Post attachment methods that rely on nails, screws, blocking, and bolts have been tested and have failed to meet the target load capacity. However, guard post assemblies that incorporate a lateral anchor have consistently achieved results that met or exceeded the target load values as established by the ICC. Lateral anchors have been shown to effectively transfer load and the associated moment to the deck floor joists. This code revision prescribes a method of post-to-deck attachment that will provide guard systems the capacity to meet or exceed code prescribed performance levels.

Bibliography:

1. M. Morse, D. Walsh, 2005. Alternative Hardware for Guardrail to Post Connection, Professional Deck Builder, Vol. 4, (2). 51,59
2. M. Morse, B. Corwin, R. Morse, A. Johnson, 2007. Safety Alert: Study Reveals Sharp Increase in Deck Failures, ICC Safe
3. R. Tichy, 2005. Wood Materials and Engineering Laboratory Report No. WMEL 07-019, Washington State University
4. J. Loferski, F. Woeste, D. Albright, 2005. Load Tested Guardrail Post Connections, Professional Deck Builder, Vol. 4, (2). 48-50,52-56

Cost Impact: The code change proposal will increase the cost of construction. Since the use of lateral anchors will increase the load capacity of the guard system, fewer posts will be required. Therefore, the cost of the lateral anchors and hardware will be offset by the reduction in the number of posts and by the reduced labor costs associated with installing fewer posts.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

RB62–07/08

R313.1 (New), Appendix P, Chapter 43

Proponents: Sandra Stanek, Fire Code Consultants LLC, representing herself; John C. Dean, National Association of State Fire Marshals (NASFM)

1. Add new text as follows:

SECTION R313
~~SMOKE ALARMS~~ FIRE SPRINKLER SYSTEMS

R313.1 General. An approved automatic fire sprinkler system shall be installed in new one-and two-family dwellings and townhouses in accordance with NFPA 13D.

(Renumber subsequent sections)

2. Delete appendix without substitution:

~~APPENDIX P~~
~~FIRE SPRINKLER SYSTEM~~

~~*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*~~

~~**AP101 Fire sprinklers.** An approved automatic fire sprinkler system shall be installed in new one- and two-family dwellings and townhouses in accordance with Section 903.3.1 of the *International Building Code*.~~

3. Add standard to Chapter 43 as follows:

NFPA

13D-07 Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

Reason (Stanek): All new houses should have fire sprinklers. The majority of the members attending the Rochester ROC meeting in May 07 were in favor of residential sprinklers in all new one & two family dwellings. I believe the will of the majority of ICC members as shown in Rochester should be upheld.

There are many reasons why NOW is the time to change the IRC and establish residential sprinklers as part of the minimum safety package set forth in the national model code for residential construction. Substantial justification was offered last cycle, and additional substantiation is offered in this proposal, primarily focusing on the issues raised in opposition.

1. System freeze-ups in cold climates: Opponents of residential sprinklers assert that system freeze-ups will cause problems in cold climates. However, a sprinkler system poses no greater risk of freezing than domestic plumbing if the system is properly designed and installed. Freeze-ups result from design or installation errors that can occur with any plumbing system, and it is incorrect to suggest that sprinkler systems in cold climates are predisposed to freezing. In fact, on the contrary, there are many jurisdictions with severely freezing climates that have adopted residential sprinkler ordinances, which would surely have been repealed if freezing problems were widespread. This simply hasn't happened. There are many options available to sprinkler homes in freezing climates to combat the risks of frozen piping. These include, among others:

- Using sidewall sprinklers supplied by pipes running in walls, soffits, closets and crawl spaces to keep sprinkler piping out of unheated attics, or
- Properly installing piping beneath the insulation in attics to protect the piping from the unheated attic space. This technique has been used in climates as cold as Wrangle, Alaska to successfully sprinkler single family homes.

The Residential Fire Safety Institute documents that hundreds of jurisdictions in at least 25 states have adopted residential sprinkler legislation, including mountainous states and Northern states ranging from New York to Alaska. In addition, sprinkler systems are required in all residential occupancies governed by the IBC, which include group homes and townhouses exceeding 3-stories in height. The bottom line is that residential sprinkler systems have been installed in homes located in freezing climates for many years, and if freeze concerns are being addressed in these cases, as they must be, then homes sprinklered in accordance with the IRC can and will be handled in the same manner.

2. Cost impact of inflated water tap fees: Opponents of residential sprinklers argue that sprinklers costs will skyrocket in jurisdictions where local water purveyors inflate the cost of larger water taps. Obviously, this is not a building code issue, and local fees should not serve as an impediment to national policy established by the IRC. Nevertheless, an experienced designer can avoid the use of a larger meter, and associated fee increases, by applying alternative design approaches that are already permitted by NFPA 13D. Such alternatives include:

- Using reduced sprinkler spacing in rooms protected by more than one sprinkler. UL listed sprinklers are already on the market for reduced spacing that only require 9 gpm per sprinkler. Given that NFPA 13D requires that a maximum of two sprinklers be calculated for dwelling systems, this yields a total demand of 18 gpm, which can be supplied by many municipal systems using a standard 5/8-inch meter. With this design approach, extended coverage sprinklers can still be used in rooms requiring only a single sprinkler. Although this design approach may not be the best choice for every case, it is particularly suited to smaller homes at the entry/affordable housing level.

- If the tap fees for larger supplies are substantially out of line, there is always an option available to install a small tank/pump system supplied by a standard size water tap. Obviously, this option comes with its own associated cost, but it does provide an upper limit to the potential impact of high tap fees.

The options listed above are available today, and they meet NFPA 13D. Obviously, the most effective approach to fighting unfairly high tap fees is to encourage that the fees be reduced when increased meter sizes are being used to support the installation of a fire sprinkler system. Mandating sprinklers will put builders and code officials on the same side of this issue, trying to get affordable sprinklers, rather than arguing over whether sprinklers should be provided. The home building industry could be using its powerful political contacts to reduce the costs of tap fees rather than resisting the efforts to install fire sprinklers.

For such an effort to be successful, water purveyors will need to understand that increasing meter/tap sizes to supply residential sprinklers does not increase the demand on a public water system. On the contrary, residential sprinklers actually reduce demand because sprinklers only flow water when a fire occurs, and the amount of water used by a residential fire sprinkler system is only a fraction of what firefighters use to extinguish fires in unsprinklered properties. This argument has already successfully resolved tap fee issues in some jurisdictions.

3. Cost of sprinklers and impact on affordable housing. Before specifically addressing the cost of sprinklers, there is a basic question that has to be asked when it comes to the price of housing in America, "What drives the price of a new home?" In many markets, the answer to this question is not "construction costs." Instead, prices are established based on an analysis of what the market will bear. In these markets, sales prices will continue to rise as long as there are buyers who are willing to pay the asking price, and in these markets, it would be disingenuous, at best, to suggest that the cost of fire sprinklers would price buyers out of the market.

In other segments of the home building industry, new home pricing does follow the "cost plus" model, and in these cases, the added cost of a sprinkler system is an important consideration. Such costs will be a function of many variables, including but not limited to, the availability of a public water supply, the size of the home, the level of competition in the local market, the design approach, the climate and enhancements that may be desired by the owner, such as custom colored cover plates for sprinklers.

One source of cost data associated with the widespread installation of residential sprinklers is available from Scottsdale, Arizona. Scottsdale, which became one of the first major U.S. jurisdictions to require residential sprinklers roughly 20 years ago, serves as an excellent demonstration case to show the effects of a community's decision to require residential sprinklers on system cost, life safety, property protection and the local fire-protection infrastructure. With respect to cost, residential sprinkler systems in Scottsdale were recently quoted as costing $0.55 to $0.75 per square foot, and there are now well over 40,000 sprinklered homes in the city. No one is suggesting that every other jurisdiction where residential sprinklers are required will match Scottsdale's cost structure, but Scottsdale's experience clearly demonstrates that a competitive marketplace greatly reduces sprinkler costs.

Technology, creative design approaches and labor charges also impact these costs. Multipurpose systems, which are already permitted by NFPA 13D, have been shown to be particularly well suited to certain types of homes because they add minimal cost to the plumbing installation. Recent surveys of sprinkler costs for affordable homes in the 1,000 to 1,200 square foot range showed that the added cost of materials related to sprinkler protection was in the $0.25 to 0.30 per square foot range, and the sprinkler installation required less than 8 hours of additional labor. While no cost increase is inconsequential when dealing with affordable housing, the significant fire safety benefits gained by installing sprinklers for such a small cost (in the $4/month range on a 30-year mortgage, not including any insurance or tax credit) certainly appears to be money well invested.

With respect to the cost of sprinklers in larger homes, the actual impact of sprinkler costs on the owner's monthly payment isn't much different. Figuring the cost of a hypothetical $3,000 sprinkler system in a $300,000 home with a 6.5% mortgage, a 5% credit on a $2,000/year insurance bill, and a combined Federal/State income tax rate of 33%; the net cost of fire sprinklers, after mortgage related tax deductions, would be $4.37 per month. This represents a 0.23% increase in the monthly payment and roughly equates to the cost of a premium beverage at Starbucks. The total cost on an annual basis would be $52.44, which would easily be offset by insurance reductions.

With all of the foregoing information in mind, it seems fair to say that the true impact on the housing market associated with requiring residential sprinklers will be far less than what opponents of residential sprinklers would like code officials to believe. It has been demonstrated many times in the many jurisdictions throughout the country where residential sprinklers are required that housing markets are not affected by fire sprinklers. These local experiences show us that, once the IRC requires residential sprinklers, home building will continue as it always has. Home prices will fluctuate based on the law of supply and demand; home builders will adjust their products to meet consumer preferences and trends; and home buyers will continue to buy homes.

For a full cost/benefit analysis of the impact of sprinklers on society, see the article, "Cost/Benefit to Society for Having Sprinklers in One and Two Family Dwellings – A Pessimistic Analysis", written by Kenneth E. Isman, P.E. for *SQ Magazine* in the Fall 2005 issue. It should be noted that the article is not designed to show what the fire sprinkler industry thinks will happen if all one and two family dwellings are sprinklered. Instead, the article was written to show that sprinklers still make sense, from a cost/benefit perspective, even if all of the pessimistic assumptions of the homebuilders are correct such as the assumption that fires only occur in older homes. If a more realistic approach is taken, then the benefits for fire sprinklers far outweigh the costs.

4. Does the public want residential sprinklers? Opponents of residential sprinklers have suggested that the general public, which isn't well represented at code hearings, would oppose residential sprinklers, but a recent national poll conducted by Harris Interactive indicates that this claim misrepresents public opinion. The survey of over 1,000 adults revealed that:

- 45% of homeowners said that a sprinklered home is more desirable than an unsprinklered home,
- 69% of homeowners said that having a fire sprinkler system increases the value of a home, and
- 38% of homeowners said that they would be more likely to purchase a home with fire sprinklers than without. The reason that this number isn't higher appears largely tied to an unfounded fear of water damage. 48% of homeowners cited water damage as the reason they would not want to install a sprinkler system. Clearly, this indicates a need for public education on the operation and reliability of sprinkler systems as being a major component in enhancing public support and demand for sprinklers.

The results of this survey support the assertion that the general public has become aware of and has warmed up to the concept of residential sprinklers. Certainly, this is due, at least in part, to the fact that many homeowners live in multifamily occupancies before they own a one- or two-family dwelling. Now that the IBC requires all new multi-family dwellings to be sprinklered, it is fair to say that the home-buying public will continue to become more familiar with residential sprinklers and that public support for residential fire sprinkler systems will continue to grow.

5. Correlation between a home's age and fire risk...aren't homes built to the IRC already safe enough? Opponents of residential sprinklers would like to convince us that residential fire deaths are a function of a home's age and that new homes, built in accordance with the IRC, are safe. Many people buy these arguments because, on the surface, they seem to make sense. However, further analysis paints a different picture.

First, most residential fires deaths result from fires caused directly or indirectly by people. Compliance with the IRC doesn't prevent these types of fires or many other common fire causes, and once a fire starts, compliance with the IRC will not slow its spread. The speed by which a fire spreads in a home is instead a function of contents and room geometry.

Second, a simplistic correlation of residential fire deaths with the age of homes ignores several variables that tend to vary based on the age of a home. These include the socioeconomic status of the occupants, the density of occupants, the age of the occupants, and the presence or omission of smoke detectors (discussed separately below), among others. Fire safety experts know that these factors are far more likely to be contributory factors in fire deaths than the age of a structure. In addition, the fact that more fire deaths occur in "older" homes than newer homes may also be related to the fact that the median age of homes in the U.S., according to a recent HUD study, is 32 years. By sheer numbers, a lot of people live in older homes.

6. Since only a small percentage of fire department responses are for actual structure fires, does the fire service really need residential sprinklers? With respect to residential fire losses, the statistics submitted with last cycle's proposal clearly demonstrated the scope and magnitude of the residential fire problem in the United States. Although the percentage of emergency responses to residential structure fires is a small fraction of overall fire department responses, a shocking 45 percent of firefighter deaths that occur on the fire ground occur at residential occupancies, almost always 1- and 2-family dwellings. Dwelling fires have three characteristics that present disproportionate risks as compared to fires in other occupancies:

- First, they are typically well developed, post-flashover fires by the time the fire department arrives.
- Second, they often occur at night, and
- Third, they often involve a real or perceived need to perform search and rescue operations.

In short, dwelling fires represent a small percentage of our emergency responses but account for a very large percentage of firefighters who are killed in the line of duty.

It is also important to point out that the ability of the fire service to protect our communities by responding to residential fires has declined significantly in recent years, and the situation isn't getting better. The public has a relatively simple expectation with respect to the fire department when a fire happens...they call 911, and the fire department responds to rescue trapped occupants and put out the fire. Unfortunately, that expectation isn't being effectively met in many parts of the country because of dwindling resources.

Nationally, volunteer firefighters, who comprise 73% of the American fire service and protect the vast majority of the geographic area of the United States, are becoming harder and harder to retain. In New York alone, the ranks of volunteer firefighters have declined from 110,000 in the early 1990s to approximately 85,000 today. Considering that all-volunteer fire departments protect 95% of New York communities with a population of less than 10,000, what will happen when there are no longer enough firefighters to respond to 911 calls? This situation is national. It is not unique to New York.

Long after many home builders leave a community, the homes that they leave behind and the people who live in them continue to place demands on the fire service. While the fire service will always strive to meet those demands, it is unrealistic to expect that our volunteers will always be able to do so. Therefore, the fire services' message is simple...if the public is going to be protected from home fires; it's time that we build that protection into new construction.

7. Aren't smoke alarms enough? Homebuilders often suggest that smoke alarms are good enough to protect the public and that residential sprinklers aren't justified. Everyone can agree that smoke alarms save lives and that they are largely responsible for a reduction in the fire death rates that occurred over the past 30 years. Nevertheless, smoke alarms on their own do nothing to stop the spread of fire, protect property or protect firefighters.

Two other issues related to reliance on smoke alarms are of concern. First, as smoke alarms age, their reliability declines. This concern prompted smoke alarm manufacturers and testing laboratories to begin stamping an expiration date on each unit indicating a 10-year replacement cycle. How many alarms will actually be replaced at 10-year intervals, and what will happen to the reliability of alarms that are not replaced? Although an estimated 96% of U.S. homes with telephones now have at least one smoke alarm, in ¼ of reported fires in smoke alarm equipped homes, the devices didn't work.

The second issue related to the effectiveness of smoke alarms in further reducing fire death rates has to do with their performance and waking effectiveness. In a study that was just completed in 2006, only 58% of a test group of children ages 6-12 awakened when a standard smoke alarm sounded, and only 38% of the test group successfully evacuated. The median time to awaken was 3 minutes, and the median time to escape was the maximum allowed 5 minutes.

Another study revealed that a surprising 34% of fire deaths in one- and two-family dwellings during the 2000-2004 period occurred in homes with a working smoke detector. Perhaps this statistic correlates with the fact that fire death rates for the young and the elderly, those who are least likely to be capable of self-preservation even if they are awakened by a smoke detector, are roughly double those for individuals in the central age group. Smoke detectors are good, but they can only go so far in reducing the nation's fire death and injury rates. We need residential sprinklers.

8. What about homes without a public water supply? Opponents of residential sprinklers have suggested that it is impractical and too expensive to require sprinklers in homes that will use a well as the water supply. However, design options are available that make wells a viable water supply for both sprinklers and domestic service. Wells essentially fall into two categories, deep and shallow. With a shallow well, the well will likely be designed to provide a direct feed to the home, with no intervening tank. With these types of systems, pumps can be selected at reasonable costs that are capable of supplying both the domestic and sprinkler demands. Constant pressure, variable speed pumps are an excellent choice for this type of application.

One question that is frequently raised with respect to direct feed well systems involves the "recharge" rate, or the rate at which water can keep up with the required flow. Wells may not be capable of keeping up with the demand associated with a sprinkler system, which will typically be 20 gallons per minute or more. Many automatically assume that a tank and a secondary pump are necessary in these cases, greatly increasing the cost of the sprinkler system, but a lesser known yet simple approach called "developing the well" is a much better solution.

Developing a well essentially creates an underground cistem that replaces the need for a tank. The approach involves digging the well substantially below the water table and allowing the hole to fill with water, retaining the needed capacity underground. By using an appropriate pump with a developed well, an interior tank and pump arrangement can be avoided, and the water supply costs can be limited.

For deeper wells, there are two options. First, there are constant pressure, variable speed pumps suited for these applications. For installations utilizing this approach, a "developed well" as described above can also be used to accommodate needed water retention to satisfy the sprinkler demand.

The second alternative involves a tank and pump, which can be installed between the well pump and the plumbing system. This approach is the common arrangement utilized for deep wells supplying domestic service. To supply sprinklers simply requires that the size of the domestic supply tank be increased to something in the range of 200-300 gallons, and the secondary pump needs to have an increased flow rating. Both of these enhancements can be made at modest cost.

Some have suggested that the IRC should not require homes on wells to have fire sprinklers, yet homes in rural areas, usually corresponding to homes served by wells, are the homes that are least likely to survive a fire because of long or inadequate responses by the fire service. The solution is instead educating contractors on cost-efficient design options for well systems.

9. Impact of residential sprinklers on public and private water systems: It was suggested by one builder last cycle that the operation of residential sprinklers connected to a small water system resulted in the jurisdiction having to drain and decontaminate the entire water system. Subsequent identification and review of the cited event revealed that the concern regarding contamination of the water supply, which was a private system, was linked to the use of fire hydrants during suppression activities, not the sprinkler system. This clearly makes more sense, and for the record, the fire actually started outside of this building, spread to the interior, and sprinklers still helped to stop the fire's progress.

To suggest that the water demand caused by operation of a one- or two-family dwelling or townhouse sprinkler system will lead to contamination of an entire community water system is absurd and demonstrates a complete lack of understanding regarding residential sprinkler systems. The same logic would suggest that a single broken residential pipe, which would flow more water than operating sprinklers, would have the same result. Any water system that is this feeble has much bigger concerns than residential sprinklers.

The truth is that residential sprinklers actually result in a significantly decreased demand on water systems because residential sprinklers use far less water than firefighters to extinguish a fire. Scottsdale, Arizona's experience provides data to support this claim. Scottsdale found that the average estimated sprinkler flow per residential fire incident was 341 gallons, as compared to an estimated manual suppression flow for unsprinklered residential fire incidents of 2,935 gallons.

10. Wait for more cost-effective approaches to residential sprinkler protection before adopting a requirement in the IRC. Opponents of residential sprinklers suggest that we should hold off on requiring such systems in dwellings until improvements in technology make the systems more cost effective. The truth is that many recent improvements in sprinkler technology have largely improved cost effectiveness already. The real problem isn't a lack of cost effective design and installation options.

Instead, the problem appears to stem from a lack of communication within the supply, design and installation communities regarding these efficient design options and the fact that momentum often drives us to continue doing things the way we've done them in the past. To drive the industry toward more innovative solutions, more competition is needed, and changing the IRC to require residential sprinklers will create the demand that will increase competition and motivate cost efficient designs.

Market demand will also drive the creation of design tools that will simplify the exercises of locating sprinklers and sizing pipe. These tools, which will present design requirements in prescriptive, cookbook formats, have already been developed, and are being used in communities like Prince Georges County, Maryland, with a great deal of success for well over ten years. It is expected that they can easily become national in scope as more communities adopt the IRC.

11. Required maintenance: Opponents of residential sprinklers have stated that residential sprinkler systems need regular maintenance and questioned who would perform this service. Someone suggested that local fire departments will have to perform or verify maintenance, potentially raising concerns regarding right of entry.

The fact is that residential sprinkler systems are essentially maintenance free. The owner just needs to be taught what NOT to do. Don't close the valve, don't paint the sprinklers and don't hang clothes from sprinklers. Multipurpose systems are essentially tested every time the domestic water is used. For systems with water flow alarms (not required by NFPA 13D, but installed on some systems) the alarm can easily be tested by the homeowner by turning a valve to create some flow and seeing if the alarm sounds. The test is hardly rocket science and is no more complicated than testing a burglar alarm or replacing a furnace filter, operations that homeowners perform regularly. None of this maintenance would need to be performed or witnessed by the fire department.

12. Trained labor/inspectors: Opponents of residential sprinklers have suggested that, if the IRC were to require residential sprinklers, there would be a shortage of trained labor and trained inspectors to install and inspect these systems. This subject is not a legitimate concern. The fire sprinkler industry has always responded to the increased demand created by code requirements. In the seven years between 1992 and 1999, the fire sprinkler industry doubled in size (going from approximately 20 million sprinklers installed each year to 40 million sprinklers installed). During this time, the industry kept pace with demand, adding additional people to the labor force. There is no doubt that the sprinkler industry can continue to respond to the increase in demand. Once the IRC has been revised, it will take several years for jurisdictions to begin to adopt and enforce the 2009 edition. Some jurisdictions will not choose to adopt the sprinkler requirements, so the impact on the industry will be gradual. There is no question that the demand will be met by the industry as the IRC is changed, adopted and implemented at the local level.

Preliminary discussions have already taken place with the ICC and other certification bodies regarding the possibility of having specific certification programs for installers of residential sprinkler systems and local inspectors that would review and approve the installations. Training programs are underway to take people with a general knowledge of pipe fitting and teach them the additional important requirements for residential fire sprinkler systems, so that all of the installations meet NFPA 13D.

13. Leakage and mold damage: Opponents of residential sprinklers have expressed fear that sprinklers would leak and cause mold damage, which could make a home uninsurable. In response, it should be pointed out that residential sprinkler systems are no different than residential plumbing. If quality products are used and the system is properly installed, it won't leak.

With respect to sprinkler systems, sprinkler piping and fittings, and sprinklers themselves, are subject to rigorous testing to ensure quality. Unquestionably, sprinklers are far higher quality and more thoroughly tested than domestic piping and fixtures. Sprinkler tests required for listing include, among other requirements, a 700 psi hydrostatic strength test, a 500 psi leakage resistance test, a 100,000 cycle water hammer resistance test, a 35-125°F temperature cycling test, and a freeze performance test to -20°F for 24 hours. Also, sprinkler piping and components are rated for a pressure of 175 psi, while plumbing water supply systems are rated for only 80 psi.

14. Appendix P, good enough for now? Opponents of residential sprinklers have suggested that the IRC Appendix P is fairly new and that we should wait to see what happens with it. Unfortunately, this dodges the issues at hand.

When a local jurisdiction goes to adopt Appendix P, the first statement that the local homebuilders make during the hearings is, "Appendix P isn't necessary or important. After all, if sprinklers were really necessary, they would have put them in the body of the code rather than the Appendix." So, the homebuilders end up playing both sides of the fence. At the IRC hearings, they point to Appendix P and use that as justification to keep the requirements for sprinklers out of the code. Then, at the local hearings, they point to the fact that the requirements are in the Appendix as a reason not to mandate sprinklers.

Another reason that we need sprinklers in the body of the standard rather than the Appendix is that the benefits to society become significantly greater when all homes are sprinklered. With the rule in the Appendix, there will be some jurisdictions that don't pass the requirement, leaving these communities unprotected and the public will not be able to reap the benefits (in fact, they may never even know what they are missing). But with the requirements in the body of the IRC, people may debate removing them when they adopt the IRC, but at least they will have some sense of what they are losing.

A third reason that we need the requirements for sprinklers in the body of the IRC rather than the Appendix is that the fire service and the fire sprinkler industry can't bring experts to the debate in every local jurisdiction. There are tens of thousands of jurisdictions where this debate might occur and the homebuilders are going to have their local representatives loaded for these hearings. The fire service and the fire sprinkler industry just don't have the money or the personnel to compete with the homebuilders on a dollar-for-dollar basis. The debate as to the right level of fire protection for a home should be at the national level, with all of the national experts. The right decision (to put sprinklers in homes) should be done at the national level in the body of the code. Then, if people want to modify the code at the local level and take sprinklers out, they do so at their own peril and without the recommendations of the national experts.

Putting the sprinkler requirement into the body of the IRC certainly won't end the local debate, but it will at least put the burden on the home building industry to justify making an amendment to take sprinklers out. Other codes including the Uniform Fire Code, the NFPA Building Code and the Life Safety Code have already set a moral precedent by adding mandatory dwelling sprinkler requirements in their 2006 editions. The IBC and IFC have also done their parts by now requiring all residential occupancies within their respective scopes to be protected by fire sprinklers. Now it is time for the IRC to catch up.

Conclusion: Unlike many issues that we face at code hearings, THIS change strikes directly at the heart of America's fire problem. Opponents of residential sprinklers have a record of fighting just about every initial effort to improve dwelling safety. The same groups initially fought against smoke detectors, ground fault interrupters and mandatory sprinklers in multi-family residential occupancies. On each of these topics, code officials heard the same predictions of gloom and doom, but once the codes moved forward to require these features, the home building industry proceeded without so much as a detectible bump in the road. As years passed, prices for all of these features declined, some dramatically, and technology advanced to create better, yet less expensive products.

Reason (Dean): The life safety hazards in one- and two-family occupancies are clear: Between the years of 2000 and 2004 there was an average of 375,200 reported home structure fires resulting in 2,970 civilian deaths, 14,390 civilian injuries and $5.6 billion dollars in direct property damage per year[i] These losses and deaths far exceed any of the other occupancy types. 75% of reported home structure fires and 87% of total fire deaths occurred in the one- and two-family dwelling environment[ii]

The ICC documents provide much more onerous code requirements for occupancy types other than the one- and two-family dwelling. These other occupancy types have significantly less fire death and loss history, yet they are provided with greater protection. Based on the current code requirements, the protection levels in the IRC do not match the life safety hazards in the one and two-family dwelling environment.
In the year 2006, 39% of all fireground firefighter deaths occurred in dwellings and apartments[iii] At the 2006 Code Development Hearing in Orlando, the Committee disapproved the original proposal put forward and at the May 2007 Rochester Final Action Hearing, the membership heard many of the same arguments. The following paragraphs identify and respond to the concerns raised at both hearings. With these issues addressed, NASFM encourages the support of all code officials in supporting this code change.

1. Does the public want residential sprinklers? Opponents of residential sprinklers suggested in Orlando that the general public, which isn't well represented at code hearings, would oppose residential sprinklers, but a recent national poll conducted by Harris Interactive indicates that this claim misrepresents public opinion. The survey of over 1,000 adults revealed that:

- 45% of homeowners said that a sprinklered home is more desirable than an unsprinklered home, • 69% of homeowners said that having a fire sprinkler system increases the value of a home, and
- 38% of homeowners said that they would be more likely to purchase a home with fire sprinklers than without. The reason that this number isn't higher appears largely tied to an unfounded fear of water damage. 48% of homeowners cited water damage as the reason they would not want to install a sprinkler system. Clearly, this indicates a need for public education on the operation and reliability of sprinkler systems as being a major component in enhancing public support and demand for sprinklers.

The results of this survey support the assertion that the general public has become aware of and has warmed up to the concept of residential sprinklers. Certainly, this is due, at least in part, to the fact that many homeowners live in multifamily occupancies before they own a one- or two-family dwelling. Now that the IBC requires all new multi-family dwellings to be sprinklered, it is fair to say that the home-buying public will continue to become more familiar with residential sprinklers and that public support for residential fire sprinkler systems will continue to grow.

2. Correlation between a home's age and fire risk...aren't homes built to the IRC already safe enough?: Opponents of residential sprinklers would like to convince us that residential fire deaths are a function of a home's age and that new homes, built in accordance with the IRC, are safe. Many people buy these arguments because, on the surface, they seem to make sense. However, further analysis paints a different picture. First, most residential fires deaths result from fires caused directly or indirectly by people. Compliance with the IRC doesn't prevent these types of fires or many other common fire causes, and once a fire starts, compliance with the IRC will not slow its spread. The speed by which a fire spreads in a home is instead a function of contents and room geometry.
Second, a simplistic correlation of residential fire deaths with the age of homes ignores several variables that tend to vary based on the age of a home. These include the socioeconomic status of the occupants, the density of occupants, the age of occupants, and the presence or omission of smoke detectors (discussed separately below), among others. Fire safety experts know that these factors are far more likely to be contributory factors in fire deaths than the age of a structure. In addition, the fact that more fire deaths occur in "older" homes than newer homes may also be related to the fact that the median age of homes in the U.S., according to a recent HUD study, is 32 years. By sheer numbers, a lot of people live in older homes. In summary, we do not debate that a home built in accordance with the IRC is safe, but that changes when people move in.

3. Since only a small percentage of fire department responses are for actual structure fires, does the fire service really need residential sprinklers? With respect to residential fire losses, the statistics submitted clearly demonstrate the scope and magnitude of the residential fire problem in the United States. Although the percentage of emergency responses to residential structure fires is a small fraction of overall fire department responses, a shocking 45 percent of firefighter deaths that occur on the fire ground occur at residential occupancies, almost always 1- and 2-family dwellings. Dwelling fires have three characteristics that present disproportionate risks as compared to fires in other

occupancies. First, they are typically well developed, post-flashover fires by the time the fire department arrives. Second, they often occur at night, and third, they often involve a real or perceived need to perform search and rescue operations. In short, dwelling fires represent a small percentage of our emergency responses but account for a very large percentage of firefighters who are killed in the line of duty.

It is also important to point out that the ability of the fire service to protect our communities by responding to residential fires has declined significantly in recent years, and the situation isn't getting better. The public has a relatively simple expectation with respect to the fire department when a fire happens...they call 911, and the fire department responds to rescue trapped occupants and put out the fire. Unfortunately, that expectation isn't being effectively met in many parts of the country because of dwindling resources.

Nationally, volunteer firefighters, who comprise 73% of the American fire service and protect the vast majority of the geographic area of the United States, are becoming harder and harder to retain. In New York alone, the ranks of volunteer firefighters have declined from 110,000 in the early 1990s to approximately 85,000 today. Considering that all volunteer fire departments protect 95% of New York communities with a population of less than 10,000, what will happen when there are no longer enough firefighters to respond to 911 calls? This situation is national and is not unique to New York. Long after many home builders leave a community, the homes that they leave behind and the people who live in them continue to place demands on the fire service. While the fire service will always strive to meet those demands, it is unrealistic to expect that our volunteers will always be able to do so. Therefore, the fire services' message is simple...if the public is going to be protected from home fires, it's time that we build that protection into new construction.

4. Aren't smoke alarms enough? Homebuilders who testified at the Orlando hearing suggested that smoke alarms are good enough to protect the public and that residential sprinklers aren't justified. Everyone can agree that smoke alarms save lives and that they are largely responsible for the dramatic reduction in fire death rates that has occurred in the U.S. over the past 30 years. Nevertheless, smoke alarms are only life-safety devices. On their own, they do nothing to stop the spread of fire, protect property or protect firefighters.

Two other issues related to reliance on smoke alarms are of concern. First, as smoke alarms age, their reliability declines. This concern prompted smoke alarm manufacturers and testing laboratories to begin stamping an expiration date on each unit indicating a 10-year replacement cycle. The questions before us are how many alarms will actually be replaced at 10-year intervals, and what will happen to the reliability of alarms that are not replaced? Although an estimated 96% of U.S. homes with telephones now have at least one smoke alarm, in ¼ of reported fires in smoke alarm equipped homes, the devices didn't work.

In contrast, residential sprinkler systems have a life expectancy of 50-years, and they require essentially no maintenance, particularly for multipurpose systems. With these systems, if the domestic water is turned on, sprinklers are on as well. With the combination of sprinklers and smoke alarms, homeowners will have the best of both technologies. The second issue related to the effectiveness of smoke alarms in further reducing fire death rates has to do with their performance and waking effectiveness. In a study that was just completed in 2006, only 58% of a test group of children ages 612 awakened when a standard smoke alarm sounded, and only 38% of the test group successfully evacuated. The median time to awaken was 3 minutes, and the median time to escape was the maximum allowed 5 minutes. Another study revealed that a surprising **34% of fire deaths in one- and two-family dwellings during the 2000-2004 period occurred in homes with a working smoke detector**. Perhaps this statistic correlates with the fact that fire death rates for the young and the elderly, those who are least likely to be capable of selfpreservation even if they are awakened by a smoke detector, are roughly double those for individuals in the central age group. Smoke detectors are good, but they can only go so far in reducing the nation's fire death and injury rates. We need residential sprinklers.

5. What about homes without a public water supply? Opponents of residential sprinklers have suggested that it is impractical and too expensive to require sprinklers in homes that will use a well as the water supply. However, design options are available that make wells a viable water supply for both sprinklers and domestic service. Wells essentially fall into two categories, deep and shallow. With a shallow well, the well will likely be designed to provide a direct feed to the home, with no intervening tank. With these types of systems, pumps can be selected at reasonable costs that are capable of supplying both the domestic and sprinkler demands. Constant pressure, variable speed pumps are an excellent choice for this type of application.

One question that is frequently raised with respect to direct feed well systems involves the "recharge" rate, or the rate at which water can keep up with the required flow. Wells may not be capable of keeping up with the demand associated with a sprinkler system, which will typically be 20 gallons per minute or more. Many automatically assume that a tank and a secondary pump are necessary in these cases, greatly increasing the cost of the sprinkler system, but a lesser known yet simple approach called "developing the well" is a much better solution. Developing a well essentially creates an underground cistern that replaces the need for a tank. The approach involves digging the well substantially below the water table and allowing the hole to fill with water, retaining the needed capacity underground. By using an appropriate pump with a developed well, an interior tank and pump arrangement can be avoided, and the water supply costs can be limited.

For deeper wells, there are two options. First, there is constant pressure, variable speed pumps suited for these applications. For installations utilizing this approach, a "developed well" as described above can also be used to accommodate needed water retention to satisfy the sprinkler demand. The second alternative involves a tank and pump, which can be installed between the well pump and the plumbing system. This approach is the common arrangement utilized for deep wells supplying domestic service. To supply sprinklers simply requires that the size of the domestic supply tank be increased to something in the range of 200-300 gallons, and the secondary pump needs to have an increased flow rating. Both of these enhancements can be made at modest cost. Some have suggested that the IRC should not require homes on wells to have fire sprinklers, yet homes in rural areas, usually corresponding to homes served by wells, are the homes that are least likely to survive a fire because of long or inadequate responses by the fire service. The solution is instead educating contractors on cost-efficient design options for well systems.

6. Impact of residential sprinklers on public and private water systems: It was suggested by one builder during testimony at the Orlando hearing that operation of residential sprinklers connected to a small water system in a Michigan jurisdiction resulted in the jurisdiction having to drain and decontaminate the entire water system. Subsequent identification and review of the cited event revealed that the concern regarding contamination of the water supply, which was a private system, was linked to the use of fire hydrants during suppression activities, not the sprinkler system. This clearly makes more sense, and for the record, the fire actually started outside of this building, spread to the interior, and sprinklers still helped to stop the fire's progress.

To suggest that the water demand caused by operation of a one- or two-family dwelling or townhouse sprinkler system will lead to contamination of an entire community water system is absurd and demonstrates a complete lack of understanding regarding residential sprinkler systems. The same logic would suggest that a single broken residential pipe, which would flow more water than operating sprinklers, would have the same result. Any water system that is this feeble has much bigger concerns than residential sprinklers.

The truth is that residential sprinklers actually result in a significantly decreased demand on water systems because residential sprinklers use far less water than firefighters to extinguish a fire. Scottsdale, Arizona's experience provides data to support this claim. Scottsdale found that the average estimated sprinkler flow per residential fire incident was 341 gallons, as compared to an estimated manual suppression flow for unsprinklered residential fire incidents of 2,935 gallons.

7. Wait for more cost-effective approaches to residential sprinkler protection before adopting a requirement in the IRC. Opponents of residential sprinklers suggest that we should hold off on requiring such systems in dwellings until improvements in technology make the systems more cost effective. The truth is that many recent improvements in sprinkler technology have largely improved cost effectiveness already. The real problem isn't a lack of cost effective design and installation options. Instead, the problem appears to stem from a lack of communication within the supply, design and installation communities regarding these efficient design options and the fact that momentum often drives us to continue doing things the way we've done them in the past.

To drive the industry toward more innovative solutions, more competition is needed, and changing the IRC to require residential sprinklers will create the demand that will increase competition and motivate cost efficient designs.

Some have suggested that we should wait for NFPA 13D or the IRC to permit the use of a single operating sprinkler as a design basis, as opposed to the currently required two sprinklers, before requiring sprinklers in the IRC. Some have also suggested that we should revisit whether sprinklers are really needed everywhere NFPA 13D requires them before requiring residential sprinklers in the IRC. The best way to encourage research and discussion on both of these ideas is to pass the IRC requirement now. Market demand will drive the research and interest in residential sprinklers will grow.

Market demand will also drive the creation of design tools that will simplify the exercises of locating sprinklers and sizing pipe. These tools, which will present design requirements in prescriptive, cookbook formats, are already being developed, and it is expected that they will be published prior to publication of the 2009 IRC.

8. Required maintenance: Opponents of residential sprinklers stated in Orlando that residential sprinkler systems need regular maintenance and questioned who would perform this service. Someone suggested that local fire departments will have to perform or verify maintenance, potentially raising concerns regarding right of entry.

The fact is that residential sprinkler systems are essentially maintenance free. Multipurpose systems have no maintenance requirements at all, and stand-alone systems only require an occasional test of the water flow alarm, if provided (not required by NFPA 13D or the IRC when the sprinkler pipe is copper, CPVC, or PEX) and the backflow preventer, if provided (again, not required by NFPA 13D). None of this maintenance would be performed or witnessed by the fire department. The alarm test can be conducted by the owner, in the same way the owner may periodically test a burglar alarm, and a plumber is required to test a backflow preventer. This test, which is a public health issue, is not associated with functionality or reliability of the sprinkler system, and therefore, it is not a fire safety concern.

9. Trained labor/inspectors: Opponents of residential sprinklers suggested in Orlando that, if the IRC were to require residential sprinklers, there would be a shortage of trained labor and trained inspectors to install and inspect these systems. While that is true today, there is no doubt that industry and code officials will respond once the IRC has been revised, and there will be several years to ramp up before the 2009 IRC begins to have an impact. This is exactly what has happened in the many local jurisdictions that have passed sprinkler ordinances.

Preliminary discussions have already taken place with ICC regarding the possibility of having ICC oversee a certification program for residential sprinkler installers and inspectors. Other organizations have also expressed interest in handling installer training and certification. It is expected that, in some jurisdictions, plumbers will become trained and certified to install residential sprinklers and sprinklers will be installed as part of the plumbing system. Likewise, it is expected that, in some jurisdictions, plumbing inspectors will be trained and certified to inspect these systems. This model is not unlike the approach taken with smoke alarms. They are located and installed by electricians and they are inspected by the electrical or building inspector.

10. Leakage and mold damage: In Orlando, opponents of residential sprinklers expressed fear that sprinklers would leak and cause mold damage, which could make a home uninsurable. In response, it should be pointed out that residential sprinklers systems are no different than residential plumbing. If quality products are used and the system is properly installed, it won't leak. If substandard products are used or workmanship is faulty, leaks will occur.

With respect to sprinkler systems, sprinkler piping and fittings, and sprinklers themselves, are subject to rigorous testing to ensure quality. Unquestionably, sprinklers are far higher quality and more thoroughly tested than domestic piping and fixtures. Sprinkler tests required for listing include, among others, 700 psi hydrostatic strength, 500 psi leakage resistance, 100,000 cycles water hammer resistance, 35-125°F temperature cycling, and freeze performance to 20°F below for 24 hours. Also, sprinkler piping and components are rated for a pressure of 175 psi, while plumbing water supply systems are rated for only 80 psi.

11. Appendix P, good enough for now? Opponents of residential sprinklers suggested in Orlando that, with the IRC having just accepted Appendix P, maybe it would be best to leave the sprinkler requirements in the appendix for a while to see what happens with it. This approach will certainly be appealing to some because it delays the sprinkler issue and gives home builders a leg up in fighting sprinklers at the local level.

However, isn't it time that we give local code officials the leg up? Code officials who have been through the local adoption process will certainly understand that it's much easier to justify taking something controversial out of the code than to add something new during an adoption review. With respect to residential sprinklers, code officials know all too well that arguing them into the code at the local level is a very uphill climb given local politics and the strength of local home builder associations.

Putting the sprinkler requirement into the body of the IRC certainly won't end the local debate, but it will at least put the burden on the home building industry to justify making an amendment to take sprinklers out. Local code officials would then have a respectable chance of keeping the sprinkler requirement. Other codes including the Uniform Fire Code, the NFPA Building Code and the Life Safety Code have already set a moral precedent by adding mandatory dwelling sprinkler requirements in their 2006 editions. The IBC and IFC have also done their parts by now requiring all residential occupancies within their respective scopes to be protected by fire sprinklers. Now it is time for the IRC to do the same.

i Ahrens, 2007, p. 2
ii Ibid.
iii Fahy & Leblanc, 2007, p. 24

Cost Impact (Stanek): The code change proposal will have the effect of a minor increase in the cost of construction in the short term that will be recouped in the long run due to other savings that more than offset the costs. See the Cost/Benefit analysis submitted with this proposal.

Cost Impact (Dean): The code change proposal will increase the cost of construction.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF