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ADVISORY COMMITTEE COMMENT FORM
FOR PROPOSED CODE CHANGES
(This form must be submitted electronically)

IRC-132, R302.7

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Proposed Code Change - Language

SECTION R302
FIRE-RESISTANT CONSTRUCTION

R302.7 Under-stair protection. Enclosed accessible space under stairs shall have walls, under-stair surface and any soffits protected on the enclosed side with 1/2-inch (12.7 mm) gypsum board.

Exception: Dwellings provided with an automatic fire sprinkler system complying with the requirements of section R313 and a minimum of one sprinkler head is installed in the enclosed space.

Proposed Code Change – Need and Reason

At the December 14, 2011 IRC Hearing the Minnesota Fire Chiefs Association (MSFCA) and Fire Marshal's Association (FMAM) provided the MN 1309 International Residential Code Committee with twenty scientific based research reports detailing a number of issues related to residential fire sprinklers. Those reports have been entered into the record and are summarized below.

Opponents of the code change continue to advocate for removal of the provision from the model code despite overwhelming evidence that sprinklers work, smoke detectors do not, and follow these arguments with exaggerated cost estimates. Of primary focus is their myopic argument that no deaths have occurred (according to their research) in homes built with interconnected smoke detectors. We believe this data analysis to be false, but more importantly, fails to recognize numerous other issues of equal and/or greater importance.

Cost/Benefit of Sprinklers:

1. Traditional fire suppression has proven to be inefficient, extremely costly, and extremely dangerous. Sprinkler requirements in commercial, industrial, educational and multi-family properties have substantially reduced the devastating impacts of fire specific to fatalities, injuries and property loss.

While it will be a measure of time before the full benefit of residential sprinklers are realized, the traditional model of fire suppression is not sustainable. Sprinklers are the solution as the cost offsets including insurance and property tax savings will pay for every system and several times that over the life of the home.

2. Property taxes will be impacted favorably as departments can maintain volunteer/paid-on-call or more efficient career departments. Quantifying the amount is difficult to do, however, using Minnesota as an example and data from the Minnesota Taxpayers Association we rank 44th to 47th in per capita and per $1,000 income for fire protection as compared to the other 50 states. This is a function of our volunteer pension system which encourages longevity AND a strong building and fire code with many of the metropolitan communities adopting 1306 and other code provisions dating back to the early 1980's. For comparison, we see departments in the Twin City metro region with annual operating budgets of $750,000 to $2,000,000 protecting populations of 20,000 to 90,000 with volunteer/paid-on-call or duty crew models. Other cities of similar population across the nation have budgets two to three times this amount.
3. Fatalities of residents are clearly important and a justifiable criteria for sustaining the sprinkler provision in the code. However, of equal concern is that of responder safety. The fire service seldom knows if a home is occupied and must always assume it is, absent irrevocable proof. Thus, a fire in a residence will result in a fire department responding from which, at the moment in time that the alarm is sounded, risks escalate for both responders and citizens as evidenced by the number of fire, police, and ambulance crashes. Those risks continue in terms of both injury and fatality throughout the mitigation of the hazard (s) but also days and even years past the event as evidenced by the numerous studies of cardiac disease, respiratory disease, and cancer rates, all of which are disproportionately higher for emergency responders as compared to the rest of society.

In summary, the issue is far greater than homeowner deaths; rather, it is the combination of costs, risks, injuries and deaths. Sprinklers have proven themselves in all other occupancies (educational, industrial, commercial, assembly and multi-family) both the life safety side of the equation and also the fiscal side of the equation as proven by the tens of thousands of occupancies that have been constructed with sprinklers and are in operation today.

Additionally, sprinklers have been installed in thousands of twin homes, quad homes and condo's throughout the Twin Cities over the past decade or two with no apparent negative impact on builders' ability to "sell" their product as evidenced by the record number of units constructed.

MSFCA and FMAM recognize the need to address cost impacts in conjunction with the proven effectiveness of sprinklers. Simply put, sprinklers are so effective that traditional construction requirements are simply not needed given the undisputable effectiveness of sprinklers. To that end, we submit the changes as outlined above, which become redundant and therefore add cost to the construction of the home if the passive requirements are not removed from the code.

Reports

1. ***Smoke Alarms in U. S Home Fires***

September, 2011
National Fire Protection Association
Almost all households in the U.S. have at least one smoke alarm, yet in 2005-2009, smoke alarms were present in less than three-quarters (72%) of all reported home fires and operated in half (51%) of the reported home fires. ("Homes" includes one- and two-family homes, apartments, and manufactured housing.) More than one-third (38%) of all home fire deaths resulted from fires in homes with no smoke alarms, while one-quarter (24%) resulted from fires in homes in which smoke alarms were present but did

not operate. The death rate per 100 reported fires was twice as high in homes without a working smoke alarm as it was in home fires with this protection. Hardwired smoke alarms are more reliable than those powered solely by batteries.

2. ***Performance of Home Smoke Alarms Analysis of the Response of Several Available***

Technologies in Residential Fire Settings
February 2008
National Institute of Standards and Technology
This report presents the results of the project and provides details of the response of a range of residential smoke alarm technologies in a controlled laboratory test and in a series of real-scale tests conducted in two different residential structures. The data developed in this study include measurement of temperature and smoke obscuration in addition to gas concentrations for a range of fire scenarios and residences. The results are intended to provide both insight into siting and response characteristics of residential smoke alarms and a set of reference data for future enhancements to alarm technology based on fires from current materials and constructions. Smoke alarms of either the ionization type or the photoelectric type consistently provide time for occupants to escape from most residential fires, although in some cases the escape time provided can be short. Consistent with prior findings, ionization type alarms provide somewhat better response to flaming fires than photoelectric alarms, and photoelectric alarms provide (often) considerably faster response to smoldering fires than ionization type alarms. Escape times in this study were systematically shorter than those found in a similar study conducted in the 1970's. This is related to some combination of faster fire development times for today's products that provide the main fuel sources for fires, such as upholstered furniture and mattresses, different criteria for time to untenable conditions, and improved understanding of the speed and range of threats to tenability.

3. ***U.S. Firefighter Injuries 2010***

2010
National Fire Protection Association
NFPA estimates that 71,875 firefighter injuries occurred in the line of duty in 2010. An estimated 32,675 or two-fifths (45.4%) of the all firefighter injuries occurred during fireground operations. An estimated 14,190 occurred during other on duty activities, while 13,355 occurred at nonfire emergency incidents. The leading type of injury received during fireground operations was strain, sprain or muscular pain (52.8%), followed by wound, cut, bleeding, and bruises (14.2%). Regionally, the Northeast had the highest fireground injury rate.

4. ***The Economic Consequences of Firefighter Injuries and Their Prevention. Final Report***

August 2004
National Institute of Standards and Technology
Based on methods applied from two of the more relevant economic studies, the estimated cost of addressing firefighter injuries and of efforts to prevent them is $2.8 to $7.8 billion per year. The cost elements that comprised those two studies were based on workers compensation payments and other insured medical expenses, including long-term care; lost productivity; administrative costs of insurance; and others. Other costs heretofore have not been factored into assessments of firefighter injuries. The study team analyzed such elements as the labor costs of investigating injuries, along with the hours required for data collection, report writing, and filing. Another cost relates to what employers of firefighters pay to provide insurance coverage, and for safety training, physical fitness programs, and protective gear and equipment—all of these expenses are related to preventing injuries and reducing their severity. The study researchers were fortunate to obtain workers compensation information that was specific to the occupational codes for firefighters, a unique feature of this new research. Some of these expenses were applied to the total number of injuries, while others were factored around the total number of firefighters

since they involve all firefighters, not just those who are injured. Estimates of these cost components alone accounted for $830 to $980 million in direct and indirect costs.

5. ***Total Cost of Fire in the United States***

2011

National Fire Protection Association

The total cost of fire in the United States, as it is defined, is a combination of the losses caused by fire and the money spent on fire prevention, protection and mitigation to prevent worse losses, by preventing them, containing them, detecting them quickly, and suppressing them effectively. For 2008, that total cost is estimated at $362 billion, or roughly 2.5% of U.S. gross domestic product. Economic loss (property damage) – reported or unreported, direct or indirect represents only $20.1 billion of this total. The net costs of insurance coverage ($15.2 billion), the cost of career fire departments ($39.7 billion), new building costs for fire protection ($62.7 billion), other economic costs ($44.0 billion), the monetary value of donated time from volunteer firefighters ($138 billion), and the estimated monetary equivalent for the civilian and firefighter deaths and injuries due to fire ($42.4 billion), all are larger components than property loss.

6. ***Third Needs Assessment of the U.S. Fire Service***

June, 2011

National Fire Protection Association

Fire service needs are extensive across the board, and in nearly every area of need, the smaller the community protected, the greater the need. Fire service needs have declined to a considerable degree in a number of areas, particularly personal protective and firefighting equipment, and two types of resources that received the largest shares of funding from the Assistance to Firefighters grants (AFG). Declines in needs have been more modest in some other important areas, such as training, which have received much smaller shares of AFG grant funds. In all areas emphasized by the AFG and SAFER grants, there is ample evidence of impact from the grants but also considerable residual need still to be addressed, even for needs that have seen considerable need reduction in the past decade.

There has been little change in the ability of departments, using only local resources, to handle certain types of unusually challenging incidents, including two types of homeland security scenarios (structural collapse and chem/bio agent attack) and two types of large-scale emergency responses (a wildland/urban interface fire and a developing major flood). However, the surveys have indicated improvement in the development of written agreements to help in the use of outside resources. This may provide the strongest base on which to build, namely, the creation of regional and national agreements to allow costs of shared resources to be shared across a much wider area while also providing a protocol for any community to respond to an unusually challenging incident that is very unlikely within the community but not so unlikely within the entire region.

7. ***Fire Performance of Houses. Phase I. Study of Unprotected Floor Assemblies in Basement Fire Scenarios.***

December, 2008

Institute for Research in Construction

Details high fire hazards of lightweight truss construction in residential construction and the increased threat to occupants as well as firefighters.

8. ***Report on Structural Stability of Engineered Lumber in Fire Conditions***

September, 2008

Underwriters Laboratory

This report describes the fire resistive performance of nine assemblies tested as part of a fire research and education grant sponsored by the Fire Prevention and Safety Grants under the direction of the Department of Home Security/Federal Emergency Management Agency/Assistance to Firefighters Grants.

9. ***Report on Structural Stability of Engineered Lumber in Fire Conditions***

January, 2009
Underwriters Laboratory
This report describes the fire resistive performance of three assemblies tested as part of a fire research and education program in cooperation with The City of Chicago Fire Department.

10. **The Performance of Composite Wood Joists under Realistic Fire Conditions**

2008
Tyco
The results from this test series demonstrate that exposed, lightweight composite wood joists are likely to fail three to five minutes after compartment flashover for structures with typical residential loadings. Further, the time to collapse as measured from the start of flaming combustion for the fire scenarios employed in this test series was between 8 and 12 minutes. This relatively small timeframe prior to the failure of exposed composite wood joists may require the fire service to adopt alternative tactics and procedures for structures built using lightweight construction methods. This test program further highlights the dramatic differences between the sprinklered and un-sprinklered scenarios, as demonstrated through photographs, observations and data collected. All of the information presented shows that the addition of a sprinkler system can greatly enhance life safety of both residents and firefighters and aid in property protection. Today's homes contain more products with higher heat release rates than in previous years and the construction of these homes has become less fire resistant due to the use of lightweight construction materials. This combination has proven to be deadly for firefighters.

11. ***A Study of Metal Truss Plate Connectors when Exposed to Fire***

January 2007
National Institute of Standards and Technology
The popularity of lightweight, metal plate connected wood truss construction is increasing due to cost effectiveness, versatility, and ease of construction. This type of construction brings many concerns to the firefighting community, since structural collapse has caused numerous injuries and fatalities in the fire service. In an attempt to determine the performance of metal plate wood truss connections during fire exposures, NIST conducted a series of twelve instrumented tests exposing one side of the test specimen to the thermal exposure. Load carrying ability of the metal plate truss connections was not measured during these tests. The tests were purely an attempt to study the heat transfer between the metal plate and the wood. Results from these tests suggest that the metal plates help to protect the wood beneath the plates. However, additional work is required to produce more detailed information.

12. ***Preventing Injuries and Deaths of Firefighters due to Truss Failure Systems***

April 2005
National Institute for Occupational Safety and Health
Report provides details on in which firefighter deaths were due in some part to lightweight truss construction, the dangers of lightweight trusses in fire conditions, and need to make changes.

13. ***U.S. Experience with Sprinklers and Other Automatic Fire Extinguishing Equipment.***

January 2009

Dr. John Hall, National Fire Protection Association
Automatic sprinklers are highly effective elements of total system designs for fire protection in buildings. They save lives and property, producing large reductions in the number of deaths per thousand fires, in average direct property damage per fire, and especially in the likelihood of a fire with large loss of life or large property loss. When sprinklers are present in the fire area, they operate in 93% of all reported structure fires large enough to activate sprinklers, excluding buildings under construction. When they operate, they are effective 97% of the time, resulting in a combined performance of operating effectively in 91% of reported fires where sprinklers were present in the fire area and fire was large enough to activate sprinklers. In homes (including apartments), wet-pipe sprinklers operated effectively 96% of the time. When wet-pipe sprinklers are present in structures that are not under construction and excluding cases of failure or ineffectiveness because of a lack of sprinklers in the fire area, the fire death rate per 1,000 reported structure fires is lower by 83% for home fires, where most structure fire deaths occur, and the rate of property damage per reported structure fire is lower by 40-70% for most property uses. In homes (including apartments), wet-pipe sprinklers were associated with a 74% lower average loss per fire. Also, when sprinklers are present in structures that are not under construction and excluding cases of failure or ineffectiveness because of a lack of sprinklers in the fire area, 95% of reported structure fires have flame damage confined to the room of origin compared to 74% when no automatic extinguishing equipment is present. When sprinklers fail to operate, the reason most often given (53% of failures) is shutoff of the system before fire began. (All statistics are based on 2003-2007 fires reported to U.S. fire departments, excluding buildings under construction.)

14. U.S. Experience with Sprinklers

May, 2011

National Fire Sprinkler Association

Automatic sprinklers are highly effective elements of total system designs for fire protection in buildings. They save lives and property, producing large reductions in the number of deaths per thousand fires, in average direct property damage per fire, and especially in the likelihood of a fire with large loss of life or large property loss. In 2009, 4.6% of occupied homes (including multi-unit) had sprinklers, up from 3.9% in 2007, and 18.5% of occupied homes built in the previous four years had sprinklers. When sprinklers are present in the fire area, they operate in 91% of all reported non-confined structure fires large enough to activate sprinklers, excluding buildings under construction. When they operate, they are effective 96% of the time, resulting in a combined performance of operating effectively in 87% of reported non-confined fires where sprinklers were present in the fire area and fire was large enough to activate sprinklers. In homes (including multi-unit), wet-pipe sprinklers operated effectively 92% of the time. When wet-pipe sprinklers are present in homes that are not under construction and excluding cases of failure or ineffectiveness because of a lack of sprinklers in the fire area, the fire death rate per 1,000 reported structure fires is lower by 83%, and the rate of property damage per reported home structure fire is lower by 71%. When sprinklers fail to operate, the reason most often given (65% of failures) is shutoff of the system before fire began.

15. Home Fire Sprinkler Cost Assessment

September, 2008
Fire Protection Research Foundation
Comprehensive cost analysis of residential sprinkler system installation cost in U. S. at $1.61 per square foot as the national average. Assessment was conducted under oversight committee comprised of Fire, Home, Insurance and other interested stakeholders.

16. Benefit - Cost Analysis of Residential Sprinkler Systems

September 2007

National Institute of Standards and Technology

This report documents a benefit-cost analysis performed to measure the expected present value of net benefits resulting from the installation of a multipurpose network fire sprinkler system in a newly-constructed, single-family house. The benefits and costs associated with the installation and use of a fire sprinkler system are compared across three prototypical single-family housing types: colonial, townhouse, and ranch. The installation costs differ by housing types, with the colonial being the most expensive and the ranch the least. The benefits experienced by residents of single-family dwellings with sprinkler systems, as measured in this report, include reductions in the following: the risk of civilian fatalities and injuries, homeowner insurance premiums, uninsured direct property losses, and uninsured indirect costs. The primary costs examined are for initial purchase and installation of the sprinkler system. Maintenance and repair costs are not examined because they are negligible.

Results of the benefit-cost analysis show that multipurpose network sprinkler systems are economical. The expected present value of net benefits (PVNB) in 2005 dollars is estimated as $2919 for the colonial-style house, $3099 for the townhouse, and $4166 for the ranch-style house. A sensitivity analysis is performed to measure the variability of the results to changes in the modeling assumptions. The sensitivity analysis confirms the robustness of the baseline analysis. The PVNB ranges from $704 to $4801 for the colonial-style house, from $884 to $4981 for the townhouse, and from $1950 to $6048 for the ranch-style house. Multipurpose network systems are the lowest life-cycle cost systems because homeowners can perform their own regular inspections and maintenance, and thereby save on costs they would incur with other systems. Given that they provide a similar level of performance, in terms of fire-risk mitigation, multipurpose network systems then achieve greater cost-effectiveness over alternate systems.

17. ***Residential Sprinklers and Housing Economics. A legislators guide to Life Safety***

February 2009
Buddy DeWar

Independent analyst who debunks numerous myths about fiscal impact specific to residential fire sprinklers complete with validated data.

18. ***International Residential Code and Fire Sprinklers***

November 2009
Minnesota Governor's Council on Fire Protection

Residential fire sprinklers were introduced in the 1970's for use in single- and two-family homes, but have never been required for installation by the model building codes in the United States on a nationwide basis. Recent action by the International Code Council has moved the requirement for the installation of these sprinklers in new single- and two-family homes into the most widely adopted of the model codes and brought the possibility of adoption to the state of Minnesota. This document provides an overview of information on residential fire sprinklers.

19. **United States Fire Administration Position on Residential Fire Sprinklers**

March, 2008
Federal Emergency Management Agency

20. **National Fire Protection Agency Comments on IRC Proposals**

In addition to these reports we submit the following article and report into the record:

1. **The Crusader – National Fire Protection Association Journal**
   For years, Canadian homebuilder Murray Pound rejected home fire sprinklers based on notions of exorbitant cost and installation hassles. Now he's an outspoken sprinkler advocate on a mission to dispel the myths. What changed?
2. **Communities with Home Fire Sprinklers. The Experience in Bucks County, Pennsylvania**

November 2011
http://homefiresprinkler.org/images/stories/pdfs/BucksCountyReport.pdf

Fire sprinkler systems have been saving lives, preventing injuries and limiting property loss since the mid-1800s. Initially used in manufacturing and commercial structures, over time the technology's unique protective qualities were extended to other occupancies, including residential structures. This is fortunate; homes have for decades been where the vast majority of structural fire deaths occur and that fact remains true today. In 2011, the National Fire Protection Association's (NFPA) 2010 fire loss survey showed that home fires accounted for 85%of all civilian fire deaths. Fire sprinklers are uniquely suited to protecting occupants of homes. Most fatal home fires occur at night, when people are typically sleeping. Working smoke alarms provide an early warning that can alert or awaken occupants so they can deploy their escape plan. However, smoke alarms can only detect and signal a fire; they do nothing to control it. Survival is dependent upon the occupants' willingness and ability to quickly and appropriately respond (normally, to escape). When a fire occurs in a home with a fire sprinkler system, the heat from that fire quickly activates the sprinkler closest to the fire (not the entire system). That action controls the fire while it is still small, and in many cases extinguishes it. Controlling a fire in this incipient stage limits the spread of deadly heat and smoke, and prevents flashover (the point at which everything in the room ignites). Sprinklers give occupants a safe window of opportunity to escape the fire. This added time is especially valuable for the more vulnerable populations – young children, older adults, and people with disabilities that limit their mobility.
This report looks at home fire sprinkler installation in six municipalities in Bucks County, Pennsylvania. These municipalities were selected because sprinkler installation was required in those jurisdictions at varying times over several decades. That widespread use provided our researchers with a unique picture of home fire sprinkler installation and the opportunity to compare that experience with homes in the same municipalities that do not have sprinklers installed. The six municipalities include Buckingham Township, Ivyland Borough, New Britain Township, Warrington Township, Warwick Township and Wrightstown Township. Each is located in the central portion of the County, and has undergone significant growth since the 1980s. The jurisdictions range from rural to suburban, with and without public water service.
This report focuses on the life safety advantages of installing home fire sprinkler systems, primarily the prevention of civilian fire deaths. Some attention is also given to the additional benefits of the technology, including injury prevention (civilian and firefighter), reduced tax rates and lower capital expenditures for community fire protection. Because most discussions about installing fire sprinkler systems in new homes include a debate about added costs, our report also investigated this aspect and reviewed the impact the systems have had on development in the six communities. Our study illustrates many ways in which home fire sprinkler system installations have become an important part of the community fire protection plan for these jurisdictions. Most importantly, we recount the documented "life saves" that resulted when fires occurred in sprinklered homes.

Overall, there were 90 fire deaths in un-sprinklered one- and two-family dwellings in Bucks County from 1988-2010 (88%of all County fire deaths during that time frame), with no fire deaths occurring in sprinklered dwellings. Five fire incidents in sprinklered homes have been documented as saving at least five lives.
The average property loss in the sprinklered home fire incidents was $14,000, with an average of 340 gallons of water used to extinguish the fires. These incidents can be compared to 51 fires in un-sprinklered homes in the six studied municipalities from 2005-2010, in which the average fire loss per incident was $179,896 and for those fires where water usage data was available, an average of 5,974 gallons (nearly 25 tons) of water was needed to extinguish the fires.

Proposed Code Change – Cost/Benefit Analysis

The proposed changes will decrease costs of construction from the current IRC requirements.

The phase-in process allows both the building industry and sprinkler industry time to adjust to the requirements and develop cost efficiencies. It is difficult and subject to quantify this amount; however,

based on sound economic principles of market forces it is reasonable to conclude that significant savings will occur.

Trade-off savings will be substantial and vary based on site specific facts. Egress window installation ranges from $600 to $1,000 each. Under-floor protection costs range from $.50 cents a square foot to $1.10 per square foot. Fire blocking, draft stopping, penetrations protection costs vary with the home and construction types.

Insurance premium savings, based on an average metro homeowner's policy of $845, is between 5% and 12% per year or $42 and $101 per year. Over the course of 20 years the insurance savings equate to $840 to $2,020. This average is based on 2008 data from the Insurance Federation of Minnesota and is for the entire State. Predictably, the IRC will have greater consequence in the Metro area given that more new homes will likely be constructed there. Similarly, home values and thus, insurance coverage and policy premiums will be higher in the metro area than the State average resulting in greater savings to the metro homeowner via their insurance coverage.

For those interested in reforming government and reducing costs; sprinklers are the perfect solution as the recipient is the investor who realizes their return via the combination of insurance savings, trade-offs reduced property taxes and the confidence and comfort of knowing the level of protection provided by sprinklers is unequalled.

The combination of construction trade-offs and insurance savings over time will exceed the installation costs.

For those homes constructed as part of new developments, the additional cost reductions related to street construction and hydrant spacing (per the MN State Fire Code) will either result in further cost reductions to the homeowner or increased profitability for the developer/builder. Finally, when adding the reduced property taxes, the homeowner realizes further fiscal benefit.

In closing, the "Crusader" article and Bucks County Report provides additional evidence and proof that residential fire sprinklers are cost effective.

Other Factors to Consider Related to Proposed Code Change

1. Is this proposed code change meant to:

   x change language contained in a published code book? If so, list section(s).

   R302.7

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in a published code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   neither; this language will be new language, not found in the code book or in Minnesota Rule.

2. Is this proposed code change required by a Minnesota Statute or new legislation? If so, please provide the citation to the Statute or legislation.
   No

3. Will this proposed code change impact other sections of a published code book or of an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

4. Will this proposed code change impact other parts of the Minnesota State Building Code? If so, please list the affected parts of the Minnesota State Building Code.
   No

5. Who are the parties affected or segments of industry affected by this proposed code change?
   Homeowners, Firefighters, Code Officials, Builders

6. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No

7. Are you aware of any federal requirement or regulation related to this proposed code change? If so, please list the regulation or requirement.
   No