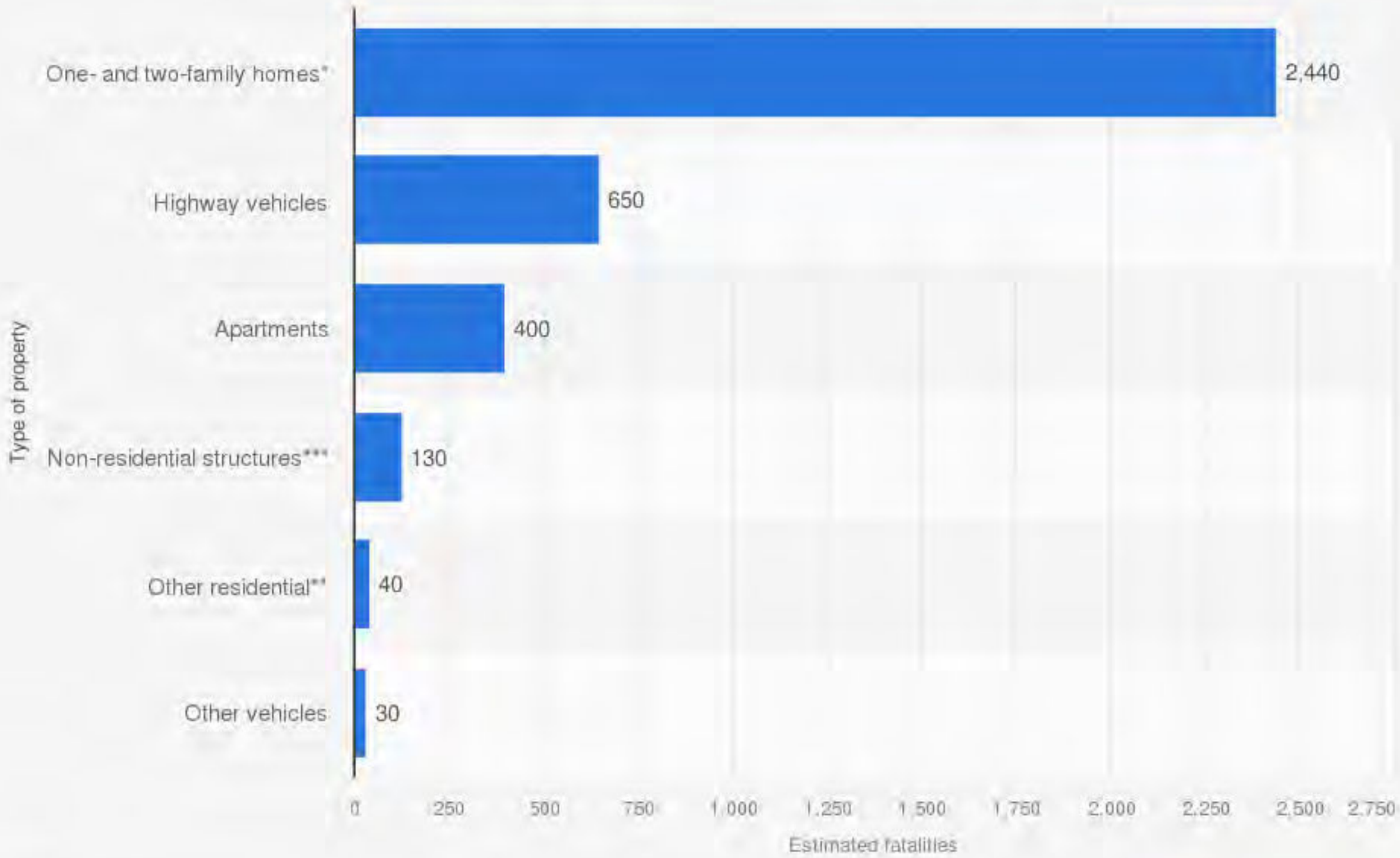


Data Source: U.S. Census Bureau, Building Permits Survey

Note: Data for 2023 and 2024 is preliminary, through Februray 2024

A2.2Fire Fatality Data

Civilian fire deaths in the United States in 2021, by property use



Source
National Fire Protection Association
© Statista 2024

Additional Information:
United States; National Fire Protection Association; 2021

Overview of fatal firefighter injuries in 2019-2023

In 2023, 89 firefighters in the United States died from traumatic injuries, heart attacks, strokes, or aneurysms while on duty or within 24 hours of duty. This fatal injury count is a decrease over the 97 fatal injuries the previous year, but it is otherwise the second highest since 2013, during which there were 98 on-duty deaths.[1]

The increase in recorded fatalities over the past two years has been substantially influenced by the inclusion of deaths that occurred within 24 hours of duty. Prior to 2022, these deaths were not included in the study unless victims expressed a specific physical complaint while on duty.

Of the 89 firefighters who died of on-duty injuries in 2023, 80 were municipal firefighters, and nine were non-municipal firefighters. The municipal firefighters included 48 volunteer firefighters, 30 career firefighters, and two paid part-time firefighters. The nine non-municipal firefighters included seven wildland firefighters and two military firefighters. For purposes of this study, the paid part-time firefighters are included in the volunteer fatality totals.

Figure 1 shows the annual firefighter fatal injury totals since 1977, excluding the 343 firefighter deaths that occurred on 9/11 and the deaths resulting from exposures related to 9/11 in subsequent years. The data show a consistent downward trend in fatalities over time, with the high count in each decade being lower than the last. The highest fatal injury total throughout the study is 174 firefighter deaths in 1978, and the lowest total is the 48 deaths recorded in 2019. To accurately depict fatality trends, the deaths within 24 hours of duty were excluded from the 2022 and 2023 totals in Figure 1 to provide consistency with historical data. Seventeen of the 97 fatalities in 2022 and 16 of the 89 fatalities in 2023 were newly included heart attacks and strokes within 24 hours. Thus, Figure 1 indicates only the historically consistent fatalities: 80 in 2022 and 73 in 2023[74].

In New York State, between 2019 and 2021, there were 13 firefighter fatalities. Four of these fatalities occurred at residential homes and were caused by cardiovascular events. The average age of these fatalities was 54 years old[15,22].

NYS FIREFIGHTER FATALITIES

First Name	Last Name	Age	Rank	Classification	Incident Date	Date of Death	Cause of Fatal Injury	Activity	Emergency	Duty	Property Type	Dept Name	Dept City	Dept State
Steven	Pollard	30	Firefighter	Career	1/6/2019	1/6/2019	Fall	Unknown	Yes	On-Scene Non-Fire	Street/Road	Fire Department New Yor	Brooklyn	NY
Brian	Sullivan	54	Lieutenant	Career	8/9/2019	8/10/2019	Stress/Overexertion	Advance Hose Lines/Fi	Yes	On-Scene Fire	Residential	Fire Department of New Y	Bronx	NY
Dale	Jaynes	72	Firefighter/Chaplain	Volunteer	9/16/2019	10/1/2019	Stress/Overexertion	Incident Command	Yes	On-Scene Fire	Industry	Burdett Fire Department	Burdett	NY
Robert	Bush	**49**	Firefighter	Volunteer	10/19/2019	10/19/2019	Stress/Overexertion	Not On Scene	No	Training	N/A	Homer Fire Department	Homer	NY
Darryl	Rollins	**42**	Chief	Volunteer	11/19/2019	11/20/2019	Stress/Overexertion	Incident Command	Yes	On-Scene Fire	Residential	North Amityville Volunteer	Amityville	NY
Robert	White, Jr.	65	Chief	Volunteer	12/5/2019	12/5/2019	Stress/Overexertion	Incident Command	Yes	On-Scene Fire	Residential	West Stockholm Fire Dep	West Stockholm	NY
Michael	Cardinale, Sr.	63	Firefighter	Volunteer	12/18/2019	12/18/2019	Stress/Overexertion	Unknown	Yes	Other On-Duty	Street/Road	East Farmingdale Fire Co	Farmingdale	NY
Michael	Field	**59**	Firefighter/EMT	Volunteer	3/24/2020	4/8/2020	Exposure	EMS/Patient Care	Yes	On-Scene Non-Fire	Residential	Valley Stream Volunteer F	Valley Stream	NY
Edward	Ciocca	62	Deputy Fire Chief	Career	3/24/2020	5/1/2020	Exposure	Other	Yes	Other On-Duty	N/A	White Plains Fire Departm	White Plains	NY
Andrew	DiMaggio	57	Fire Captain	Career	4/5/2020	5/3/2020	Exposure	Other	No	Other On-Duty	N/A	New Rochelle Fire Depart	New Rochelle	NY
James	Brooks Jr.	**45**	Second Assistant Fire Chie	Volunteer	5/2/2020	9/18/2020	Stress/Overexertion	Responding	Yes	Responding	Residential	Whitehall Volunteer Fire C	Whitehall	NY
Donald	Trzepacz Sr.	67	Fire Police Captain/1st Vic	Volunteer	9/2/2020	9/2/2020	Stress/Overexertion	Other	No	Other On-Duty	Store/Office	Spring Brook Fire District	Elma	NY
Peyton	Morse	21	Firefighter	Career	3/3/2021	3/12/2021	Other	Fitness Activity	No	Training	Outdoor Property	City of Watertown Fire De	Watertown	NY
Jared	Lloyd	35	Firefighter	Volunteer	3/23/2021	3/23/2021	Caught or Trapped	Search and Rescue	Yes	On-Scene Fire	Institutional	Spring Valley Fire Departn	Spring Valley	NY
Judy	Spencer	65	Firefighter	Volunteer	8/24/2021	8/24/2021	Struck By	Support	Yes	On-Scene Fire	Outdoor Property	Hartland Volunteer Fire Co	Gasport	NY
Vincent	Malveaux	31	Probationary Firefighter	Career	12/2/2021	12/3/2021	Other	Fitness Activity	No	Training	Educational	Fire Department of New Y	Brooklyn	NY

Average age	51.1

Casues 2019-2021	
Fall	1
Exposure	3
Stress/Overexertion	8
Other	2
Caught or Trapped	1
Struck By	1
Total	16
Average per Year	5.3

Incident Type	
Residential	5
Store/Office	1
Outdoor	2
Educational	1
N/A	3
Industry	1
Street/Rd	2
Instituational	1
Total	16

A3. Supporting Data

Legislations

STATE OF NEW YORK

1383

2021-2022 Regular Sessions

IN SENATE

January 11, 2021

Introduced by Sens. BROOKS, BIAGGI, THOMAS -- read twice and ordered printed, and when printed to be committed to the Committee on Consumer Protection

AN ACT to amend the general business law, in relation to requiring that a homeowner be provided a cost estimate for installation of a fire sprinkler system

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Section 759-a of the general business law, as added by chapter 201 of the laws of 2014, is amended to read as follows:

§ 759-a. Disclosure of automatic fire sprinkler system information. A builder of a one- or two-family residential dwelling having less than three stories, prior to entering into a contract for construction of such dwelling with a buyer, shall provide the buyer with a copy of written materials prepared by the office of fire prevention and control pursuant to subdivision twenty-one of section one hundred fifty-six of the executive law, which details the benefits of and includes factors that can affect the costs associated with the installation and maintenance of an automatic fire sprinkler system. **The builder shall further provide an estimate of the cost for the installation of an automatic fire sprinkler system in such dwelling.** Upon request of the buyer, the builder shall, at the buyer's expense, install an automatic fire sprinkler system in such one- or two-family residential dwelling having less than three stories.

§ 2. This act shall take effect on the first of September next succeeding the date on which it shall have become a law; provided, however the amendments to section 759-a of the general business law made by section one of this act shall not affect the repeal of such section and shall be deemed repealed therewith.

EXPLANATION--Matter in ***italics*** (underscored) is new; matter in brackets [-] is old law to be omitted.

LBD02220-01-1

Smoke Alarms and Heat Detectors in Residential Structures

This issue of the Code Outreach Program will give a brief overview of the requirements for smoke alarms, heat detectors, and smoke alarm interconnection in new and existing structures regulated by the 2020 Residential Code of New York State (RCNYS). Section 202 of the 2020 Fire Code of New York State (FCNYS) defines smoke alarms as "*a single- or multiple-station alarm responsive to smoke."* Smoke alarms are devices which typically include both a smoke detector and an audible (and/or visible) alarm in one unit. Requirements for carbon monoxide detectors are not addressed in this issue. In many existing residential structures, existing smoke alarms are not interconnected, meaning the activation of any individual alarm does **not** activate other alarms within the structure. However, Section R314.4 of the 2020 RCNYS requires smoke alarms to be interconnected in all new construction that includes dwelling units, and Appendix J of the 2020 RCNYS requires interconnection between smoke alarms in some existing buildings undergoing modifications. All section numbers included below reference the 2020 RCNYS unless otherwise noted.

Required Locations

Per Section R314.3, smoke alarms are required:

- *"In each sleeping room."*
- *"Outside each separate sleeping area in the immediate vicinity of the bedrooms."*
- *"On each additional story of the dwelling, including basements and habitable attics and not including crawl spaces and uninhabitable attics."*

Smoke alarms shall be installed as follows (all distances shall be measured horizontally), unless these constraints would prevent the installation of an alarm in any of the required locations listed above:

- Smoke alarms - not less than 3 feet from the door or opening of a bathroom that contains a bathtub or shower.
- Ionization smoke alarms - not less than 20 feet from a permanently installed cooking appliance.
- Ionization smoke alarms with an alarm-silencing switch - not less than 10 feet from a permanently installed cooking appliance.
- Photoelectric smoke alarms - not less than 6 feet from a permanently installed cooking appliance.

Per Sections R314.2.3 and R314.4.1, heat detectors *"shall be installed in new garages that are attached to or located within new and existing dwellings"* and *"shall be connected to an alarm or smoke alarm that is installed in the dwelling unit."* Heat detectors are not required in existing garages, except where such existing garages are required by the Uniform Code to meet the requirements for new construction.

Interconnection in New Construction

For new construction, smoke alarms "*shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual dwelling unit"* per Section R314.4. Smoke alarms can be interconnected physically (wired together) or by listed wireless devices designed for this purpose. Smoke alarms within two-family dwellings and townhouses do not need to be interconnected between adjacent dwellings–only within the individual dwelling unit.

Interconnection in Existing Buildings

Per Sections AJ401.8, AJ501.6, and AJ601.8, repairs and alterations "*shall be done in a manner that maintains the level of fire protection provided."* Existing interconnected smoke alarms cannot be replaced by non-connected smoke alarms even if, absent the existing interconnected smoke alarms, the 2020 RCNYS would otherwise permit an existing dwelling unit of this type to have non-connected smoke alarms. Except in bed-and-breakfast dwellings, for additions or alterations to existing buildings, smoke alarms within the new construction area(s) are not required to be interconnected to existing smoke alarms outside the new construction area(s) which are either not currently interconnected or are unable to be interconnected with the new smoke alarm devices.

All modifications to existing structures require smoke alarms to be located "*as required for new dwellings"* for any construction which involves modifications to the interior of the structure (per AJ401.8.1, AJ501.6.1, and AJ601.8.1). Except for bed-and-breakfast dwellings, interconnection of the smoke alarms is not required *"where existing interior wall or ceiling finishes are not removed to expose the structure."*

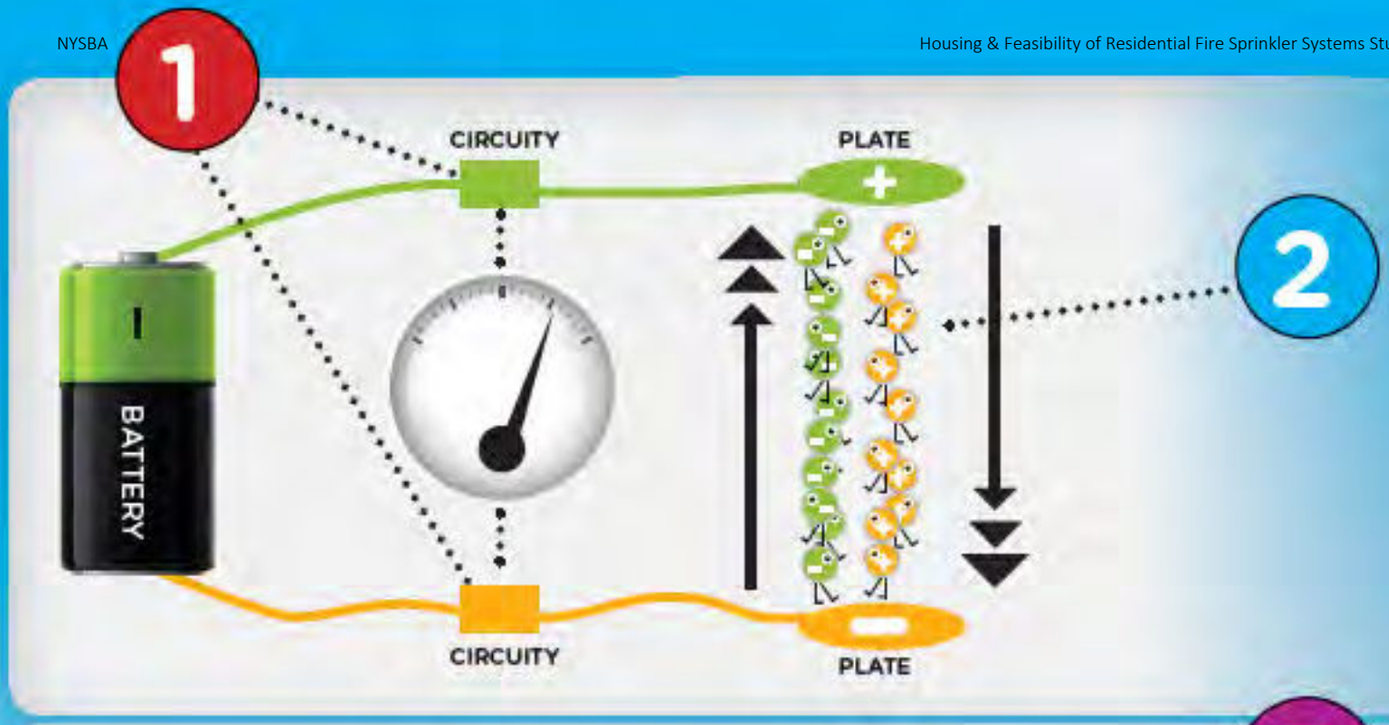
Power Source Requirements

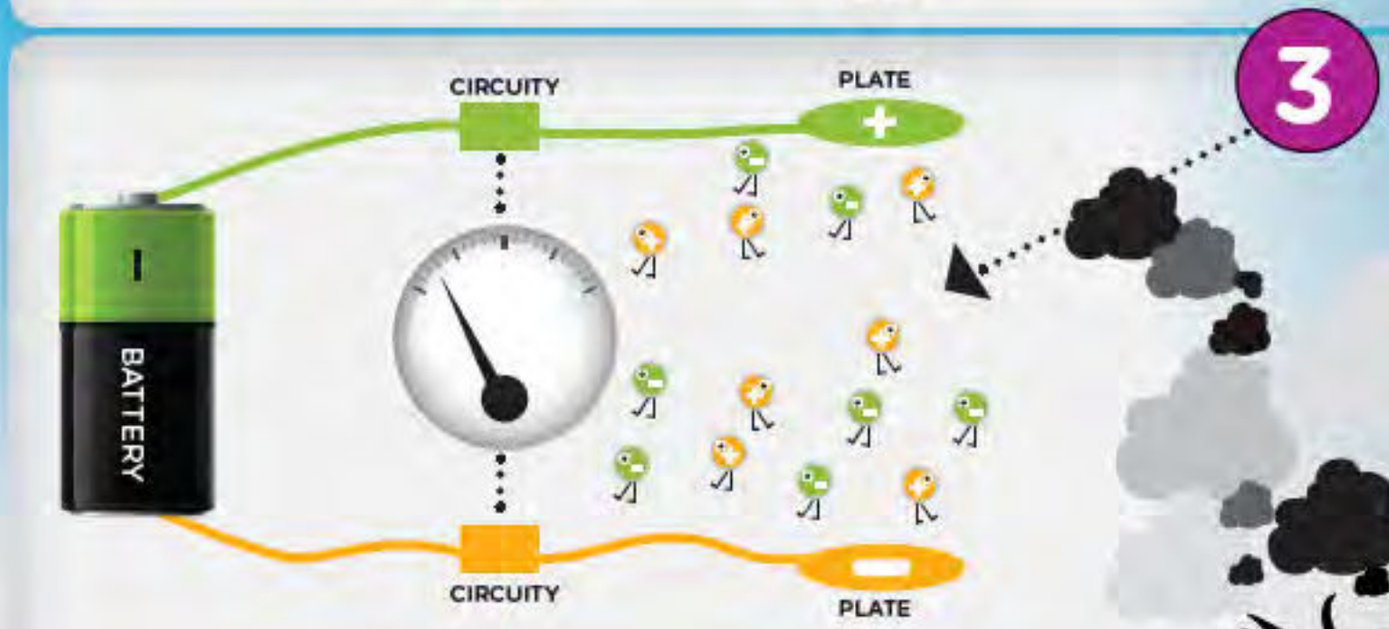
In new construction, smoke alarms and heat detectors are required to receive primary power from building wiring and have battery backup, with a few exceptions (R314.6). In existing buildings undergoing repairs or either level of alteration, smoke alarms which operate solely from battery power are permitted to be installed "*where existing interior wall or ceiling finishes are not removed to expose the structure*" (AJ401.8.2, AJ501.6.1.1, and AJ601.8.1.1) Battery-powered smoke alarms are not required to be interconnected.

Maintenance Requirements

Per Section 907.10 of the 2020 FCNYS: *"Smoke alarms shall be tested and maintained in accordance with the manufacturer's instructions. Smoke alarms shall be replaced when they fail to respond to operability tests, or when they exceed 10 years from the date of manufacture, unless an earlier replacement is specified in the manufacturer's published instructions."*

Smoke Alarms





SMOKE ALARMS

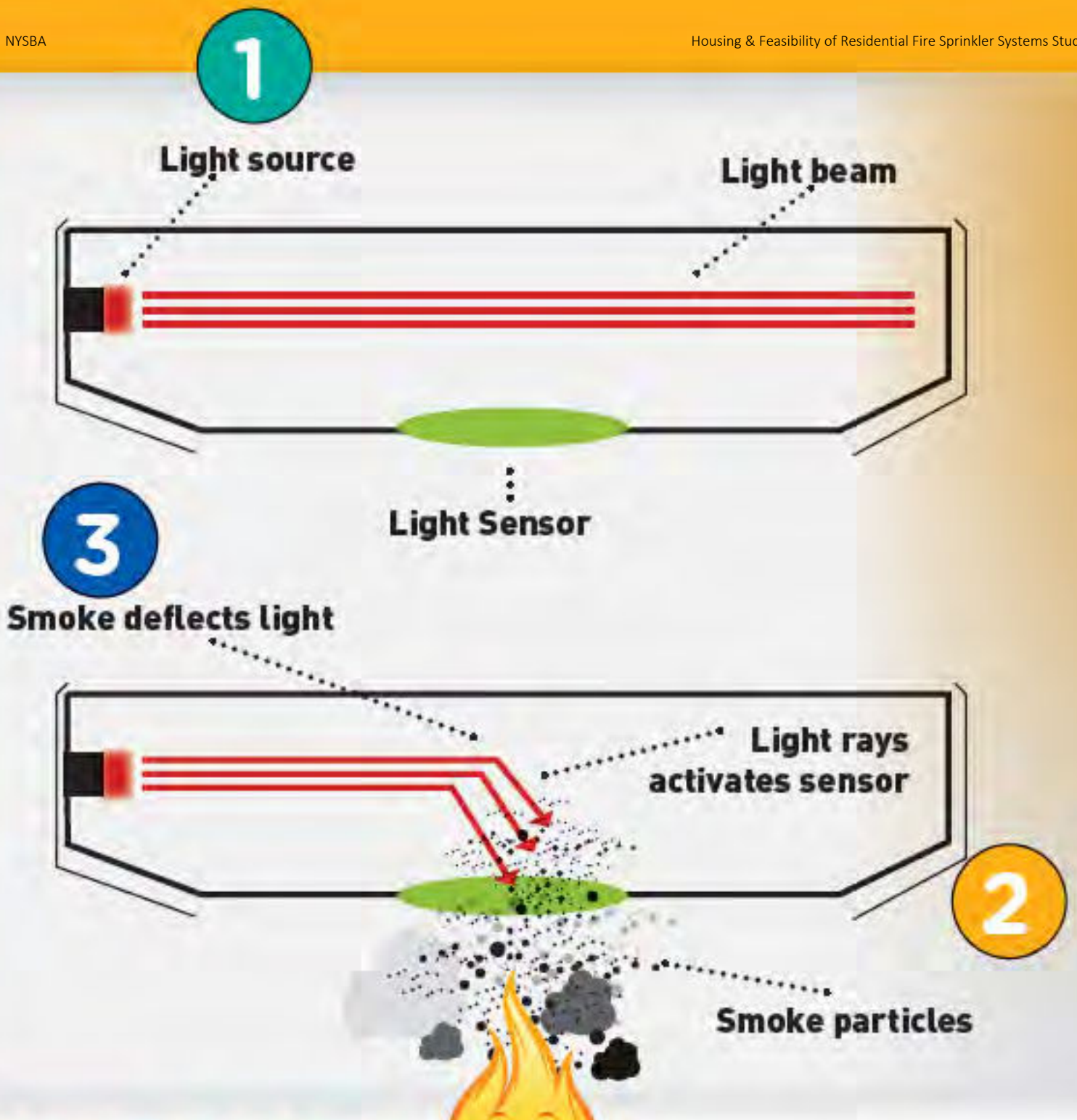
Did you know that scientists have spent many years working on smoke alarms to keep us safe? One of the most common types is an ionization smoke alarm. Here's how it works:

1 Inside the smoke alarm, there are two tiny metal plates called electrodes that are connected to a battery. This is called a circuit.

2 There is also a substance called Americium-241. Americium-241 converts air molecules into positive and negative ions. Because opposites attract, the negative ions move toward the positive plate and the positive ions move toward the negative plate. This movement creates a complete circuit or path of electricity.

3 When smoke enters the smoke alarm, the ions bond with the smoke, breaking the path of electricity.

4 When the flow of electricity is reduced, the alarm goes off.



SMOKE ALARMS

Another type of detector is an photoelectric smoke alarm. Here's how it works:

1 Inside the smoke alarm, there is an LED light that sends a beam of light (similar to a laser pointer) in a straight line across the chamber. In a separate compartment inside the chamber, there is a photosensor that detects light.

2 As smoke enters the detector, the smoke particles interrupt the light beam, scattering it in many directions. Some of the LED light scatters toward the light sensor. When light beams hit the sensor, the alarm will go off!

3 When the batteries in your smoke alarm get low, the smoke alarm automatically activates a low battery chirping sound different from the alarm sound so you know it's time to get new batteries.

Some smoke alarm contain both optical and ionization smoke detection systems.

Sprinklers

FIRE SPRINKLER INITIATIVE
Bringing Safety Home

A PROJECT OF THE NATIONAL FIRE PROTECTION ASSOCIATION

Myths vs Facts*

When considering home fire sprinkler requirements for your community, it is important to address key myths often raised by sprinkler opponents. The fact is, because automatic sprinkler systems have been commonly used in structures for many years, the evidence is clear that such systems are a proven way to protect lives and property against fires.

MYTH
"A smoke alarm provides enough protection."

FACT
Smoke alarms alert occupants to the presence of danger, but do nothing to extinguish the fire. Home fire sprinkler systems respond quickly to reduce heat, flames, and smoke from a fire, giving residents valuable time to get out safely. Smoke alarms reduce the risk of dying in a home fire by 50%. If you have a reported fire in your home, the risk of dying decreases by about 80% when sprinklers are present.

Beware misleading percentages on survival and death: Fire sprinkler opponents have been using a statistic of 99.45% to illustrate the effectiveness of smoke alarms in reducing home fire deaths. This NFPA statistic estimates the likelihood of surviving a home fire when a working smoke alarm is present.

A 100% chance of dying would mean that every fire is fatal, or, roughly, 100 deaths per 100 fires. Fortunately, that is not the case. The chances of surviving a reported home fire when working smoke alarms are present is 99.45% (100 minus 0.55) vs. 98.87% (100 minus 1.13) in home fires with no working smoke alarms. The first number is barely higher than the second.

The 99.45% vs. 98.87% statistic is based on "chances of survival" which is not the same thing as "risk of fire death" based on total number of reported fires. Chances of survival don't have much bearing in the discussion; preventing home fire death and reducing home fire death risk is the goal.

Consider this: Each year, there are an estimated 3,000 home fire deaths out of approximately 400,000 reported structure fires.Therefore, the likelihood of surviving a home fire is approximately 99% without regard to the presence of smoke alarms or any other fire safety provisions. Does that mean 3,000 deaths are acceptable? Most people would say no.

Important comparison: Each year, there are an estimated 42,000 deaths due to motor vehicle crashes and an estimated 6 million reported motor vehicle crashes. The likelihood of surviving a motor vehicle crash is 99%. Does that mean 42,000 deaths are acceptable? Most people would say no

---

MYTH
"Newer homes are safer homes; the fire and death problem is limited to older homes."

FACT
Age of housing is a poor predictor of fire death rates. When older housing is associated with higher rates, it usually is because older housing tends to have a disproportionate share of poorer, less educated households. Statistically, the only fire safety issue that is relevant to the age of the home is outdated electrical wiring. Beyond that, age of the home has little to nothing to do with fire safety. A fire at 2:00 a.m. is just as deadly in a new home as it is in an older home.

In fact, new methods of contruction negatively impact occupant and firefighter life safety under fire conditions. The National Resarch Council of Canada (NRC) tested the performance of unprotected floor assemblies exposed to fire. The findings of the study, The Performance of Unprotected Floor Assemblies in Basement Fire Scenarios assert that these structures are prone to catastrophic collapse as early as six minutes from the onset of fire.

In 2008, Underwriters Laboratories® (UL) conducted a study to identify the danger to firefighters created by the use of lightweight wood trusses and engineered lumber in residential roof and floor designs. The findings of the report, Structural Stability of Engineered Lumber in Fire Conditions, point to the failure of lightweight engineered wood systems when

exposed to fire. Firefighters expecting thirty minutes of structural integrity with dimensional wood structures face higher peril in lightweight structures.

The same UL study found that the synthetic construction of today's home furnishings add to the increased risk by providing a greater fuel load. Larger homes, open spaces, increased fuel loads, void spaces, and changing building materials contribute to:

- Faster fire propagation
- Shorter time to flashover
- Rapid changes in fire dynamics
- Shorter escape time
- Shorter time to collapse

Lightweight construction has been variously estimated to be used in one-half to two-thirds of all new wood one- and two-family homes. Fire sprinklers can offset the increased dangers posed by lightweight construction and create a safer fire environment for firefighters to operate in.

MYTH
"Home fire sprinklers are expensive and will make housing unaffordable, especially for first-time buyers moving to our area."

FACT
The fact is, home fire sprinklers are affordable. The Fire Protection Research Foundation recently issued the Home Fire Sprinkler Cost Assessment report (PDF, 634 KB), which revealed that the cost of installing home fire sprinklers ***averages $1.61 per square foot for new construction.*** To put the cost of a sprinkler system into perspective, many people pay similar amounts for carpet upgrades, a paving stone driveway, or a whirlpool bath.

Sales in many U.S. communities where sprinkler systems are available show that, not only are consumers requesting this feature, but also that houses with sprinkler systems are selling faster than those without. Installing home fire sprinklers can help residents: s ignificantly reduce property loss in the event of fire; cut homeowner insurance premiums; help qualify home for a tax rebate; and help support local fire service efforts.

MYTH
We don't need sprinkler mandates; home fire sprinklers should be a matter of consumer choice

FACT
Every major model safety code now requires home fire sprinklers in new construction. In 2006 three major NFPA codes were revised to include the requirement for home fire sprinklers in new construction of one- and two-family dwellings. In 2008, the International Code Council voted to add a similar provision to the 2009 edition of *International Residential Code*. This ocurred through a process properly vetted by both private and public concerns and not influenced by any single special interest group. The standard of home fire safety has been set.

National model codes represent minimum standards of safety to protect people in their homes. U.S. consumers expect that the products they buy, including their homes, come equipped with the minimum standards of safety. Minimum standards of safety are always included in the fixed cost of a product.

MYTH
"Home fire sprinklers often leak or activate accidentally."

FACT
Home fire sprinkler systems are much like home plumbing systems – when installed and maintained properly, there is a very low risk of leaks. Each individual sprinkler is designed and calibrated to activate only when it senses a significant heat change, directing water to the area of the fire. Over the last 50 years, records indicate the likelihood of leaks from automatic sprinkler systems is very remote.

MYTH
"If you want your home fire sprinklers to be reliable, they will need frequent, expensive maintenance."

FACT
The standard design for home fire sprinklers is much simpler than the design for more traditional sprinklers like the ones used in commercial buildings. If you install a home fire sprinkler system, the only "inspection and maintenance" you will need is to (a) walk around your home and make sure the sprinklers are not obstructed by something that would block the water coming out, and (b) avoid turning off the main control valve, which you don't normally operate anyway.

MYTH
"When a fire occurs, every sprinkler will activate and everything in the house will be ruined."

FACT
In the event of a fire, only the sprinkler closest to the fire will activate, spraying water directly on the fire, leaving the rest of the house dry and secure. Ninety percent of the time, just one sprinkler operates.

MYTH
"The water damage caused by the sprinkler system will be more extensive than fire damage."

FACT
Home fire sprinklers can significantly reduce property loss and damage due to a fire. The sprinkler will quickly control the heat and smoke from the fire, limiting damage to other areas of the house, giving residents valuable time to get out safely. Any resulting water damage from the sprinkler will be much less severe than the damage caused by water from fire-fighting hose lines. On average, home fire sprinkler systems use about eight times less water than fire hoses.

MYTH
"Home fire sprinkler systems are not practical in colder climates, as the pipes will freeze and cause water damage."

FACT
With proper installation, home sprinkler systems will not freeze in cold settings. NFPA13D sets forth guidelines on proper insulation to avoid pipes freezing. The Chicago area is a great example of a cold weather region where many jurisdictions have passed sprinkler mandates for new homes with limited to no problems with systems freezing.

MYTH
"Home fire sprinkler systems are unattractive and will ruin the aesthetics of our residents' homes."

FACT
Actually, new home fire sprinkler models are very unobtrusive, can be mounted flush with walls or ceilings, and can be concealed behind decorative covers.

MYTH
"Any time a smoke alarm goes off it will activate the home fire sprinklers."

FACT
This is incorrect. Each individual sprinkler is designed and calibrated to activate when it senses a significant heat change. They do not operate in response to smoke, burned toast, cooking vapors, steam, or an activating smoke alarm.

The Fire Sprinkler Initiative®, a project of the National Fire Protection Association, is a nationwide effort to encourage the use of home fire sprinklers and the adoption of fire sprinkler requirements for new construction.
**Data referenced form NFPA, the Home Fire Sprinkler Coalition, and other sources.*
www.firesprinkerinitiative.org

UPGRADED DOMESTIC WATER SUPPLY FOR HOME FIRE SPRINKLER SYSTEMS

Saving Lives, Saving Water

Home Fire Sprinkler COALITION
Protect What You Value Most®
HomeFireSprinkler.org

COMMUNITY WATER SUPPLY

You turn on the tap and the water comes out. Pretty simple. On the surface, water supply seems like an uncomplicated subject. But fire and other local officials in communities across the country are discovering there are widespread myths and misinformation about how water is actually used for new houses protected by fire sprinkler systems.

Unfortunately, when there is uncertainty about home fire sprinkler water supply or usage, homeowners may end up with unnecessary add-ons that increase costs and discourage installations.

Every time a home is built without a fire sprinkler system, generations of families miss out on the ultimate protection from fire. This brochure was produced by the nonprofit Home Fire Sprinkler Coalition (HFSC) as a public service to clear confusion about water supply and help communities build safer homes. To learn more and to hear water purveyors and members of the fire service talk about this important topic, please visit our website at HomeFireSprinkler.org.

HOME FIRE SPRINKLER SYSTEMS

Fire sprinkler technology has been saving lives and protecting property for more than 100 years. Home fire sprinkler systems are different from commercial and industrial sprinkler systems, but their technology is similar – all types of sprinklers respond quickly to a fire and control or extinguish it while it is still small. Yet the systems have significant differences, and water supply is chief among them.

Because home fire sprinkler systems are still an emerging trend across the country, local water utilities and other suppliers are often less familiar with systems for houses. And they may incorrectly assume that residential systems are basically the same as commercial or industrial.

SPRINKLERS ARE DESIGNED TO BE DISCREET, TYPICALLY HIDDEN BEHIND WALLS AND CEILINGS AND USUALLY DRAWING UPON HOUSEHOLD WATER SOURCES.

EACH SPRINKLER PROTECTS AN AREA BELOW IT, AND WHEN HEATED BY FIRE, ACTIVATES.

ONLY THE SPRINKLER CLOSEST TO THE FIRE WILL ACTIVATE, SPRAYING WATER DIRECTLY ON THE FLAMES.

Design, installation and maintenance of home fire sprinkler systems are governed by NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*. Fire sprinkler systems for commercial, industrial and other structures are governed by different national standards. All systems installed in homes should comply with NFPA 13D.

WHY FIRE SPRINKLERS? THEY PREVENT INJURIES AND SAVE LIVES

Although sprinklers also protect property from fire damage, the purpose of the NFPA 13D standard for home systems is life safety. That's because nine out of every 10 U.S. structure fire deaths happen in homes (NFPA). Many people are surprised to find out that the very place they feel the most safe is actually where they are at greatest risk from fire. Sprinklers provide residents with peace of mind and increase safety in communities.

PREVENTING DEADLY FLASHOVER

When a home fire grows and spreads, it leads to flashover – the point at which everything combustible in the room ignites. No one can survive flashover. An uncontrolled home fire can reach flashover in fewer than three minutes. Working smoke alarms are essential, but they only can provide early warning so residents can follow their escape plan.

Fire sprinklers go an important step beyond: they automatically react to the heat from a fire and put water on it, confining it and keeping it small. With that fast action, sprinklers control the spread of deadly flames, smoke and searing heat, preventing flashover.

Sprinklers uniquely give residents time to follow their escape plan and survive; even young children, older adults and those whose physical abilities may slow them down in an emergency can get out safely.

TODAY'S HOMES BURN FASTER

There's never been a more important time to protect new homes with fire sprinkler systems. Today's new houses feature open spaces and are filled with synthetic furnishings and products. This results in houses burning faster and hotter (NIST). Modern construction materials also have increased fire dangers in homes because unprotected lightweight wood construction products (such as wood-truss roofing and I-joists) burn faster and fail sooner in a fire (UL).

"The key thing with a fire sprinkler system is it slows the fire down and prevents flashover – when the entire room and its contents suddenly burst into flames."

– Bill Kirkpatrick, East Bay Municipal Utility District (CA)

When fire sprinkler systems are installed in homes, everyone is safer, including firefighters.

TYPICAL HOME FIRE SPRINKLER PROTECTION

It's important to understand how a home fire sprinkler system works in order to understand its water supply needs.

A sprinkler is very simple: basically it's a heat-sensitive plug on a piping system. In homes, the plug is most commonly held in place by a glass tube that contains a liquid element. That liquid responds when the temperature at the sprinkler reaches 135°-165°F. A fire produces those high temperatures in its early stages. The liquid in the sprinkler nearest the fire expands until the glass tube bursts, releasing water. The deflector distributes the water.

When a fire starts in a room, smoke and heat rise. When the high heat reaches the sprinkler's operating temperature, that sprinkler's plug will release water on the fire. Sprinklers operate individually and only in response to the high heat from fire. They don't operate all together. In most sprinklered-home fires, only one sprinkler was needed to control the fire.

Neither interconnected smoke alarms nor smoke can cause sprinklers to operate.

In most rooms, a single fire sprinkler will provide enough protection. Some larger great rooms or kitchens may need more than one sprinkler or a specially listed extended-coverage sprinkler.

THREE TYPES OF RESIDENTIAL FIRE SPRINKLERS

Sidewall Sprinkler

Concealed Sprinkler

Pendent Sprinkler

The American Water Works Association recognizes the increasing use of residential fire sprinkler systems and encourages that they be designed by licensed or accredited professionals and installed by licensed fire sprinkler contractors or properly trained personnel.

– AWWA statement of policy

ENVIRONMENTAL IMPACT OF FIRE SPRINKLERS

Water demand and usage are issues of critical importance in every community. Conservation of this precious resource is one of the reasons why home fire sprinkler systems are increasing in popularity. Fire sprinklers are green.

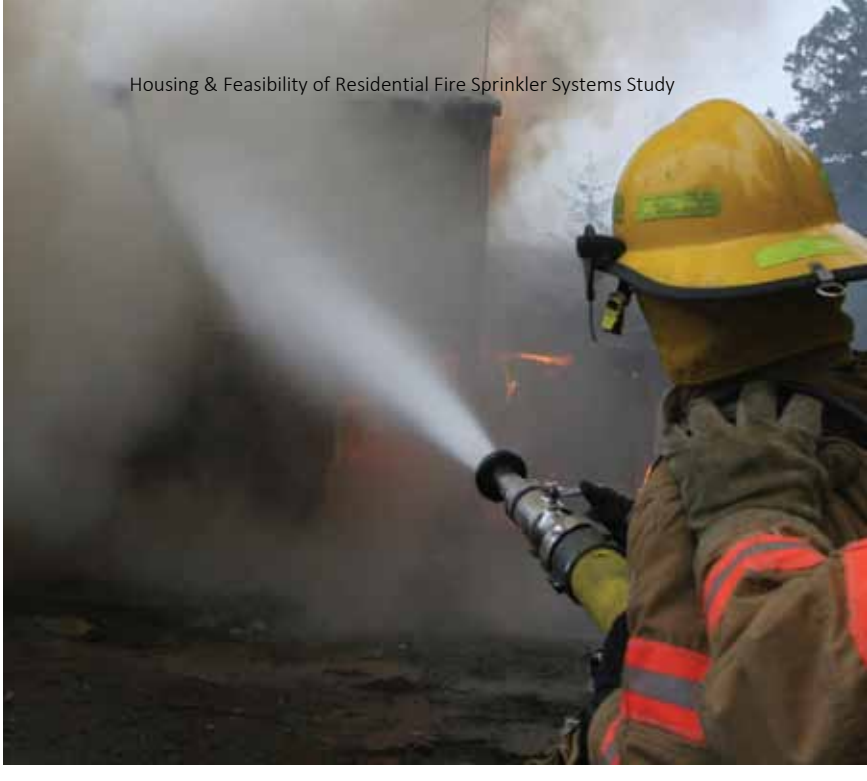
In a fire in a sprinklered home, the system controls the fire with only a fraction of the water that would be used by fire department hoses in non-sprinklered homes.

How much less? According to research conducted by FM Global, fire sprinklers reduce water usage to fight a fire by upwards of 90% compared to responding fire departments. They also reduce water pollution. When sprinklers are present in a fire, the resulting wastewater has fewer persistent pollutants, such as heavy metals, and fewer solids.

"The sprinkler will come on in the room where the fire is started, instead of spreading thousands of gallons on the entire structure. When the fire is contained to one room, obviously you're going to use a lot less water." – Dave Petty, City of Scottsdale Water Department (AZ)

FM Global's study, which captured wastewater from test fires with and without sprinklers, showed that the pH value of the test wastewater from unsprinklered fires exceeded the allowable discharge range of 5.5 to 9.0 required by most environmental agencies, and was four orders of magnitude higher in alkalinity than the wastewater from the sprinklered test.

The study proved that sprinklers can reduce fire damage by up to 97%, which means less waste is sent to landfills. Sprinklers can also reduce greenhouse gas emissions by 98%.



Fire departments have to use far more water to fight an unsprinklered house fire. That's because the fire will have grown and spread during the time between detection, fire department notification and when the fire department can arrive on scene and get set up. A fire department response time of nine to 12 minutes is considered good. Yet with flashover possible in as few as three minutes, the damage to the house will be considerable at that point. It's easy to see why so much water under high pressure is required for fires in unsprinklered homes.

When sprinklers activate, the fire department response is more often than not a clean-up operation. When additional suppression is necessary, the water use is minimal.

HOME FIRE SPRINKLER SYSTEM HYDRAULICS

Two types of residential fire sprinkler systems are permitted under the NFPA 13D standard: *stand-alone* systems, where the sprinkler system is independent of the plumbing system; and *multipurpose* systems, where the sprinkler system is combined with the cold water plumbing. Most home fire sprinkler systems are connected to the domestic water supply. When public water is not available or pressure is insufficient, a well or a tank and pump can be used for water supply.

Designing the domestic-fed system requires communication with the water utility so that available water pressures and flow to the system can be determined, and so that the design can meet the utility requirements. Proper hydraulic calculations are paramount to life safety, so the systems must be designed and installed by qualified professionals.

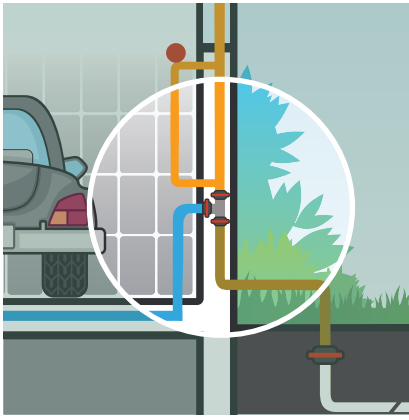
A sprinkler system should be designed so that water flow is at least 15 gallons per minute (gpm) and up to a maximum of 40 gpm.

Regardless of the type, the standard requires that the water supply for a home fire sprinkler system accommodate one or two operating sprinklers for a period of seven to 10 minutes. That's not a significant demand on a municipal water system, especially compared to the volume of water used by fire departments when sprinklers are not installed.

NFPA 13D does not require sprinklers in all areas of a dwelling. Sprinklers may be omitted from small bathrooms and closets. Sprinklers are not required in garages, open attached porches or attics that are not used for living space. Some jurisdictions exceed the standard, however, and do require sprinklers in those areas.

MAKING THE CONNECTION

The connection includes a single supply from the water main into the house. Once inside the house, for *stand-alone* systems, the water delivery is split so that the domestic system is isolated from the fire sprinkler system.



Stand-alone system in garage

The riser is typically located in the basement where the water main enters the home. In regions where there are no basements, the riser is located in the garage.

With a *stand-alone* system, the NFPA 13D standard recommends that a water meter not be installed on the sprinkler line because the meter could produce friction or blockage or reduce water pressure. In jurisdictions that require meters on *stand-alone* systems, the meter is placed before the split between the domestic and sprinkler lines. In these cases, the meter must be included in the hydraulic calculations for the sprinkler system.

For combined, *multipurpose* systems, the lines are metered.

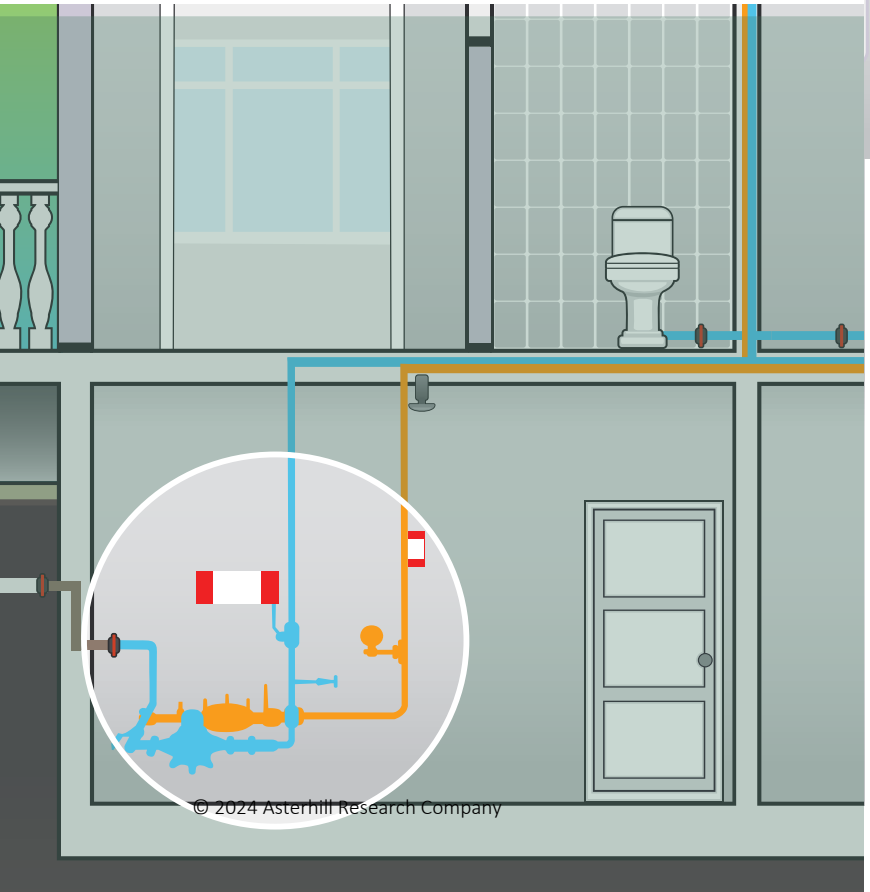
"In most cases, the flow is between 15 to 25 gallons per minute — nothing more than you would see in the fixture count of an average home. Because the water demand is so low, that allows us to tie it into the domestic system and really make it an extension of the existing plumbing system in the home."

– Christina Jamison, San Ramone Valley Fire Protection District (CA)

MAINTAINING WATER QUALITY

Backflow preventers are not required by NFPA 13D. Where required by local code, backflow preventers must be considered in the hydraulic calculations.

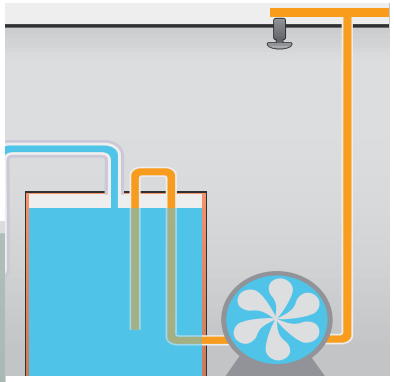
One innovative approach to ensuring fresh water and eliminating the need for a backflow preventer is connecting the sprinkler system to the toilet tank that is farthest away from the water supply. With each flush, water is drawn through the fire line.



STAND-ALONE SYSTEM IN BASEMENT

ALTERNATIVES TO PUBLIC WATER SUPPLY

Fire sprinklers can be installed in areas where homes are built without a municipal water supply or where there is insufficient water pressure from the main. The options include utilizing the home's well system. If the well does not have adequate pressure, a pump may be required.



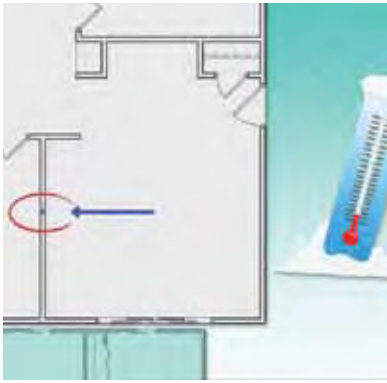
TANK AND PUMP SYSTEM

A tank and pump may be used on *stand-alone* systems. The pump is off until a fire causes a sprinkler to activate, when the pump will automatically turn on to provide the required water flow.

A pressurized tank system stores the sprinkler water supply under pressure, which is maintained by an external source, such as a nitrogen tank. These are used when the power supply is unreliable.

FREEZE PROTECTION

Home fire sprinklers can be installed anywhere in the country, regardless of climate. When a home system is correctly installed to the requirements of NFPA 13D, freezing is not a problem. Methods include installing sprinkler piping in interior walls, avoiding placement of pipes in unheated attics, or if installing in attics, using proper insulation. An alternative is to install dry-pipe systems, which keep all water out of sprinkler pipes until a sprinkler activates.



SPRINKLER PIPE INSTALLED IN INTERIOR WALLS TO AVOID FREEZING

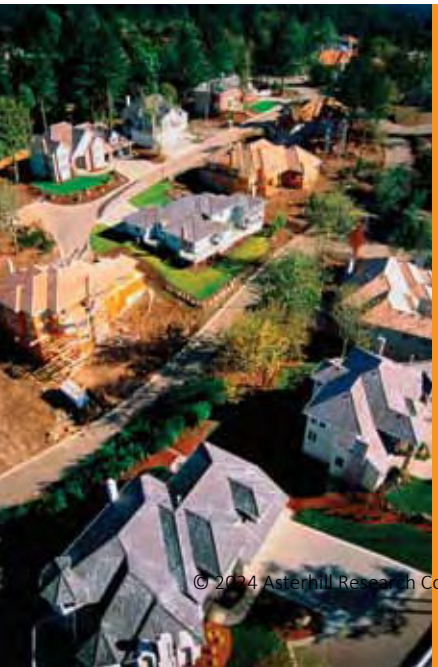
MAINTENANCE

Home fire sprinkler systems are easily maintained with some simple safeguarding steps to make sure the system is ready to function when called upon. Additionally, a water flow test is recommended every six months. The resident or a contractor can do this. Systems with a tank should be checked to confirm the water level. Pumps should be operated to verify functionality.

HOME FIRE SPRINKLERS BENEFIT COMMUNITIES

The bottom line is that home fire sprinkler systems are good for residents, good for the fire service and good for communities. In addition to their life-safety and property-protection benefits, fire sprinkler systems reduce local infrastructure costs and provide environmental benefits.

Communities across the country are offering incentives for homes protected with fire sprinklers.



The state of New Jersey has a law that eliminates the standby fees for stand-alone fire service water lines of two inches or less.

Altamonte Springs, Florida allows a 40% credit against the water connection charge for residences with sprinklers.

Scottsdale, Arizona and other communities allow reduced fire hydrant spacing requirements.

To learn more about all aspects of home fire sprinkler systems, installations and water use, please visit the Home Fire Sprinkler Coalition website at HomeFireSprinkler.org. All HFSC information is available free of charge.

This brochure was produced with generous funding through a Fire Prevention & Safety Grant award.

Home Fire Sprinkler COALITION
Protect What You Value Most
HomeFireSprinkler.org

Form No. WSGB-9/2013-10M-L

Reports

National Association of Home Builders

Fire Sprinkler Mandates

State-by-State Data

Since the 2009 edition of the International Residential Code (IRC), the model code has included a requirement for all new one- and two-family dwellings and townhouses to include fire sprinkler systems. Since then, almost all states have removed the requirement from their residential building codes as they have adopted newer editions.

- Forty-six states have completely removed the sprinkler requirements for one- and two-family homes.
- In twenty of those states, local jurisdictions have the authority to adopt sprinkler requirements.
- Two additional states have limited the requirement based on the size or height of the home.
- Forty-two states have also removed the sprinkler requirement for townhouses.
- Four states require builders to give buyers the option of installing a fire sprinkler system (mandatory option).
- Only California and Maryland have left the sprinkler mandate in place.

States may avoid the sprinkler mandate in one of three ways.

- Twenty-two states defeated the sprinkler mandate through legislation.
- Twenty-two states defeated the sprinkler mandate through the code adoption process.
- Four states have not adopted a statewide residential code.

The maps and table on the following pages detail the status of residential fire sprinkler mandates in each state. The table includes hyperlinks to state building code agencies as well as relevant documents. Although care was taken to develop this document, it is for general reference only, and we make no claim as to the accuracy of the information as the adopted codes and laws affecting sprinkler mandates continue to change.

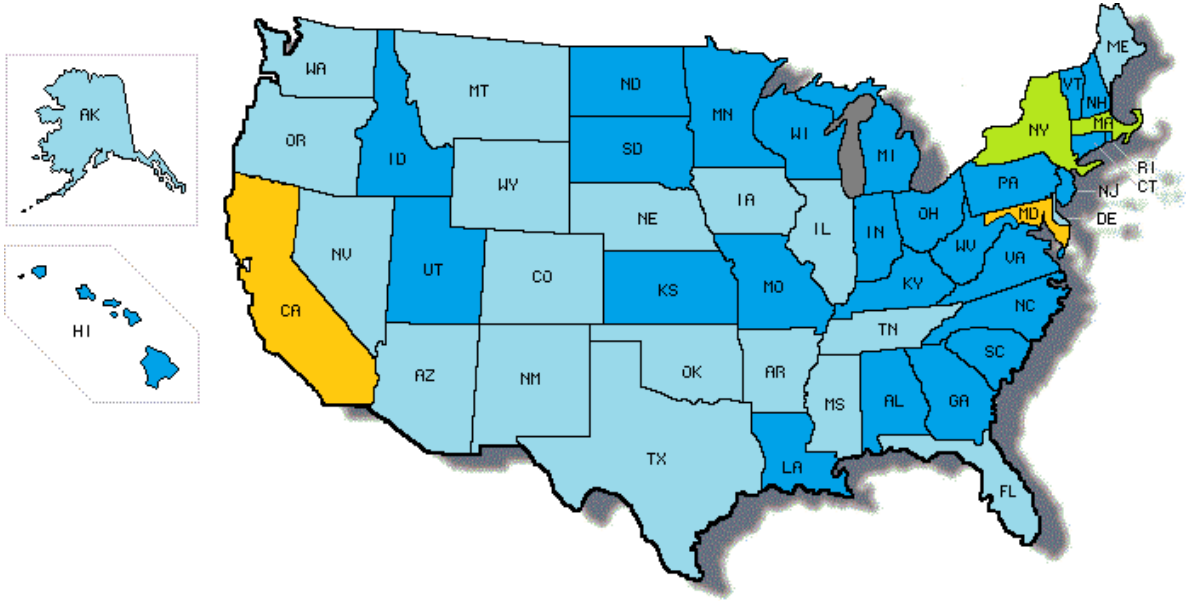
If you have questions or comments about the information in this table, please contact Dan Buuck at 202-266-8366.

Revised July 2019

Where Fire Sprinkler Mandates Have Been Defeated

For One- and Two-Family Dwellings

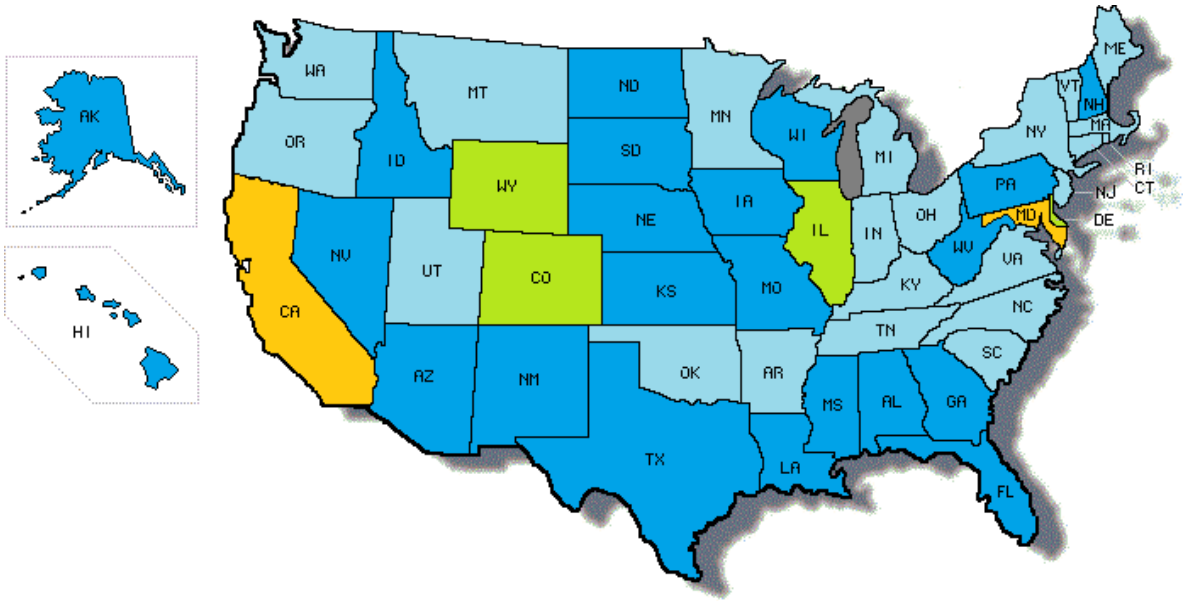
Fire Sprinkler Mandate Defeated	Fire Sprinkler Mandate Defeated But Local Jurisdictions Have Authority to Adopt Requirements	Partial Fire Sprinkler Mandate Approved	Fire Sprinkler Mandate Approved
Total: 26	Total: 20	Total: 2	Total: 2
Alabama	Alaska	Massachusetts [T]	California [T]
Connecticut	Arizona	New York	Maryland [T]
Georgia	Arkansas		
Hawaii [T]	Colorado		
Idaho	Delaware		
Indiana	Florida		
Kansas	Illinois		
Kentucky	Iowa		
Louisiana	Maine [T]		
Michigan	Mississippi		
Minnesota [T]	Montana		
Missouri	Nebraska		
New Hampshire	Nevada		
New Jersey	New Mexico		
North Carolina	Oklahoma [T]		
North Dakota	Oregon		
Ohio	Tennessee		
Pennsylvania [T]	Texas		
Rhode Island	Washington		
South Carolina	Wyoming		
South Dakota			
Utah			
Vermont			
Virginia			
West Virginia			
Wisconsin			



[T] Townhouses required to be sprinklered

How Fire Sprinkler Mandates Have Been Defeated

Fire Sprinkler Mandate Defeated Through Legislation	Fire Sprinkler Mandate Defeated Through Code Adoption Process	No Statewide Code Adoption And No Legislation	Fire Sprinkler Mandate Approved
Total: 23	Total: 21	Total: 4	Total: 2
Alabama	Arkansas	Colorado	California
Alaska	Connecticut	Delaware	Maryland
Arizona	Indiana	Illinois	
Florida	Kentucky	Wyoming	
Georgia	Maine		
Hawaii	Massachusetts		
Idaho	Michigan		
Iowa	Minnesota		
Kansas	Montana		
Louisiana	New Jersey		
Mississippi	New York		
Missouri	North Carolina		
Nebraska	Ohio		
Nevada	Oklahoma		
New Hampshire	Oregon		
New Mexico	Rhode Island		
North Dakota	South Carolina		
Pennsylvania	Utah		
South Dakota	Vermont		
Tennessee	Virginia		
Texas	Washington		
West Virginia			
Wisconsin			



State	Sprinkler Mandate (Yes/No/ No - Local*)	Defeated by Adoption or Legislation	Code Adopted and Effective Date	State Building Code Agency	Documents*	Notes
	* Local jurisdictions have authority to require fire sprinklers.				* Relevant sections are highlighted.	
Alabama	No	L	2015 IRC Effective 10/26/2015	Energy and Residential Codes Board	Amendments Legislation	Act 2010-185 prohibits state or local entities from adopting ordinances, policies, or codes that would require the installation of sprinkler systems in one- or two-family dwellings.
Alaska	No - Local	L	No Statewide Adoption	Dept. of Public Safety	Legislation	Municipalities may not mandate fire sprinklers unless they go through a special process which includes at least three public hearings.
Arizona	No - Local	L	No Statewide Adoption		Legislation	Municipalities may still require townhouses to be sprinklered.
Arkansas	No - Local	A	2012 IRC Effective 1/1/2014	Fire Marshal	Adopted Code (Chapter 3)	The 2012 IRC was amended to remove the sprinkler requirement for townhouses and one- and two-family dwellings.
California	Yes		2015 IRC Effective 1/1/2017	Building Standards Commission	Adopted Code (Chapter 3)	Residential sprinklers have been required in CA codes since the 2010 edition was adopted.
Colorado	No - Local		No Statewide Adoption	Office of the State Architect	Denver Amendments	Denver removed the sprinkler requirement when it adopted the 2015 IRC.
Connecticut	No	A	2015 IRC Effective 10/1/2018	Office of the State Building Inspector	Amendments	

State	Sprinkler Mandate (Yes/No/ No - Local*)	Defeated by Adoption or Legislation	Code Adopted and Effective Date	State Building Code Agency	Documents*	Notes
Delaware	No - Local		No Statewide Adoption	State Fire Marshal	Mandatory Option Legislation	Builders of new, one- and two-family homes are required by legislation to give buyers a cost estimate for installing fire sprinklers and information from the State Fire Marshal's Office about sprinkler benefits (mandatory option).
District of Columbia	Yes		2012 IRC Effective 3/28/2014	Dept. of Consumer and Regulatory Affairs	Adopted Code	
Florida	No - Local	A	2015 IRC Effective 12/31/2017	Building Commission	Amendments Legislation Adopted Code [Chapter 3]	Section R313 on automatic fire sprinkler systems has been deleted.
Georgia	No	L	2012 IRC Effective 1/1/2014	Dept. of Community Affairs	Amendments Legislation	
Hawaii	No	L	2012 IBC Effective 11/13/2018	Building Code Council	Amendments Legislation Extension	Townhomes are required to be sprinklered. Legislation was passed in 2017 to prohibit counties from requiring automatic fire sprinklers. It has a sunset date of June 30, 2027.
Idaho	No	L	2012 IRC Effective 1/1/2015	Division of Building Safety	Amendments Legislation Adopted Code [Chapter 3]	Legislation exempts one- and two-family dwellings from the provisions requiring automatic fire sprinklers. The IRC is amended to exempt townhouses with code-compliant fire separations.

State	Sprinkler Mandate (Yes/No/ No - Local*)	Defeated by Adoption or Legislation	Code Adopted and Effective Date	State Building Code Agency	Documents*	Notes
Illinois	No - Local		No Statewide Adoption	Capital Development Board		State building codes only apply to commercial buildings in areas of the state where codes have not adopted.
Indiana	No	A	2003 IRC Effective 9/11/2005	Fire Prevention & Building Safety Commission	Amendments Legislation	The adopted model code edition (2003 IRC) does not include residential sprinklers.
Iowa	No - Local	L	2015 IRC Effective 5/18/2016	Building Code Bureau	Amendments Legislation	The state building code applies to State Owned Buildings; State Financed Buildings in jurisdictions without an adopted and enforced building code; Board of Regents facilities; Modular and Manufactured homes and commercial buildings; School owned structures in jurisdictions without an adopted and enforced building code.
Kansas	No	L	No Statewide Adoption	Office of the State Fire Marshal	Legislation	
Kentucky	No	A	2015 IRC Effective 1/1/2019	Dept. of Housing, Buildings and Construction	Amendments	
Louisiana	No	L	2015 IRC Effective 2/1/2018	State Uniform Construction Code Council	Amendments Legislation	
Maine	No - Local	A	2015 IRC Effective 1/23/2018	Bureau of Building Codes & Standards	Amendments	Townhomes are required to be sprinklered.

State	Sprinkler Mandate (Yes/No/ No - Local*)	Defeated by Adoption or Legislation	Code Adopted and Effective Date	State Building Code Agency	Documents*	Notes
Maryland	Yes		2015 IRC Effective 1/1/2016	Codes Administration	Amendments Local Adoption	Local amendments may not weaken the automatic fire sprinkler systems provisions for townhouses and one- and two-family dwellings.
Massachusetts	No	A	2015 IRC Effective 10/20/2017	Office of Public Safety and Inspections	Amendments	Townhomes are required to be sprinklered. Sprinkler systems are required in one- and two-family dwellings with an area larger than 14,400 square feet. The area calculation includes basements, but not garages.
Michigan	No	A	2015 IRC Effective 2/8/2016	LARA Building Division	Amendments	The sections on fire sprinkler systems were not adopted as part of the IRC.
Minnesota	No	A/ Legal Action	2015 IRC Effective 1/24/2015	Construction Codes and Licensing Division	Amendments Adopted Code (Chapter 3)	Townhomes are required to be sprinklered. One- and two-family dwellings and townhouse buildings containing facilities required to be licensed or registered by the state shall be provided with a fire sprinkler system
Mississippi	No - Local	L	No Statewide Adoption	State Fire Marshal	Legislation	The Building Codes Council is prohibited from requiring fire sprinklers in one- and two-family dwellings, but local jurisdictions can require them.

State	Sprinkler Mandate (Yes/No/ No - Local*)	Defeated by Adoption or Legislation	Code Adopted and Effective Date	State Building Code Agency	Documents*	Notes
Missouri	No	L	No Statewide Adoption		Mandatory Option Legislation	Builders of new, one- and two-family homes are required by legislation to give buyers the option of installing a fire sprinkler system. (Mandatory option)
Montana	No - Local	A	2012 IRC Effective 11/6/2014	Building Codes Bureau	Amendments	Fire sprinkler systems are deleted in their entirety from the IRC.
Nebraska	No - Local	L	2012 IRC Effective: 8/30/2015	Administrative Services	Legislation	
Nevada	No - Local	L	No Statewide Adoption	State Fire Marshal	Legislation	Local jurisdictions may require sprinkler systems in dwelling units with an area of livable space larger than 5,000 square feet. They also may require sprinklers in smaller dwelling units under certain circumstances.
New Hampshire	No	L	2009 IRC Effective: 4/1/2010	State Building Code Review Board	Amendments Legislation	The residential code was adopted with the fire sprinkler requirement in place, but legislation prohibits local planning boards from requiring sprinklers in one- and two-family dwellings.
New Jersey	No	A	2015 IRC Effective: 9/21/2015	Dept. of Community Affairs	Amendments Adopted Code [Chapter 3]	
New Mexico	No - Local	L	2015 IRC Effective: 11/15/2016	Construction Industries Division	Amendments Legislation	

State	Sprinkler Mandate (Yes/No/ No - Local*)	Defeated by Adoption or Legislation	Code Adopted and Effective Date	State Building Code Agency	Documents*	Notes
New York	No - Local	L	2015 IRC Effective: 5/6/2016	Code Enforcement & Administration	Amendments Mandatory Option Legislation	Sprinkler systems are required in dwellings that are three stories high. Builders of new, one- and two-family homes are required by legislation to give buyers the option of installing a fire sprinkler system (mandatory option).
North Carolina	No	A	2018 IRC Effective: 1/1/2019	Office of State Fire Marshal	Adopted Code (Chapter 3)	
North Dakota	No	L	2015 IRC Effective: 1/1/2017	Div. of Community Services	Amendments Legislation	
Ohio	No	A	2018 IRC Effective 7/1/2019	Board of Building Standards	Amendments Adopted Code [Chapter 3]	
Oklahoma	No - Local	A	2015 IRC Effective 11/1/2016	Uniform Building Code Commission	Amendments	Townhomes are required to be sprinklered.
Oregon	No - Local	A	2015 IRC Effective: 10/1/2017	Building Codes Division	Adopted Code [Chapter 3]	Local jurisdictions have very limited ability to amend the code. Approval through the Building Codes Division is required.
Pennsylvania	No	L	2015 IRC Effective 10/1/2018	UCC Review and Advisory Council	Legislation	Townhomes are required to be sprinklered. Builders of new, one- and two-family homes are required by legislation to give buyers the option of installing a fire sprinkler system (mandatory option).

State	Sprinkler Mandate (Yes/No/ No - Local*)	Defeated by Adoption or Legislation	Code Adopted and Effective Date	State Building Code Agency	Documents*	Notes
Rhode Island	No	A	2015 IRC Effective 8/1/2019	Building Code Commission	Amendments Adopted Code [Chapter 3]	
South Carolina	No	A	2015 IRC Effective 7/1/2016	Building Code Council	Amendments Adopted Code [Chapter 3]	
South Dakota	No	L	No Statewide Adoption	State Fire Marshal	Legislation	
Tennessee	No - Local	A	2009 IRC Effective 6/27/2010	State Fire Marshal	Amendments Legislation	
Texas	No - Local	L	2000 IRC Effective 1/1/2002	State Fire Marshal's Office	Legislation	Later editions of the code are required to be enforced in unincorporated areas and areas specified by the Commissioner of Insurance.
Utah	No	A	2015 IRC Effective 5/8/2018	Uniform Building Code Commission	Amendments	
Vermont	No	A	2015 NFPA 101 Effective 10/10/2016	Building Code and Safety Services	Amendments	Section 24.3.5.1 Fire Sprinkler Protection for One- and Two-Family Dwellings of NFPA 101 was deleted. (See p. 10 of Amendments pdf.)
Virginia	No	A	2018 IRC Effective 9/4/2018	Dept. of Housing and Community Development	Amendments Adopted Code [Chapter 3]	

State	Sprinkler Mandate (Yes/No/ No - Local*)	Defeated by Adoption or Legislation	Code Adopted and Effective Date	State Building Code Agency	Documents*	Notes
Washington	No - Local	A	2015 IRC Effective 7/1/2016	State Building Code Council	Amendments	
West Virginia	No	L	2015 IRC Effective 4/30/2019	Office of the State Fire Marshal	Legislation	The State Fire Commission approved IRC without amending the sprinkler section, but legislation removed sprinkler requirements.
Wisconsin	No	L	Uniform Dwelling Code Effective 4/1/2009	Dept. of Safety and Professional Services	Adopted Code Legislation	
Wyoming	No - Local		No Statewide Adoption	Dept. of Fire Prevention and Electrical Safety		
	* Local jurisdictions have authority to require fire sprinklers.				* Relevant sections are highlighted.	

A5. References and Data

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PRIMARY DATA SOURCES

- 2010 U.S. Census
- 2020 U.S. Census
- 2011-2022 U.S. Census Estimates
- Google Earth Pro
- HUD
- USDA Rural Development
- State of New York
- FEMA
- USFA
- NAHB
- NFPA
- CDC
- New York State Counties
- Stats America
- Stats Indiana
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A6. Credentials

ARC **Asterhill** *Research Company*
Research, Planning and Healthy Communities Advocate

James P. Carroll, *APA, APHA, IEDC*

Principal, Senior Community Health Planner

Mr. Carroll is the founder and Senior Planner focusing on housing, poverty, and community health issues. He holds a Masters' in Public Health and will complete his Ph.D. in 2023. Carroll has extensive experience and training with USDA and HUD. He has worked with housing, community, and economic renewal agencies throughout the northeastern United States. This includes many regional programs promoting housing and community and economic development initiatives. He has over 30 years of planning, development, and management experience. Mr. Carroll has worked with clients in government, private industry, and not-for-profit organizations. As an advocate for communities living healthy, He recognizes that a healthy community requires a balance of economic, environmental, educational, ecological, and social equity factors. A collaboration of community partners, stakeholders, and professionals are necessary to help clients develop strategies and solutions to increase the health capacities of their communities and improve the quality of life

EDUCATION

Doctoral Candidate Public Health (*Expected 2023*)
Master's in Public Health, Walden University
Bachelor's in Landscape Architecture
Bachelor of Science Environmental Studies
SUNY College of Environment Science & Forestry, Syracuse, NY

FIELDS OF RESEARCH

Housing, Homeless, and Poverty
Women Victims of Domestic Violence
Food and Housing Insecurities
Housing and Healthy Communities
Hunger and health in vulnerable populations
Health literacy in rural communities,
Communities health capacities: economic, environmental, educational, ecological and social equity

CURRENT AFFILIATIONS

American Planning Association
American Public Health Association
International Economic Development Council
NYS Association for Affordable Housing
NYS Community Action Association

CERTIFICATION

NYSDHCR, NHHFA, FAME, MHFA Approved Market Analyst
HUD & USDA Approved Market Analyst
Certified Health Educational Specialist
NIH Certified
URMS-EPRP

SERVICE

Genesee Valley Emergency Medical Services
President, 2012-2021
EMT-B and Driver, 2011-2020
Mumford Fire Department
Vice President, 2012-2014
Volunteer Fireman, 2010-2020
Monroe County Planning Board (92-98)

SELECTED PROJECT EXPERIENCE

New Hampshire Housing Finance Authority
Commissioned to provide housing market studies for LIHTC applications submitted to the agency

Essex County, NY
Commissioned to provide a population and housing study to assess existing conditions, and the future demand for housing and to interview town officials, developers, realtors, and other business owners.

Fulton County, NY
Commissioned to provide two population-based studies; (i) a housing study to assess the demand for housing and (ii) conduct a retail trade analysis for a 10 and 25-minute trade area for the "Gloversville —Johnstown" market.

City of Elmira, NY
Commissioned to provide a population-based study to assess the housing, economic, and health status and capacity as part of updating the City of Elmira's Comprehensive Master Plan and Regional Corridor Study

City of Yonkers, NY
Commissioned to provide a population-based study to assess the housing and economic needs for the "HUD *Choice Neighborhood Initiative Target Area*" in Yonkers, NY

City of Rome, NY
Commissioned to provide a population-based study to determine the need for rental housing in the City of Rome, former Griffis AFB property, and other selected sites

Ithaca Housing Authority, Ithaca, NY
Commissioned to conduct a comprehensive housing market study for a proposed RAD project.

Plattsburgh Housing Authority, Plattsburgh, NY
Commissioned to conduct a comprehensive housing market study for a proposed RAD project.

Binghamton Housing Authority, Binghamton, NY
Commissioned to conduct a comprehensive housing market study for a proposed RAD project.

Easterseals NH/Me/Vt/Farnum, Manchester, NH
Provided market and feasibility studies for senior housing projects funded by HUD and New Hampshire Housing Finance Agency Community Renewal

Asterhill Research Company
Research, Planning and Healthy Communities Advocate

PROJECT EXPERIENCE *(Continued)*

Chamber of Commerce Cazenovia, NY

The project reviewed and evaluated community conditions for senior housing and identified services needed to improve the quality of life. Surveyed the population and conducted community workshops and focus groups to assess the community's needs. The final action plan was presented to the community and implemented within 12 months.

Community Action of Wyoming County, Perry, NY

Provided planning service to assess existing housing and services and recommend action plan to increase capacity. The final action plan was presented to the board and implemented within 18 months.

Belmont Shelter, West Seneca, NY

Provided market and feasibility studies for homeless, transitional, affordable, and senior housing projects funded by HUD, USDA and New York State Department of Housing and Community Renewal. Conducted HUD Rent Comparison Studies.

Dakota Partners, Rochester and Concord, NH

Provided market and feasibility studies for homeless, transitional, affordable, and senior housing projects funded by HUD New Hampshire Housing Finance Agency Community Renewal.

Delta Development, Buffalo, NY

Provided market and feasibility studies for Mt. St. Mary's Academy, a multi-million dollar renovation and re-use of a former school for independent senior housing.

East House, Rochester, NY

Provided market and feasibility studies for homeless, transitional, affordable, and senior housing projects funded by HUD and New York State Department of Housing and Community Renewal.

Flower City Management, Rochester, NY

Commissioned to provide a population-based study to assess the need for economic and housing initiative in the "South Wedge. "Presented the findings to a symposium sponsored by the City of Rochester.

Help USA, New York, New York

Commissioned to conduct housing and feasibility studies in upstate New York and New Haven Connecticut

Heritage Christian Home, Inc, Rochester, NY

A New Group Home, approximately 4,000 square feet. The project cost was $500,000. Services rendered were site plan development, town approvals, landscape design, construction documentations, and construction administration services. Senior Housing Study, Services rendered: Market and Feasibility Studies and Master Planning rendered in connection with developing a senior living community, CHDO Certification with Monroe County.

Housing Opportunities, Rochester, NY

Provided market and feasibility studies for homeless, transitional, affordable, and senior housing projects funded by HUD and New York State Department of Housing and Community Renewal.

JCEO, Plattsburg, NY

Provided planning service to assess existing housing and services and recommend action plan to increase capacity. The final action plan was presented to the board and implemented within 24 months. Conducted HUD Rent Comparison Studies.

Manchester Neighborhood Housing Services, Inc., Manchester, NH

Provided market and feasibility studies for homeless, transitional, affordable, and senior housing projects funded by HUD and New Hampshire Housing Finance Agency Community Renewal.

Neighborhood Works Southern NH, Nashua, NH

Provided market and feasibility studies for homeless, transitional, affordable, and senior housing projects funded by HUD and New Hampshire Housing Finance Agency Community Renewal.

Omni Development, Albany, NY

Provided market and feasibility studies for homeless, transitional, affordable, and senior housing projects funded by HUD, USDA, and New York State Department of Housing and Community Renewal. Conducted HUD Rent Comparison Studies.

People Inc., Buffalo NY

Completed an assessment and analysis of non-profit elderly properties for quality of housing, services, and capacity

Providence Housing Development, Rochester, NY

Provided market and feasibility studies for homeless, transitional, affordable, and senior housing projects funded by HUD and New York State Department of Housing and Community Renewal.

Seneca Harbor Place, Watkins Glenn, NY

Commissioned to provide a population-based market study to determine the need for above-market rate housing to rent and/or sell. Provide analysis of market & population trends.

South End Development, Albany, NY

Conducted housing market study and retail trade gap analysis for the south end neighborhood in Albany, NY. The developer proposes to build an energy efficient mixed use project to include 150 new housing units and 30,000 square feet of retail/commercial space.

Syracuse Housing Authority, Syracuse, NY

Conducted housing market study for the Almus Olver Tower. The developer McCormack Baron Salazar proposes to redevelop AOT as part of a RAD property. This project is part of the neighborhood revitalization and the Interstate 81 Project.

Tanglewood Manor, Jamestown NY

Provided project management including government approval and general contractor compliance to contracts. This $5 million project involved an addition of 50 Alzheimer beds to the existing Tanglewood Manor Adult Care Facility, which provides affordable market-rate care for seniors with Alzheimer's and other forms of memory loss.

YMCA Binghamton/Broome County, NY

Completed housing market studies for affordable low-income populations and the homeless and conducted a market analysis of the needs for services and beds for women victims of domestic violence.

YMCA Cortland, NY

Completed housing market studies for affordable low-income populations and the homeless and conducted a market analysis of the needs for services and beds for women victims of domestic violence.

Woodbrook Adult Home, Elmira, NY

Provided the client with master planning services, market and feasibility studies, and government approvals. The $3 million project entailed renovation of the existing facility and adding a 13, 000-square -foot addition.