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A CRITIQUE OF THE NIST REPORT ON THE FIRE AT THE SOFA SUPER STORE

By Richard Schulte

Recently, the National Institute of Standards and Technology (NIST) released the final report on its investigation into the fire at the Sofa Super Store. The report titled *"Technical Study of the Sofa Super Store Fire-South Carolina, June 18, 2007*" is authored by Nelson P. Bryner, Stephen P. Fuss, Bryan W. Klein and Anthony D. Putorti of the Fire Research Division of the Engineering Laboratory at NIST and is dated March 2011. The following are a number of excerpts from the report:

> "*The collaboration with the National Institute for Occupational Safety and Health, including Tim Merinar, Matt Bowyer, Jay Tarley, Dawn Castillo, and Robert Koedam, provided on-scene assistance, access to interviews, and support for computer fire model simulations. The cooperation of the Bureau of Alcohol Tobacco and Firearms, including John Golder, Chris Porreca, and David Sheppard provided on-scene assistance and discussions on computer simulations and fire origin and cause.*" (Acknowledgments, Page *xiv*)
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> "*A number of people from NIST assisted the official team members. Of particular note were David Stroup, Glenn Forney, and Anthony Hamins, who devoted considerable time on the fire scene documenting dimensions, materials of construction, and burn patterns. William Grosshandler, Anthony Hamins, and Richard Gann devoted significant time to reviewing and improving the report. The assistance of Adam Barowy and Jonathan Kent in improving the figures, slice files, and digital images was critical and much appreciated. The support that Kelly Opert provided for documenting the reports and media citation significantly improved the readability of the appendices. The energetic assistance of Sue Haga in formatting, assembling, and proofreading these two volumes is also gratefully acknowledged.*" (Acknowledgments, Page *xiv*)
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> **Commentary:** It is interesting to note that the Acknowledgments section of the report does not include any mention of members of the public who took the time to review and comment on the draft report. Given the extensive number of technical errors contained in the draft report, the incorporation of the public comments into the final report substantially improved the technical content and accuracy of the report.

"*A fire occurred on the evening of June 18, 2007, in the Sofa Super Store at 1807 Savannah Highway, Charleston, South Carolina. . .Nine fire fighters from the Charleston Fire Department were killed in the fire.*" (Executive Summary, Page *xv*)

"*Based on the NIST technical study, the following sequence of events are likely to have occurred. From an unknown source, a fire ignited in a pile of packing material and discarded furniture outside an enclosed loading dock area. The fire spread from the exterior to the interior of the loading dock, which was used for staging furniture for delivery and for repair of furniture. The fire spread quickly within the loading dock and moved into both the retail showroom and warehouse spaces. . .When the front windows were broken out or vented, additional oxygen flowed in the front windows, along the floor, and to the rear of the showroom and became available to the fire. The additional oxygen allowed the heat release rate of the fire to increase extremely rapidly and ignite the layer of unburned fuel below the suspended ceiling. The fire swept from the rear to the front of the main showroom extremely quickly, then into the west and east showrooms. Both the temperatures and oxygen depletion reached values that were life-threatening to unprotected individuals. Intense heat from sustained burning of furniture in the main showroom weakened the roof joists and supports and resulted in the collapse of a portion of the roof over the main showroom approximately 13 minutes after flames emerged from the front windows (40 minutes after the fire department arrived on scene). Furniture and merchandise in the showrooms and warehouse continued to burn for an additional 140 minutes before the fire was extinguished.*" (Executive Summary, Page *xv*)

"*Nine fire fighters from the Charleston Fire Department were killed in the fire.*"

"*During the course of this technical study, NIST was able to identify the reasons for the rapid spread of fire and smoke, and the reasons for the difficulties encountered by the fire fighters as they attempted to exit the main showroom.*" (Executive Summary, Page *xvi*)

"*Fire was observed at rear of store at 6:56 p.m. The fire began in trash outside the loading dock and spread into the enclosed loading dock. Fire department arrived at 7:11 p.m., less than four minutes after being dispatched.*" (Executive Summary, Page *xvi*)

"*Fire was observed at rear of store at 6:56 p.m. The fire began in trash outside the loading dock and spread into the enclosed loading dock. Fire department arrived at 7:11 p.m., less than four minutes after being dispatched.*"

"*The extremely rapid spread of fire through the main and west showrooms trapped six fire fighters in the main showroom and three fire fighters in the west showroom. Although the intense heat from the fire weakened the light weight steel trusses and led to the partial collapse of the roof, the coroner's report indicated that the fire fighters died from thermal burns and/or smoke inhalation, not from compression type injuries that would have been associated with the collapse.*" (Executive Summary, Page *xvi* and *xvii*)

"***Three fire doors between the main and west showrooms activated, but did not close during the fire. Three fire doors between the main and east showrooms activated; two doors closed completely and the third door partially closed.***" (Executive Summary, Page *xviii*)

"***Fire sprinklers were not installed in the showrooms or distribution warehouse.***" (Executive Summary, Page *xix*)

"***Only three of the seven roll-down fire doors activated and closed fully during the fire.***" (Executive Summary, Page *xx*)

"***Only three of the seven roll-down fire doors activated and closed fully during the fire.***"

"*There were more than five portable fire extinguishers located in the structure. A store employee discharged two portable extinguishers at the loading dock fire.*" (Executive Summary, Page *xx*)

"*Fire department inspections did not identify the large fuel load, the non-code compliant wood construction, the solvent storage on the loading dock, or the lack of a fire door between loading dock and holding area as significant fire hazards.*" (Executive Summary, Page *xxiv*)

"*NIST recommends that all state and local jurisdictions ensure that fire inspectors and building plan examiners are professionally qualified to a national standard such as NFPA 1031 Standard for Professional Qualifications for Fire Inspector and Plan Examiner. Professional qualification may be demonstrated through a nationally accepted certification examination, such as the Fire Plan Examiner; Fire Inspector I and II, and Certified Fire Marshal.*" (Executive Summary, Page *xxv*)

"*NIST recommends that research be conducted to better understand ignition and fire spread on upholstered furniture in order to provide the tools needed by the design profession to improve the fire performance of furniture.*" (Executive Summary, Page *xxvi*)

"*NIST recommends that research be conducted to provide the tools needed by the design profession to improve the performance of compartmentation.*" (Executive Summary, Page *xxvi*)

"*The purpose of NIST building and fire safety studies is to use knowledge gained from the studies to help improve safety through recommended changes to codes, standards, and practices. NIST does not have the statutory authority to make findings of fault nor negligence by individuals or organizations.*" (Page 1-1)

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"*The NIST team had access to the exterior of the Sofa Super Store the day after the fire.*" (Page 1-2)

"*Unburned sections of structure including walls, ceilings, and flooring, provided insight into what materials had been incorporated into the structure.*" (Page 1-2)

"*Working in cooperation with the National Institute for Occupational Safety and Health (NIOSH) and South Carolina Department of Labor, Licensing, and Regulation, NIST team members recorded the physical dimensions of the structure, the construction materials, and the function of each area within the space.*" (Page 1-3)

"*Roughly three-quarters of the main showroom space was used to display various pieces of furniture (Figure 1-8).*" (Page 1-10)

"*Based on post-fire inspection of the showroom, most of the showroom space was used to display various pieces of furniture. As evidenced by unburned material including glass, knobs, hinges, frames, and springs, some of the displays involved a row of similar pieces, such as a number of different recliners, while other displays featured multiple pieces of furniture, such as a chair, loveseat, and coffee table arranged in a living room configuration. Area rugs and carpets were also displayed on the showroom floor as well as in vertical hanging racks (see Figure E-25). The rear portion of the showroom displayed sofas, sleeper sofas, and futons.*" (Page 1-13)

"*As expected from a store of this type, the inventory of combustible material within the buildings was the retail merchandise. This included a wide range of furniture including sofas, chairs, tables, beds, dressers, lamps, and rugs.*" (Page 1-23)

"*Mattresses, upholstered chairs, sofas, recliners, and futons typically contain significant amounts of polyurethane foam [19, 20]. Dressers, tables, chairs, and end tables are made of wood or wood products [21]. Area rugs and carpeting also contain large amounts of synthetic materials. All of these items contributed to the fuel loading in the store.*" (Page 1-23)

"*The hydrant that had been located at the corner of Wappoo Road and Savannah Highway had been removed and not replaced.*" (Page 1-29)

"*The hydrant that had been located at the corner of Wappoo Road and Savannah Highway had been removed and not replaced.*"

Commentary: It should be noted that the hydrant which was removed is the hydrant which was closest to the front entrance of the building. It should further be noted that the hydrant which was removed was the only hydrant in the vicinity which was supplied by a 10 inch main. The other hydrants in the vicinity of the building were either supplied by 6 or 8 inch mains. Hence, it can be concluded that the missing hydrant at the corner of Wappoo Road and Savannah Highway was critical to the fire department operation for a fire at the Sofa Super Store. NIST failed to note how critical the missing hydrant was in the final report.

The NIST report also did not provide any explanation for why the hydrant at this location was removed and not replaced.

"*NIST found no building records that identified the original owner, architect, design engineer, or builder of the Sofa Super Store building at 1807 Savannah Highway, Charleston, SC. Anecdotes indicated that the building originally was a Piggly Wiggly Supermarket that was erected in the late 1950s or early 1960s.*" (Page 1-30)

Commentary: The fact that architectural drawings for a building constructed 50 years ago no longer exist is not surprising. The building was not of any architectural significance and half a century is a long time to retain drawings for a rather nondescript building.

"*Existing records indicate that the property was annexed into the City of Charleston from Charleston County in 1990, and also provide building permits for the addition of the west showroom in 1994, the east showroom in 1995, and the warehouse in 1996.*" (Page 1-30)

"*The deaths of nine fire fighters on June 18, 2007, in the Charleston Sofa Super Store fire was the single greatest loss of life for the fire service in the United States since 343 fire fighters died in the collapse of the World Trade Center on Sept. 11, 2001. For South Carolina, this fire was the deadliest fire since 11 people died in the Lancaster County Jail fire on Dec. 27, 1979 [1-2].*" (Page 2-1)

"*On June 18, 2007, at 6:56 p.m., the time of the first sighting of the fire, the Sofa Super Store was open and employees were inside the showroom and warehouse areas within the structure. The fire was first observed by a passerby driving along Savannah Highway in front of the store and was reported to store employees. . . Upon initial verification of the fire, the store manager discharged a portable dry chemical fire extinguisher, but was unable to extinguish the fire. Upon returning to the showroom area, the store manager asked other employees to call 911. The manager subsequently returned with a second extinguisher, found the loading dock more fully involved in fire, and discharged the extinguisher into the loading dock area from outside the loading dock. At 7:08 p.m., a report of a fire at the Sofa Super Store was received by the Charleston County 911 Emergency Center and the Charleston Fire Department was dispatched.*" (Page 2-2)

Commentary: Approximately 12 minutes passed between the sighting of the fire and the receipt of an alarm by the 911 Emergency Center. Also note that the store manager attempted to extinguish the fire with a portable fire extinguisher prior to instructing store employees to contact the fire department.

"*Upon arriving on the scene at 7:11 p.m., BC 4 reported a trash/debris fire at the rear of the showroom. Engine 10 was directed by the BC to position the apparatus near the loading dock and begin suppressing the trash fire (Figure 2-1).*" (Page 2-2)

"*By 7:16 p.m., fire crews were applying water using a 3.8 cm (1.5 in) diameter hose line on the fire in the loading dock. At the same time, at the front of the store, crews were pulling a 3.8 cm (1.5 in) diameter hose line in the front door, through the main showroom, and into the west showroom. At the time, neither E-10 at the loading dock nor E-11 at the front of the store had been connected to water hydrants, so any water being used for suppression would have been drawn from the onboard tanks of E-10 or E-11.*" (Page 2-2)

"*In the next 10 minutes, two engines were connected to water hydrants (Figure 2-2). E-10 was connected through E-12 to a hydrant at the corner of Blitchridge Road and First Drive. By 7:21 p.m. a water supply line was connected to the engine pumping water to the loading dock fire teams. E-12 was pumping water through approximately 230 m (750 ft) of 6.4 cm (2.5 in) diameter supply line. Requests to increase the water pressure were radioed to E-12 at 7:25 p.m. By 7:27 p.m. the engine positioned at the front of the store (Figure 2-3) was also connected to a fire hydrant. E-11 was being supplied by E-16 which had located a water hydrant at 1714 Savannah Highway in front of Morris Nissan automobile dealership. E-16 was pumping water to E-11 through about 560 m (1850 ft) of 6.4 cm (2.5 in) diameter supply line.*" (Page 2-3)

"*During the rescue effort at about 7:27 p.m., several inaudible radio communications suggested that fire fighters were lost or disoriented. Several minutes later, between 7:29 p.m. and 7:30 p.m., there were additional radio communications that were still difficult to understand, but seem to be one or more fire fighters asking for directions to exit or requesting assistance to escape. Other radio calls were interspersed with calls for help related to getting the trapped employee out. Beginning around 7:31 p.m., additional broken radio traffic more clearly indicated that several fire fighters were in distress. An unknown fire fighter called "Mayday," and dispatch advised the Fire Chief that the L-5 engineer had activated the emergency button on his radio. At 7:35 p.m., the Fire Chief radioed, "….we need to vacate the building."*" (Page 2-6)

"*At about 7:35 p.m., the front windows of the main showroom were vented and broken out. As clean air was drawn into the main showroom through the lower part of the broken windows, heavy brown smoke poured from the upper sections of the broken windows. Less than a minute later, the brown smoke changed to thick black smoke.*" (Page 2-6)

"*The fire was brought under control after 10 p.m. Recovery operations continued until after 4:00 a.m. the next morning, June 19, 2007.*" (Page 2-6)

"*At about 7:35 p.m., the front windows of the main showroom were vented and broken out. As clean air was drawn into the main showroom through the lower part of the broken windows, heavy brown smoke poured from the upper sections of the broken windows. Less than a minute later, the brown smoke changed to thick black smoke.*"

"*The fire began in a pile of trash and discarded furniture, which had accumulated on the asphalt outside the loading dock area. The fire spread into or through a wall that had an exterior surface of metal siding, wood studs and framing, and an interior surface of plywood and/or gypsum board. Store merchandise was staged on the enclosed loading dock for delivery over the next several days. Since there were six trucks utilized to deliver merchandise to customers, there could have been multiple sofas, futons, loveseats, chairs, tables, rugs, dressers, and mattresses inside the loading dock for delivery (Figure 1-14). As the fire spread into the enclosed dock, these furniture items provided additional fuel in addition to the wood framing, synthetic carpeting, and wooden deck of the dock itself.*" (Page 2-11)

"*Partially burned fuel in the form of smoke and combustible gases from the fire on the loading dock filled the interstitial space above the ceiling in the main showroom, and the smoke began to flow through ventilation openings down into the main showroom. At about the same time, the fire spread from the holding area into the rear of the main showroom. The smoke being generated by the fire in the rear of main showroom and the smoke flowing down through the ceiling was forming a layer of unburned fuel below the ceiling of the main showroom. At this stage, the fire did not have access to sufficient oxygen to burn completely.*" (Page 2-12)

Commentary: The report refers to the space between the ceiling and the roof deck as an "*interstitial space*". An "*interstitial space*", as the term is used in construction codes, refers to a mechanical space located between floors of a building. The mechanical space is provided with a floor which permits work on mechanical/electrical systems to be made without the use of ladders or scaffolds. The space referred to as an "*interstitial space*" in the NIST report is actually a concealed space.

"*While this overview notes key tactical challenges facing the fire department and how they responded, the NIST study addressed the emergency response only as needed to reconstruct the behavior and time line of the fire.*" (Page 3-1)

"*The Charleston Fire Department (CFD) provides fire suppression services to a community of approximately 108,000 people [11].*" (Page 3-2)

"*The department's approximately 237 uniformed personnel operated from 14 stations with a combined response capability of 16 engine companies and three ladder companies [12].*" (Page 3-2)

"*Compliance with NFPA 1500 requires that a fire department develop and adopt a comprehensive risk management plan to identify and evaluate potential hazards. The risk management plan would have identified the Sofa Super Store as a low-, medium-, or high-hazard occupancy. For low hazard occupancies, compliance with NFPA 1710 advocates a minimum crew of four members operating from each type of apparatus. With the total floor space of 4700 m^2 (50,400 ft^2) and combustible merchandise, the Sofa Super Store probably would have been identified as a medium- to high-hazard occupancy. For high hazard occupancies, the standard advocates a minimum crew of five or six members operating from each type of apparatus. Unit staffing levels directly affect the fire fighting crew's tactical performance capabilities, the speed at and duration of which they can be relied upon to accomplish various tasks, such as establishing water supply, advancing hose lines, or effecting rescues, as well as the overall scope and effectiveness of the tactical intervention strategy being applied in a given situation.*" (Page 3-2)

Commentary: Most fire departments simply do not have a budget which would support five or six member fire companies. Fire company sizes of two and three are common throughout the United States.

Fire company size affects the types of operations a fire department is capable of performing. Given personnel limitations, many fire departments are not capable of conducting interior manual fire fighting operations safely.

"*CFD procedures indicated that for fires involving structures less than five stories in height, the first alarm assignment was two engine companies, a ladder truck company, and a BC [1, 8].*" (Page 3-4)

"*At 7:09 p.m., the CFD was dispatched for a possible fire behind the furniture store at 1807 Savannah Highway in the West Ashley area.*" (Page 3-8)

"*At 7:11 p.m. BC-4 arrived on the scene and reported a trash fire at the side of the store. The AC arrived next by 7:12 p.m., entered the front of the store, and walked down the center aisle to the rear of the main showroom. As BC-4 returned to the front of the store from the loading dock area, he conferred with the AC who indicated that he did not find any fire or smoke in the main showroom. As E-10 arrived at the store, it was directed to back down the driveway to the west of the store to set-up to attack a trash fire. After relocating his car, BC-4 joined E-10 near the loading dock. As E-11 arrived, it was positioned in front of the store to support operations through the front doors of the main showroom (Figure 3-5).*" (Page 3-8)

"*Each engine was equipped with a 2900 L (750 gal) water tank, which provided water until a connection to a hydrant was established. The third company on the initial dispatch, Ladder 5, was equipped with an aerial ladder, but with neither a water tank nor a water pump.*" (Page 3-8)

"*At this point (7:14 p.m.), the fire department was aware that the fire had spread into the showroom as demonstrated by the radio communication "I've got fire inside the rear of the building and it's walking it's way right on into the, into the showroom."*" (Page 3-9)

"*The captain of E-10 selected a 3.8 cm (1.5 in) diameter hose line for an interior attack into the enclosed loading dock area. . . As the team retreated from the loading dock area, the hose line burst or was burned through by the fire near the doorway.*" (Page 3-9)

"*By 7:16 p.m., the Fire Chief arrived on the fire scene and met with the AC and BC 4. After surveying the fire in the loading dock area, the Fire Chief halted the interior attack and ordered the interior team to back out of the enclosed loading dock.*" (Page 3-9)

"*Once a water supply was established to L-5, the aerial ladder/platform was used to initiate an aerial stream to suppress the fire in the warehouse and loading dock as well as protect an adjacent auto repair garage to the west of the store.*" (Page 3-10)

"*Since fire crews were pulling the hoses to the rear of the west showroom, the fire department appeared to be focused on suppressing the fire on the loading dock. They did not appear to have evidence that the fire had spread through the open roll-down door into the holding area, into the void space above the suspended ceiling, and eventually into the rear of the main showroom.*" (Page 3-10)

"*At 7:16 p.m., the L-5 engineer requested that E-11 charge with water or pressurize the 3.8 cm (1.5 in) hose line. Until a supply line was connected to E-11, the water available to the fire fighters working through the front door was limited to the on-board tank of E-11.*" (Page 3-11)

"*As water began to move through the supply hose from E-16 to E-11 at 7:26 p.m., the E-16 engineer radioed that water was coming. By 7:27 p.m., E-11 was receiving water through a single supply line. It is not clear how much or how steady the water supply was to E-11. The supply line was laid across Savannah Highway and radio calls were still requesting the Charleston Police to stop automobile traffic from driving across the hose lines.*" (Page 3-11)

"*At about 7:27 p.m., when both engines were initially connected to hydrants, a Charleston Fire Department dispatcher notified the Fire Chief that it had received a cell phone call from an employee trapped inside the rear of the building. . .The team rescued the employee through a hole in the wall in the workshop that was connected to the warehouse (not from the showroom) (Appendix H, Figure H-3). After rescuing the trapped employee, the team returned to the front of the store.*" (Page 3-11)

"*The employee who was rescued from the repair shop also indicated that he was trapped because the roll-down fire door to the warehouse was closed. The fire did not spread from the warehouse to the rear of the main showroom through the closed roll-down fire door.*" (Page 3-11)

"*The lack of a suspended ceiling above the holding area allowed the hot smoke to flow into the void space above the suspended ceiling but below the roof of the main showroom. The volume above the suspended ceiling of the main showroom was significant, representing about one-third the volume of the main showroom structure and would have required significant time to fill.*" (Page 3-12)

Commentary: The above does not provide an estimate of the temperature of the hot gases in the concealed space above the ceiling. An estimate of the temperature of the gases in the concealed space would indicate the range of temperatures to which the foam plastic insulation in the roof construction over the main showroom may have been exposed.

"*It is not clear how the fire moved from the holding room to the rear of the main showroom. There were at least three possible paths that would have allowed the fire to spread into the main showroom. . .Of the three potential paths identified above, the third path, fire spreading through the door appears most consistent with the fire development.*" (Pages 3-12 and 3-13)

"*Once the fire spread from the holding area into the rear of the main showroom, there was more fuel available to the fire. The fire in the rear of the main showroom did not have ready access to air and was under-ventilated. Post-fire review of photographs and videos, as well as fire fighter interviews, demonstrated that the only ventilation paths to the rear of the showroom were the open front doors, the roll-down door to the loading dock, and the double doors at the rear of the west showroom. . .The CFD did not ventilate the roof, so no vertical pathway existed in the rear of the main showroom.*" (Page 3-13)

"*With only limited access to air, the fire would have initially ignited the outer layers of fabric and foam on the furniture. The fabric and foam would likely have supported an intense, but relatively short, release of heat that might not have been sufficient to spread the fire due to the limited amount of oxygen. The slower burning wood components of the furniture might have allowed the fire to continue to burn, albeit at much lower heat release rate, for a longer period of time.*" (Page 3-13)

"*Inside the showroom were crew members of Engines 6, 11, 15, 16, and 19 and L-5. At this stage in the response, the crews had already pulled a 3.8 cm (1.5 in) hose and a 6.4 cm (2.5 in) hose through the front doors, through the main showroom, and to the rear of the west showroom. An additional 6.4 cm (2.5 in) hose had been pulled about 23 m (75 ft) into the main showroom. But, it was unclear as to whether the second 6.4 cm (2.5 in) hose line was intended for the rear of the main showroom or the rear of the west showroom. Even with the hose lines in place, E-11 did not appear to be providing sufficient water to charge or pressurize all three hose lines simultaneously.*" (Page 3-13)

"*As observed in photographs and videos, the smoke that initially appeared at the front of the store was light brown in color and did not flow upward quickly. This lack of upward flow or buoyancy resulted in the smoke moving across the store front rather than flowing up past the façade (Figure 3-7). The brown color was consistent with partially burned combustion products from an under-ventilated fire, a fire that did not have sufficient air for complete combustion. . . At about 7:35 p.m. the fire fighters broke the front windows to allow more of the smoke to vent and improve the visibility in the main showroom. After the windows were vented, air was drawn into the front of the main showroom through the lower portion of thebroken windows in addition to the doors. Photographs demonstrate that furniture just inside the front windows which smoke had obscured, became visible after the windows were broken. The amount of smoke at the front of the main showroom increased and changed from a brownish to a blacker color. The change in smoke color was still consistent with partially oxidized combustion products from a fire that was ventilation-limited.*" (Page 3-14)

"*Nine fire fighters were trapped within the showrooms, three within the west showroom and six within the main showroom.*" (Page 3-16)

"*Nine fire fighters were trapped within the showrooms, three within the west showroom and six within the main showroom.*"

"*The Fire Chief directed two two-man teams to attempt to enter and search for the trapped fire fighters. Both teams entered the main showroom, but were forced to retreat by the intense heat. At approximately 7:38 p.m., the last of the search teams exited the front of the structure.*" (Pages 3-16 and 3-17)

"*At around 7:44 p.m. the fire department requested that the city water department increase the water pressure in the supply lines in West Ashley. L-4 arrived and set up in the parking lot in front of the store and directed additional water streams down onto the showrooms from its elevated ladder. At about 10:00 p.m. the fire was declared under control and recovery operations were initiated.*" (Page 3-17)

"*Fire fighters were not directed to ventilate any portion of the roof on the Sofa Super Store.*" (Page 3-17)

"*There was not a single location for incoming fire fighters to check in or receive co-ordinated assignments. CFD procedures allow off-duty fire fighters to respond to and participate in fire ground activities. Department procedures required each fire fighter to provide a chief officer with an identification card before participating in fire ground activities. Department procedures did not require that the off-duty fire fighter check in with the incident commander, just a chief officer.*" (Page 3-18)

"*The lack of a single command post and the ability of off-duty fire fighters to check in with different chief officers did not allow easy or coordinated tracking of personnel on the fire ground.*" (Page 3-18)

"*On-scene mutual aid was provided to the CFD by the St. Andrew's Fire Department and St. James Island Fire Department. Each of the mutual aid departments responded on their own, not at the request of CFD.*" (Page 3-19)

"*Computer simulations, also known as numerical modeling, have been demonstrated to be useful, when properly applied, as a tool to help fill in details of the fire dynamics and to demonstrate the value of alternative building designs and fire safety measures [1]. When properly verified and validated, models can be used to obtain quantitative results. The Sofa Super Store simulation results are an approximation of the actual event, and should be considered as qualitative rather than quantitative. In other words, it is likely that the simulations do not return exactly the same results as might have been present in the real world situation, but can provide a reasonable approximation of conditions.*" (Page 4-1)

"*The Sofa Super Store simulation results are an approximation of the actual event, and should be considered as qualitative rather than quantitative.*"

"*The value of the computer simulation of the Sofa Super Store fire is its ability to generate a clearer picture of the conditions that existed within the Sofa Super Store as the fire progressed. The simulation can be used to examine the change in the initial conditions and analyze possible interventions on the dynamics of the fire and the environment within the store.*" (Page 4-1)

"*For these model simulations, the fire department was on scene at time = 0, the fire was discovered at the rear of the west showroom at 2 minutes, E-12 began pumping water to E-10 (loading dock) at 10 minutes, broken radio calls began to indicate fire fighters in trouble at 16 minutes, front windows were vented at 24 minutes, fire was emerging from front windows at 26 minutes, last fire fighter successfully exited structure at 27 minutes, and the roof over the main showroom partially collapsed at 40 minutes. Each 40 minute simulation covered the time period from fire department's arrival at 7:11 p.m., to just after the partial collapse of the main showroom roof at 7:51 p.m.*" (Page 4-2)

"*The simulation was designed to provide insight into how the fire might have spread into the showrooms in a concealed or less visible manner. This simulation considered different scenarios for fire-spread into the showrooms, including 1) through the double doors at the rear of the west showroom, and 2) through the holding area.*" (Page 4-2)

"*The simulation considered the effect of sprinklers by including a scenario in which fire sprinklers were installed in the enclosed loading dock.*" (Page 4-2)

"*Ventilation can significantly impact how a fire grows and develops. . .Ventilation can also provide additional air to the fire and can result in a greater release of heat or energy.*" (Page 4-2)

"*Inputs required by FDS include the geometry of the structure, the computational cell size, the location of the fire source, the energy release rate of the fire source, the mass, geometry and thermal properties of walls, ceilings, floors, and furnishings, and the size, location, and timing of door and window openings to the outside of the structure. The selection of thermophysical properties and dimensions for the input parameters can have a significant impact on the outcome of the simulation, and because considerable uncertainty exists in the values of these parameters, a range of values is used.*" (Page 4-3)

"*For a specific set of inputs, FDS calculates the fire-spread and smoke movement within the Sofa Super Store. The results of the simulation including the spread of fire and smoke within the loading dock, holding area, and showrooms, are compared to the photographic and video record and the statements of witnesses to assess the agreement between the simulation and the actual fire. The input parameters are systematically adjusted and the simulation re-run. This process of refining the input parameters continues until the best possible agreement has been achieved.*" (Page 4-3)

"*The FDS input parameters were adjusted by comparing the simulation results with the available photos, videos, witness statements and other documentation of the fire. This methodology has been used previously by NIST researchers in post-fire studies [6-13]. Over 250 computer simulations were required to match the observed phenomena and time line.*" (Page 4-4)

"*The FDS input parameters were adjusted by comparing the simulation results with the available photos, videos, witness statements and other documentation of the fire. . .Over 250 computer simulations were required to match the observed phenomena and time line.*"

"*The assumption was made that all furnishings in the building were composites of foam and fabric, and that this material or composite constituted the entire fuel load. Table K-2 (Appendix K) details the properties for each of these layers. It was assumed that a single step reaction occurred for each material, and that all of the material was converted into gaseous fuel. The reaction was based on polyurethane foam, represented as* $C_{6.3}H_{7.1}O_{2.1}N$ *[5, Appendix C, Table C.3]. Other fuels such as flooring, wood display shelves, ceiling tile, paper documents, or wood framing, were not included as fuel for these simulations.*" (Page 4-8)

"*The simulations did not include specific items as components of the fuel package because these items were considered to have negligible impact on the rapid fire spread through the showrooms during the early stages of the fire. These items included spray cans of solvents and paint at the rear of the main showroom and the foam insulation and membrane in the roof.*" (Page 4-8)

"*The foam insulation and roof membrane were located above the metal roof decking. If flames from the fire had impinged on the underside of the metal decking and increased the temperature of the decking, the foam insulation could have softened, melted, and eventually pyrolyzed. The pyrolysis products would then have leaked into interstitial void space below the decking and above the suspended ceiling through cracks or holes in the metal decking. If the unburned fuel/pyrolysis products had combined with sufficient air, then it would have resulted in increased heat release rate.*" (Page 4-8)

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"*The flames from the loading dock had direct access to the underside of the metal decking above the holding area because it lacked a suspended ceiling. However, a suspended ceiling had been installed above the rest of the main showroom. If the suspended ceiling tiles had remained intact, flames from fire on the showroom floor would not have been able to impinge on the underside of the metal decking and it would have been difficult for additional air to flow into the interstitial space.*" (Page 4-8)

Commentary: Pyrolysis is caused by the exposure of a combustible material to heat. The statement above does not indicate the temperatures to which the underside of the metal deck was exposed. The fact that the underside of the metal deck was not exposed to flame is extraneous information which has no bearing on the issue of whether or not pyrolysis of the foam plastic roof deck insulation occurred. The authors of the report should be well aware of this fact.

"*Since the direct impingement of flames appeared to be limited to the metal decking above the holding area, the energy content of the foam above the holding area was estimated to be less than 0.5% of the energy content of the fuels in the enclosed loading dock. During the first 40 minutes of the fire, the quantity of smoke and unburned fuel from the loading dock that was channeled through the holding area into the void space was assumed to be much greater than the leakage of foam pyrolysis through the metal decking above the holding area.*" (Page 4-8)

Commentary: The relative percentage of the energy content of the foam plastic insulation relative to the energy content of the fuels in the loading dock area is irrelevant. The information which is relevant is the relative percentage of the unburned combustible gases generated by pyrolysis of the foam plastic insulation in comparison to the quantity of unburned gases generated by other fuels in the combustible concealed space. The authors do not address how this was determined. In other words, the stated assumption in the excerpt above is not based upon factual information, nor the use of a valid scientific methodology.

The lack of factual information and the use of a valid scientific methodology calls into question the validity of the entire report.

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"*The earliest available photos of the fire were taken at 7:22 p.m., approximately 13 minutes after the first dispatch. Therefore, knowledge of the early fire development is based on eyewitness accounts obtained during interviews of fire fighters.*" (Page 4-8)

"*Purser [2] has published data that identify when conditions become untenable for humans. Purser provides an algorithm for estimating the time to lose consciousness due to low oxygen. At 0.12 volume fraction, the time is estimated at about five minutes. In a closed fire-engulfed environment, toxic gases (such as carbon monoxide) are likely to be present at incapacitating levels before the oxygen gets this low. . . A second indicator will be when the temperature exceeds 120 °C (250 °F) for about five minutes [2]. The effects of carbon monoxide, depleted oxygen, and temperature are dose-related, involving both magnitude and time of exposure [2]. Thus the time at which 120 °C (250 °F) is exceeded is before the time at which the person is incapacitated. For each of the simulations, the time for areas to become untenable due to elevated temperature or oxygen depletion will be tabulated. These incapacitation criteria are simplifications of complex studies and serve as a basis for appraising the relative effects of alternate fire scenarios.*" (Page 4-23)

"*The NIST study did not include analysis of the threat to protected fire fighters. If a fire fighter in turnout gear is utilizing a self-contained breathing apparatus (SCBA) and has an adequate supply of air, the fire fighter can temporarily survive higher temperatures and depleted external oxygen levels. This safety shell ends when the fire fighter runs out of tank air or remains within the hot fire environment too long.*" (Page 4-24)

"*FDS has been shown to be able to predict the number of sprinklers activated and the approximate activation times, as well as trends, temperatures, heat fluxes and oxygen volume fractions in reasonable agreement with measured values [5; Vols. 2&3]. However, the suppression physics in FDS is simplified and cannot capture all of the details of the suppression process.*" (Page 4-29)

Commentary: The statement above is incorrect based upon comments made by Dr. Kevin McGrattan of NIST. The capability of the Fire Dynamics Simulator (FDS) to predict the activation times of sprinklers beyond the first sprinkler activation has not been "validated" according to Dr. McGrattan.

The reason for this is that the Fire Dynamics Simulator cannot accurately determine the effect of sprinkler discharge droplets on the fire plume and upon adjacent sprinklers. Water droplets from the first sprinkler activated may be deposited on the fusible element of adjacent sprinklers, thus affecting the response characteristics of sprinklers located adjacent to the first activating sprinkler.

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"*The same initiating fire was used in this scenario as for the baseline case, an ultrafast t^2 growth curve to a peak HRR of 750 kW and then held at this level for a period of two minutes, after which time it was ramped linearly down over a period of one minute. The intent of this fire was to ignite furniture in the loading dock. However, because the initiating fire was sufficient to activate two sprinklers (at 50 s and 75 s), the fire did not spread to the nearby furniture.*" (Page 4-33)

"*Figure 4-37 shows the sprinkler temperature at each of the sprinkler locations. The graph indicates that the temperature at locations 4 and 8 reached 74°C, at which point the sprinklers were activated in these locations. Temperatures at locations 1 and 2 peaked in the 60°C to 70°C range but never reached the threshold for activation.*" (Page 4-33)

"*In the base simulation the fire HRR begins to diminish after 1380 s, but when the front windows of the main showroom were taken out starting at 1457 s, there was a rapid increase in the HRR.*" (Page 4-37)

"*The results indicate that as early as 270 s into the simulation, smoke may have begun to flow down through ventilation openings in the suspended ceiling and into the rear of the main showroom. By 300 s, there is also a layer of smoke beginning to develop under the suspended ceiling in the rear of the west showroom. It cannot be concluded from the simulation whether an observer located in the main showroom would have noticed smoke in the rear main showroom at 300 s, or would have been able to distinguish the source of that smoke. The smoke continued to flow down through ventilation openings and, after forming a substantial layer in the rear of the main showroom, began to spread throughout the main showroom. At about 400 s, the simulation indicates that the smoke layer extended down to near the floor on the west side of the main showroom. As the fire spread from the holding area into the rear of the main showroom at around 500 s, additional smoke was added to the smoke layer in the main showroom. As demonstrated by the rendering of smoke by the simulation, visibility became compromised in the showrooms within 8 minutes to 10 minutes. The simulation results are consistent with the E-11 captain reporting heavy smoke in the main showroom at 7:20 p.m., which would correspond to 555 s into the simulation.*" (Page 4-50)

"*At 900 s, the baseline simulation results demonstrate dense black smoke would have been present from the floor to the ceiling in the main and west showrooms and less dense gray smoke in the east showroom. About a minute later at 7:27 p.m. there were fragmented radios transmissions suggesting fire fighters were "lost or trapped inside" and this would have been consistent with the dense black smoke in the showrooms.*" (Page 4-50)

"*In the simulation with fire sprinklers, the two sprinklers nearest the fire (in the southwest corner of the loading dock) activated early in the fire, at 50 s and 75 s. The two sprinklers controlled the fire and prevented the fire from spreading into the showrooms or warehouse. As a result, the temperatures and oxygen volume fractions remained below untenability thresholds.*" (Page 4-58)

Commentary: We need to stop pretending that the output from the FDS is "gospel". The use of a listed "sprinkler activation time prediction dart board" will produce results with an accuracy similar to that of the FDS.

"*NIST's technical investigation did not focus on compliance or non-compliance with the specific state or local regulations in effect at the time of the fire, nor did it seek to find fault. . .The findings and recommendations from the NIST investigation are expected to be useful across the nation by being incorporated into the model codes.*" (Pages 5-2 and 5-3)

The use of a listed "sprinkler activation time prediction dart board" will produce results with an accuracy similar to that of the FDS.

"*The gypsum board covered concrete block walls and roll-down fire doors between the showrooms appear to meet the requirements of a two-hour fire resistance rated separation, and therefore provide three showroom fire areas according to the 2006 IBC §706.3.9.*" (Pages 5-4)

"*The findings and recommendations from the NIST investigation are expected to be useful across the nation by being incorporated into the model codes.*"

"*The SBC requires a three-hour fire resistance rated separation between the loading dock (S-1 occupancy) and the showrooms (M occupancy). . .The separation would not be required if the authority having jurisdiction allowed the loading dock to be considered an accessory occupancy (1994 SBC §704.1.2.2).*" (Pages 5-5)

"*The SBC and SFPC (Table 3605) require fire sprinkler systems for buildings that contain over 1115 m^2 (12,000 ft^2) of high piled combustible furniture (Commodity III or IV) storage. Fire sprinklers are also required by the IBC and IFC (Table 2306) for high piled storage of combustible furniture (Class III or IV Commodity) with areas greater than 1115 m^2 (12,000 ft^2). Based on the square footage of the warehouse building, fire sprinklers are required by the SBC/SFPC and IBC/IFC model codes.*" (Pages 5-8)

"*For display areas of furniture stores, the maximum floor areas allowed by the model codes do not appear to be effective in sufficiently limiting the magnitude and severity of furniture showroom fires. As described above in Section 5.3.5, for one-story buildings of Type IIB construction, the 2006 IBC allows unsprinklered mercantile occupancies to be up to 1115 m^2 (12,000 ft^2), and the 1991/1994 SBC allows similarly constructed, unsprinklered, mercantile occupancies to be up to 836 m^2 (9000 ft^2). The computer simulations, however, demonstrate that fire was able to spread rapidly throughout the west showroom, which had a significantly smaller area, 650 m^2 (7000 ft^2), than required by the model code. Furthermore, as seen in the post-fire images in Appendix E, the building structure housing the west showroom was severely damaged in the fire incident.*" (Pages 5-10)

"*In summary, the hazard of a fire spreading rapidly across a large furniture display area can be reduced by compartmentalizing the display area(s), or by installing fire sprinklers which have been demonstrated as an effective method of controlling building fires. The unsprinklered fire areas allowed by the model codes are too large to prevent rapid fire growth and sufficiently limit the magnitude and severity of fires in furniture display areas. Reducing the maximum allowable size of unsprinklered furniture showroom fire areas to 190 m^2 (2000 ft^2) would slow the rate of fire spread within buildings and reduce fire magnitude by compartmentalizing the otherwise open spaces.*" (Pages 5-10)

Commentary: Chapter 5 in the report does not include a rationale for the conclusion expressed above. The conclusion is merely an opinion expressed without the factual foundation for the conclusion being established.

A single fire in a fire record of more than a century cannot be considered as a sufficient foundation for the opinion that the fire area of furniture store showrooms should be limited to a maximum of 2,000 square feet if sprinkler protection is not provided.

The report clearly documented that compartmentation is not a reliable means of providing building fire protection. Hence, a recommendation that compartmentation should be considered as a viable means of providing building fire protection should be considered to be faulty logic.

"*The National Institute of Standards and Technology established a team of engineers and researchers to reconstruct the 2007 fire in the Charleston Sofa Super Store that resulted in a high number of fire fighter casualties. The technical study included the following objectives:*

- *to establish the likely technical cause or causes of the rapid fire growth inside the Sofa Super Store; and*

- *to recommend appropriate actions, including further research, to improve the structural safety of similar buildings, and to improve evacuation and emergency response procedures.*"

(Page 6-1)

"*The lack of fire sprinklers to control the fire during an early stage of its growth and the lack of effective compartmentation were direct contributors to the loss of nine fire fighters' lives and the loss of the retail showrooms and distribution warehouse. . . .Compartmentation is designed to create a series of smaller spaces which slows the spread of a fire. Fire walls and fire doors can be used to divide a single large space into multiple smaller compartments.*" (Page 6-4)

Commentary: The primary cause of this major fire was the failure of store employees to contact the fire department in a timely manner. If the fire department had been contacted when the fire was first noticed, or even 5 minutes sooner, the fire department would likely have been able to extinguish the fire in a matter of minutes. Hence, the statement regarding the lack of sprinkler protection and/or compartmentation as being "*direct contributors to the loss of nine fire fighters' lives*" can be considered to be nonsensical.

"*The two front doors allowed all of the occupants in the retail showrooms and office areas at the rear of the main showroom to exit safely. An employee was trapped for a period of time in the repair shop/warehouse area due to blocked exits. The fire department was able to rescue the trapped employee.*" (Page 6-5)

"*Doors in the warehouse, two single-wide doors and a roll-down, the two slider doors on the loading dock, and the single exit door near the front of the west showroom were locked while the store was occupied.*" (Page 6-6)

Commentary: Locked egress doors are an easy code violation to identify during the course of an inspection of a building. The fact that locked egress door violations existed in the building at the time of the fire is indicative of either a lack of a code compliance enforcement program (fire prevention inspections) or poorly performed code compliance enforcement inspections.

"***Neither current nor contemporaneous fire codes sufficiently address the uniquely high fire hazard from the type and configuration of the combustibles in a building loaded with upholstered furniture. Furniture is often displayed in large open areas. As demonstrated in the main and west showrooms and warehouse, displaying large amounts of furniture in large open spaces can contribute to extremely rapid fire spread.***" (Page 6-8)

Commentary: The statement above assumes that a mercantile occupancy which involves the sale of upholstered furniture is a high fire hazard. If this were actually the case, NIST should be able to provide a lengthy list of similar serious incidents. A list of similar incidents is not included in NIST's report because incidents similar to the fire at the Sofa Super Store are rare events.

It appears that NIST is unfamiliar with the fire record. This is an indication that the authors of the report lack sufficient expertise to express opinions such as the one above.

"***The fire department required about 10 minutes to establish a water supply from a fire hydrant to the exterior loading dock area.***" (Page 6-9)

"***The fire department took about 16 minutes to establish a water supply from a fire hydrant to the front of the store.***" (Page 6-9)

"*The initial response of the fire department included two engine companies, a ladder truck company, and a battalion chief. With an engineer, a fire fighter, and an officer on each apparatus, the fire department's initial response was 10 people.*" (Page 6-9)

Commentary: This response should have been more than adequate to control a small trash fire on the exterior of the building if the fire had been reported promptly, rather than being delayed by the store manager's attempt to extinguish the fire using a portable fire extinguisher.

"*The supply of water to the fire fighters was limited to the water on the fire engines for 9 minutes at the loading dock and 15 minutes at the front of the store. When the connection was made to the municipal water supply, the two engines were pumping water to the store through long lines of small diameter 6.4 cm (2.5 in) hose.*" (Page 6-10)

"*Inspections and record-keeping practices are an integral part of a community fire safety program.*" (Page 6-11)

"*Adoption of a model code, in and of itself, is not sufficient to guarantee the safety of a building. . .Recognizing this, model codes need to be robust and contain sufficient redundancies to minimize the chances of loss of life caused by the failure of a building that is built or operating out of compliance with code provisions.*" (Page 6-11)

Commentary: This last statement infers that model codes presently do not contain "*sufficient redundances to minimize the chances of loss of life*". The fire statistics for the United States indicate that roughly 100 Americans die as a result of fires in commercial (non-residential) buildings on an annual basis. Further, the fire statistics for the United States also indicate that fewer than 100 fire fighter fatalities occur on an annual basis. The statistics on fire fighter fatalities indicate that only a handful of fatalities occur as a result of structural fire fighting operations.

Many of the fire fighter fatalities in the United States occur during the performance of routine duties, *e.g.*, report writing, participating in parades, etc. The statistics indicate that many fire fighter fatalities occur as a result of responding to fires without wearing seatbelts.

To attribute either civilian or fire fighter fatalities to a lack of "*sufficient redundances to minimize the chances of loss of life*" is a clear indication that NIST has spent little time studying the fire loss statistics for the US, or is an indication that NIST has an agenda other than providing a clear, concise and accurate depiction of the "fire problem" in the United States.

The fire statistics for the United States clearly show that 95 percent of all civilian fire fatalities which occur as a result of structure fires are due to fires in residential occupancies which are not protected by a sprinkler system. When residential occupancies are protected by a sprinkler system, the number of fire fatalities which occur is reduced to a mere handful. The model codes currently utilized in the United States require that all multi-family residential occupancies be protected by a sprinkler system. Further, the most recent editions of the model codes now include provisions which require sprinkler protection for new one- and two-family dwellings.

Providing sprinkler protection in new dwellings will virtually eliminate both civilian and fire fighter fire fatalities in new residential occupancies. NIST's statement regarding redundancies addressing the hazard of fire included in our model construction codes demonstrates a clear lack of understanding of the fire record and our model building codes.

"*There are other areas in which the basis for making changes to local codes is not currently supported by reliable technical information. Continuing research is needed to gain new understanding and to collect the data necessary to ensure that changes are adopted, or rejected, based upon sound scientific findings. Research results may also serve as the basis for setting thresholds or pass/fail criteria for fire protection systems and recommendations for fire operations and training.*" (Page 6-14)

Commentary: NIST's statement above implies that the model construction codes in use in the United States lack a technical basis and implies that the field of building fire safety and building fire protection is in its infancy. This is hardly the case. As indicated in Chapter 5 of NIST's report, the first model building code in the United States was published in 1905. Given this, it can be stated that we have more than a century of both experience and research in the field of building fire safety and fire protection.

Statistics on building fire safety collected by the National Fire Protection Association (NFPA) and published annually clearly show that we have made great strides in reducing fire losses in the United States. Clearly, we know how to prevent both fatalities and injuries caused by fires.

The fire statistics collected by the NFPA show that 95 percent of civilian fire fatalities in buildings in the U.S. occur in residential occupancies. Further, these statistics also indicate that the number for fire fatalities which occur in residential occupancies protected by a sprinkler system is essentially zero. The model building codes now in use in the United States require that all residential occupancies be protected by a sprinkler system.

Given the facts above, the need for further research is questionable. Since NIST is primarily a research-oriented organization, it would appear that the statements about the need for further research are self-serving. In light of the facts, inclusion of recommendations for the need for further research calls into question the objectivity of the authors of the report.

"*In terms of furniture flammability, fire science needs to focus additional research on the development of two types of knowledge: 1) how to make furniture that is less flammable, and 2) how to accurately simulate the burning of existing furniture for forensic use. This research will help develop an understanding of the ignition and spread of fire over common furniture items and the resulting release of heat and harmful combustion products. At present, it is necessary to rely on scientific experiments and real-scale fire testing of products in room geometries that are similar to what existed in the actual event to develop empirical data as input to computer fire models.*" (Page 6-14)

Commentary: Given the fact that 95 percent of fire fatalities which occur in building structures in the United States occur in residential occupancies and that the model codes have recently included provisions that all new residential occupancies be protected by a sprinkler system, the actual need for the recommended research on furniture flammability is questionable. The operation of sprinklers addresses the problem of furniture flammability.

Given that we know that sprinkler protection addresses the "fire problem", the need to do further research on inputs into fire models is also questionable. Successful sprinkler operation renders fire modeling unnecessary. Capital expended on fire modeling would be better spent on increasing the utilization of sprinkler protection and on the inspection of existing sprinkler systems to verify that existing sprinkler system installations remain operational.

The recommendation above assumes that there is an unlimited source of funding for fire protection. A recent study by the National Fire Protection Association indicates that the US spends more than $300 billions annually on fire protection. $300 billion is more than an ample national expenditure on fire protection.

"*Improving fire barriers requires that additional research be focused on: 1) how to design products that will contain a fire while at the same time meeting other functional requirements, and 2) replicating the performance of existing partitions in forensic models. Fire-resistance testing of walls, floors, ceilings, and door assemblies typically ends when the temperature on the non-fire side exceeds a standard value. There is insufficient understanding of the mechanisms by which partitions and door assemblies pass flames into adjacent spaces, especially for the composite assemblies typical of real construction. Having an accurate modeling capability for how flames pass into adjacent spaces will improve the ability to accurately establish fire time lines and to evaluate the relative importance of multiple fire paths.*" (Page 6-15)

Commentary: It would seem apparent that the authors of the report did not bother to read their own report. The report clearly indicates the problem with the fire barriers provided at the Sofa Super Store building-the failure of fire door assemblies to work properly, not the failure of the fire barriers themselves. Given this fact, it is difficult to understand why this fire should be used as a justification for the need for additional research on fire barriers.

From our 100^{+} years of experience with the use of fire barriers, we know what constitutes an effective fire barrier and what does not. Obviously, the authors of the report appear to be "*trolling*" for additional research work.

It should also be noted that properly installed and maintained sprinkler protection virtually eliminates the need for fire barriers. Since fire barriers would only be necessary in large buildings, and most large buildings are provided with sprinkler protection, the need for fire barriers in buildings is essentially minuscule. The recommended research on fire barriers would be a waste of capital devoted to building fire safety.

Obviously, the authors of the report appear to be "trolling" for additional research work.

"*First responders commonly use ventilation is to improve the firefighting environment, increase the survivability of trapped occupants, and reduce property damage. In some cases though, ventilation may improve conditions within a structure, but may also lead to increased fire growth and spread, flashover, or back draft (deflagration). The effects of natural ventilation on the fire environment during fire fighter operations are not well understood.*" (Page 6-16)

"*Completing the research recommended will provide a reliable technical foundation for making changes to codes, standards and practices.*" (Page 6-16)

Commentary: In lieu of the recommended research, the fire statistics collected by the National Fire Protection Association can be utilized to "*provide a reliable technical foundation for making changes to codes, standards and practices.*" The fire statistics already exist and are published on the NFPA on an annual basis.

Analysis

Building fire protection is not "*rocket science*". While the NIST report did an excellent job documenting facts on the Sofa Super Store building and presenting a time line for the events leading up to the loss of nine fire fighters, the analysis of the fire presented in the report was "*less than stellar*". Perhaps, the reason for this was all the time devoted to the modeling efforts for the fire, the "*rocket science*" portion of the report, so to speak.

Building fire protection is not "*rocket science*".

As previously indicated above, the primary reason for the fiasco of events which occurred at this fire was the delay in reporting the fire and summoning the assistance of the fire department. If store employees had promptly reported the fire, the fire fighters would have arrived at the scene a few minutes earlier and would have been able to extinguish the fire using only the water in the tank on the engine. Fire fighters would have made "*short work*" of this fire if they had arrived at the building just a few minutes earlier.

Clearly, the primary reason for the delay in notifying the fire department was the use of a portable fire extinguisher on the fire by the store manager. Hence, it seems reasonable to conclude that portable fire extinguishers were the direct cause of the loss of nine fire fighters.

While the delay in notifying the fire department initiated the chain of events which occurred at the Sofa Super Store, it can be stated, without any hesitation, that the fire fighter fatalities would not have occurred if the Charleston Fire Department had practiced fire fighter life safety procedures. Given the difficulties in establishing a reliable water supply at the building, fire fighters had no business utilizing interior manual fire fighting operations.

The loss of a single fire fighter in attempt to save property can never be justified, let alone the loss of nine fire fighters. The fact that the Charleston Fire Department was solely involved in property preservation operations when fire fighters were lost means that these fatalities were self-inflicted.

Since the nine fire fighter fatalities were self-inflicted, it seems rather silly that NIST believes that improvements in code requirements are warranted on the basis of this fire. In essence, NIST is making an attempt to shift the blame for the fire fighter fatalities from the Charleston Fire Department to the building owner and to deficient building codes. That is complete nonsense.

There are two lessons that can be taken away from this fire. The first is that notifying the fire department of a fire is essential to protect not only building occupants and property, but also to protect fire fighters. Notification of the fire department of a fire takes priority over attempts to control an incipient fire with portable fire extinguishers. This is not to point the finger at the store manager for his attempts to control the fire, however. The store manager was simply not properly trained in how to respond to a fire. Who's responsibility is it to make sure that the public is properly trained in how to respond to a fire? That is part of the education that fire departments are supposed to provide to the public at large.

The second lesson that this fire provides is that fire fighting can be hazardous. Professional (paid) fire fighters, as well as volunteer fire fighters, need to learn about fire fighter life safety concepts and then apply those concepts at a fire scene. The National Institute for Occupational Safety and Health (NIOSH) has published two NIOSH Alerts on fire fighter life safety practices, **NIOSH 2005-132** and **NIOSH 2010-153**. Every fire fighter, whether a paid professional or volunteer, needs to study these two NIOSH documents. Given that reading these two documents shouldn't take more than 30 minutes, there is simply no excuse for not being aware of the safety concepts included in these documents.

It is interesting to note that there was no mention of either **NIOSH 2005-132** or **NIOSH 2010-153** in NIST's report. One has to wonder why NIST failed to mention either to these two documents. Perhaps, NIST had a specific agenda to serve when the report on the Sofa Super Store fire was put together.

Do we really need changes to our model building codes based upon the fire at the Sofa Super Store? In my opinion, the answer to that question is obvious-there is nothing wrong with our model construction codes. The problem is with the fire service and its "*hero mentality*". The fire service's "*hero mentality*" is also referred to as being "*stuck on stupid*".

How long will the US fire service remain being "*stuck on stupid*"? Certainly, the NIST report didn't do the fire service any favors by giving the Charleston Fire Department a "*pass*" on this one.

The fire service's "*hero mentality*" is also referred to as being "*stuck on stupid*".

Isn't saying that the fire service is "*stuck on stupid*" insulting? Yes, it most certainly is, but which would you rather be, insulted or dead? I'm willing to bet that the Charleston Fire Department would have wished that someone had insulted them to get their attention prior to the fire at the Sofa Super Store. Now go to fire fighter safety web page on this website and download the pdf of **NIOSH 2005-132** and **NIOSH 2010-153**. You can thank me later for getting your attention and maybe saving your life.

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