

**HIGH-RISE FIRE AND LIFE SAFETY:  
HAZARDS AND EDUCATION FOR OLDER ADULTS**

LEADING COMMUNITY RISK REDUCTION

BY: William F. Blackley  
Wilmington Fire Department  
Wilmington, North Carolina

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## CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: \_\_\_\_\_

### **Abstract**

A problem for the Wilmington Fire Department is two residential high rise buildings for the elderly. The purpose of this descriptive research was to identify problems associated with these high-rises, evaluate perceptions, and recommend programs that reduce risk factors. Research determined: How does lack of fire education training elevate risk factors of two residential high-rise buildings in Wilmington? How do other fire departments address elderly residential high-rise safety? How do North Carolina Fire Code requirements effect emergency planning for high-rises? How can fire and life safety education assist residents in similar high-rises? Procedures included literature review, surveys, and personal communications. Results indicated several needs. Recommendations involve staff training, educational programs, planning, and follow up surveys.

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## **Introduction**

A problem for the Wilmington Fire Department is two existing residential high-rise buildings: Solomon Towers and Cape Fear Hotel Apartments, 35 and 82 years old respectively. Both provide housing for the elderly. They are unsprinklered, do not meet other modern building code requirements, and have no fire and life safety program for residents and employees. This is a problem because that condition represents unacceptable risk factors within the population served and serious implications for the fire department. The purpose of this applied research paper was to identify problems associated with these high-rises, evaluate occupant perceptions, and recommend a fire and life safety program to reduce risk factors.

This research paper uses the descriptive method and determines: (a) How does lack of fire education training elevate risk factors of two residential high-rise buildings in Wilmington? (b) How do other fire departments address elderly residential high-rise safety? (c) How do North Carolina Fire Code (NCFC) requirements effect emergency planning for high-rises? (d) How can fire and life safety education assist residents in similar high-rises?

## **Background & Significance**

Solomon Towers is an 11-story high-rise operated by the Wilmington Housing Authority (WHA) for low-income citizens of ages from 40 to 70. It was built in 1971 and features fire resistive construction. It is unsprinklered and Class III standpipe stations are on each floor.

The building is protected by an addressable fire alarm system consisting of photoelectric smoke detectors located in common areas that feed to an electronically

monitored fire alarm panel. In the apartments are audible and visual notification devices which connect to the building's primary fire alarm system. These devices activate by common area detectors or fire alarm pull stations which set off the main fire alarm system.

Individual apartments are protected by smoke alarms which are electronically supervised by a non-monitored fire alarm panel on site. Staff consists of a building manager, maintenance employee, and a secretary. They jointly monitor the panels weekdays. Hired security on-site from 1600 to 2300 on weekdays and 1200 to 2300 during the weekend provides monitoring during these hours. An on-site resident monitors the panels for all other hours.

Apartments are equipped with electric baseboard heaters and individual window unit air-conditioners for climate control. Each corridor is heated independently and there is no air-conditioning. Apartment doors that exit to main corridors are self-closing.

The manager reports that fire drills are performed by staff, but there is no written documentation of such drills (E. Frink, personal communication, November 20, 2006).

There was a fire on the eleventh story in 1983 that resulted in three fatalities and destruction of three apartments (Belew, Hearne, Howard, Kille, McGuire, Newsome, 1983).

Solomon Towers is a problem because of its high-rise characteristics, concentration of older people in residence, minimal supervisory staff, and dependence on resident to monitor alarm panels. It is unsprinklered, there is infrequency in fire drills, there are no fire safety programs, and there is little fire department accessibility.

The nine-story Cape Fear Hotel Apartments was a premier hotel when constructed in 1924 of non-combustible construction. It features original sprinklered common areas. In 1980 it was renovated to house senior citizens over the age of 55 and is managed by Cape Fear Associates. Original Class III standpipe stations protect corridors. In 2006, new manual pull stations, smoke detectors and notification devices (horn/strobes) were installed in common areas. Audible notification devices were installed in all apartments and horn/strobe notification was installed to meet Americans with Disability Act (ADA) requirements. Apartments are equipped with hard-wired residential smoke detectors that do not connect to the main fire alarm panel. Each apartment is independently equipped with a dual function heat/air-conditioning unit. Corridors have no heating or cooling and apartment corridor doors are self-closing.

A management group consisting of a building manager, maintenance employee, and office secretary are on-site Monday-Friday from 1000 to 1600. There is no supervisory staff on-site after hours. Staff notification of fire alarm activations or other emergencies is by cellular phone via the alarm company or a designated resident. The fire alarm system is self-monitoring, automatic, and transmits to an alarm receiving station and notifies the New Hanover County 911 Center. There has not been a fire drill at this building in at least five years according to the building's manager (B. Bailey, personal communication, November 20, 2006).

Cape Fear Hotel Apartments is problematic because of its age, lack of fire sprinklers, concentration of elderly people; some with physical limitations, minimal staffing, no fire plan or safety training, questionable fire drills, and limited fire detection

system, i.e., independent detection in the apartments. There is limited fire department accessibility.

The Wilmington Fire Department (WFD) has been affected by growth factors involving annexations and regional economic growth. Unprecedented growth in the region positions Wilmington as the economic hub of southeastern North Carolina. Examples include a new 12-story world headquarters for PPD, Inc., which will employ more than 2000 people in the downtown central business district. Other planned developments include a 120,000 square foot convention center and two high-rise hotels. New high-rise buildings provide code required fire sprinkler protection.

The WFD is located in southeastern North Carolina. It is a career department comprised of three divisions: suppression, support services, and fire and life safety. It has 11 engine companies, of which three are quints, two ladder companies, and three squad companies. There are 10 stations and another is under construction. There are 217 employees serving a population of approximately 94,000 (Wilmington, 2005). It carries a Class 2 ISO rating. Initial high-rise response is two engine companies, one ladder company, one squad company, and a battalion chief. Initial manpower strength is 14 to 15.

The Division of Fire and Life Safety consists of an assistant chief who is the city fire marshal. There are five inspectors, one community fire and life safety educator, and one administrative support technician. The division uses the 2003 International Fire Code (IFC) with North Carolina amendments. Beside specific district assignments, one inspector reviews commercial and fire alarm plans; another reviews fire sprinkler and suppression system plans. The fire and life safety educator delivers public fire education

in the City of Wilmington and New Hanover County. This position is jointly funded by New Hanover County Fire Services.

Services provided by WFD include: fire suppression, regional hazardous materials response, high-angle rescue, trench rescue, confined space, water rescue and recovery, structural collapse, and medical first responder. Expansion has necessitated additional engine companies, a new squad, and an additional fire inspector.

Current structure fire response includes two engine companies, one ladder company, one squad company, and a battalion chief. This response provides 14 to 15 firefighters. A change based on a recent assessment of the WFD will increase resources to target hazards, including high-rises (ESCi, 2006). New responses will include an additional engine company with three to four additional firefighters.

WFD's Fire and Life Safety Division maintains a community fire and life safety educator position whose primary responsibility is development and delivery of fire and life safety programs. New focus on emergency planning by the division has given the educator opportunities and challenges in evacuation planning and presentation techniques. This includes residential high-rise fire and life safety education for the elderly.

This Applied Research Project relates to the United States Fire Administration (2003) *Leading Community Risk Reduction* course in a shared objective of community risk reduction, fire prevention, code enforcement, public education, mitigation, and injury prevention. It aligns with the United States Fire Administration (2003) objective because it addresses loss of life to citizens 65 years of age and older by examining issues of high-rise fire safety relating to older residential high-rises.

## Literature Review

The literature review substantiates a need for fire and life safety education programs for residents in high-rise buildings.

Dunn (2002) defines a high-rise as any building where height extends the reach of the highest ladder available, whereas the North Carolina State Building Code: Building (2006) defines high-rises as buildings which are occupied higher than 75' above the lowest level of fire department access.

The primary cause of fires in residential high-rises is cooking (United States Fire Administration, 2002). Of 15,500 high-rise fires, 75% were in residential structures; of these, 43% were kitchen related. Other causes include incendiary/suspicious and smoking.

Many hazards exist in a high-rise building fire. One such, as Norman (1999) observes, “. . . was the failure of the required fireproof, self-closing (FPSC) door to protect the public hall, because the door was blocked open or the self-closer was disabled. This created severe life-threatening conditions outside the fire apartment very early . . .” (p.19).

High-rises may lack basic fire protection devices such as sprinkler and fire alarm systems. Often, public address systems installed to provide instructions to occupants are inoperative. More often, they are non-existent. In a fire situation, isolated residents are subject to leave their apartments, become disoriented and die from smoke inhalation. Fire departments implement strategies advising occupants not immediately threatened to remain in their units behind closed doors. If there is communication, occupants are told to stay in apartments, shut doors and windows, and turn off window air conditioning

systems to prevent smoke spread (V. Dunn, personal communication, November 15, 2006).

The importance of internal communication inside a high-rise is emphasized by Moore (2001):

Records of high-rise fires indicate that voice communications not only instruct building occupants to stay in place or relocate, but they reduce panic. According to the United States Fire Administration's *Special Report: Operational Considerations for Highrise Firefighting*, building public address systems . . . allow the fire department to communicate to occupants . . . . In the absence of these systems, fire department personnel will have a difficult time managing the evacuation of a high-rise building (p. 50).

High-rises pose multiple challenges for fire service personnel and building occupants. The United States Fire Administration (2002) lists several: Upward smoke movement creates a "stack effect." In the same building there may be mixed occupancy classifications such as offices, restaurants, parking garages, and living units. There are exiting problems due to limited stairways, multi-floor air handling systems which spread smoke, and greater numbers of fire service personnel are needed for rescue, control, and extinguishment.

Occupants in high-rise buildings face critical choices when a fire occurs and must make decisions based on knowledge. Proulx (1996) discusses a questionnaire mailed to occupants of a residential high-rise building that suffered a fire on January 6, 1995, which caused six fatalities in North York, Ontario:

The questions were aimed at identifying the way and the time at which occupants became aware that something unusual was happening and, once they became aware of the facts that it was a fire, on their first few actions. There were questions on the time at which occupants left their units, the fire alarm's audibility, the smoke and lighting conditions encountered during evacuation, and the actions occupants undertook to ensure their safety. The questionnaire also determined occupants' previous exposure to fire safety information. Variables such as gender, age and limitations were identified, since these can play an important role during building evacuation. Completed questionnaires were received from 54% of the units . . . (p. 25).

More than one-third of the residents who responded to the survey stated they did not think the situation was serious. The majority of the respondents' (61%) initial action was to look in the hall or out a window. None began to evacuate the building. If occupants received fire safety training, they were likely to investigate first. Those without training would wait for information. Most occupants reacted to the fire when they smelled or saw smoke. Fifty-five percent did not evacuate because of smoke, while 20% stayed because the fire department advised them to. Occupants who stayed in their apartments were safer because they sealed the front door and vents.

Blossom (2002) observes three components that are essential for an effective evacuation. They are occupant preparedness, permission to evacuate based on decision-making ability, and physical and mental capability.

Preparedness may be lacking because occupants have learned to live in high-rise buildings as a second thought. Many have become dependent on elevators and stairs are

not mentally factored with emergency evacuation processes. Stairs are often uninviting, uncomfortable, marginally illuminated, often used for storage, and maintenance can be poor. Stair problems extend to emergency responders during evacuations because there is no traffic flow discipline.

Blossom's (2002) second component, permission to evacuate, may be problematic because there is often inadequate training to make the right decisions. Occupants may rely too heavily on fire alarms or automated directions from fire alarm communication systems, leaving leadership lacking. This deficiency may cause a tendency to hesitate when evacuation is necessary. Typical standard procedures for high-rises call for evacuation of the floor above and the two floors below the fire floor. Therefore, additional permissions to make good decisions may be necessary when there is danger.

Blossom's (2002) last component, evacuation capability, connotes physical and mental factors that affect the ability to evacuate. Other factors include occupant familiarity with stairways and comprehending a need to evacuate. This capability requires the occupants to understand what is going on around them.

Total evacuation of a high-rise building may be impractical. The 2003 IFC Commentary (2004) says, “. . . occupants located above a fire are in greater danger than occupants located below the fire, since combustion products naturally rise . . . occupants will be expected to move downward or upward to separate themselves from danger” (pp. 4-2, 4-3).

2003 IFC Commentary (2004) suggests a high-rise emergency strategy:

Direct occupants in the area or floor of fire origin to the nearest exits. Occupants on the fire floor, the floor above and the floor below will relocate sequentially up

or down at least two floors. Occupants located two floors above and one floor below the fire floor will be sequentially relocated following movement of fire floor occupants (p. 67).

The 2003 IFC Commentary (2004) provides three management modes for implementation of fire safety and evacuation plans which include managing fire, managing occupants, and life safety.

Managing fire includes informing occupants of potential threats and pre-fire prevention measures. Such education is necessary because at times it may be impractical to evacuate occupants in a high-rise. This evacuation problem is the rationale behind controlling or eliminating hazards before they become a crisis. “Successful fire control depends,” the IFC Commentary says, “on building occupants recognizing the fire threat, deciding to respond, choosing how to respond and, in the case of choosing fire control, identifying, locating and using the correct method” (p. 4-1).

Managing occupants is a critical function during an emergency. The goal is to move occupants from the hazard to a safe location. Most occupants exit a building the same way they entered, even if it is not correct. Therefore, the education of occupants to identify unsafe conditions, how to react and to respond correctly, is essential.

Fire and life safety planning requires detailed factors and methods which employ life saving strategies to accomplish the educational process, particularly since fires are not the only type of emergency that requires planning. Additionally, occupants may have disabilities and therefore create challenging life safety dilemmas. To adequately address these situations, building occupants must be trained for other emergencies.

Life safety training begins with developing specific strategies to protect occupants. The 2003 IFC Commentary (2004) continues, “Protection may include moving them (assisting), causing them to move (directing), defending them in place, or a combination of these measures” (p. 4-2).

Several strategies must be considered such as the number and capability of occupants, location of exits, possible effects of fire on people and buildings, resources, and competence of staff to carry out a fire safety plan. These strategies depend on the type of building and occupancy. Some high-rise plans will move occupants horizontally and then vertically. Other factors can make high-rise evacuation impractical; yet, occupants above a fire in a high-rise face more difficulties because of smoke. Therefore, effective fire safety plans are vital.

High-rises can pose conditions beyond the abilities of the fire department. Bennett and Forsman (2003) call this unprotected risk, which is the difference between existing risks and suppression ability. When suppression services are not adequate for fire events, this type of situation is considered unprotected risk. Based on known facts, older high storied structures fall into this category. To compensate for unprotected risk, Bennett and Forsman employ the three “E’s,” education, engineering and enforcement (p. 1031).

Education of citizens, business owners, and property operators at risk is an obtainable goal. Education which explains the limitations caused by circumstances on fire service capabilities can provide an understanding of why some property cannot be protected effectively and what can be done to reduce such risks. Information on fire

service capabilities can provide an understanding of why some property cannot be protected effectively and what to do to reduce risks.

Engineering relies on built-in protection such as sprinklers and alarm systems. It is derived from building codes, life safety codes, and maintenance of codes via enforcement, the third “E,” which encompasses regular inspections to assure continued fire code compliance.

Consequences of inadequate training, inadequate occupant education, and inadequate information is exemplified by the WTC disaster. A preliminary report from the Centers for Disease Control (CDC) (2004) on the World Trade Center disaster provides such insight regarding evacuation:

Participants’ experience with evacuations and emergency training varied by occupation. Service workers and temporary employees were less likely than others to have received no fire safety training or been instructed in procedures during an emergency. Temporary workers were at a disadvantage because of their lack of familiarity with building evacuation procedures. Many permanent workers, even those with years of experience in the buildings, also reported they did not know how to evacuate via routes that deviated from their normal paths. Other locations exhibit similar lack of education, training, and learning behavior (p. 816).

A report by the Los Angeles Alliance for a New Economy (LAANE) further substantiates the consequences resulting from inadequate training for security officers in high-rise buildings. It states,

. . . as a result of high turnover, building entry points are unguarded and security procedures are not performed. Many officers report that they do not receive the training required by state law. Under state law, training on emergency procedures—such as evacuation routes, CPR, and first aid—is optional, and training on counter-terrorism is minimal. Lack of training combined with high turnover rates leads to an ill-equipped and largely inexperienced security workforce, hampering efforts to coordinate with police, fire and emergency personnel . . . (p. 1).

With regards to educational processes that address elderly housing, other approaches to preparation and presentation are necessary. Gamache (2003) elaborates on educational methodologies needed for varying physical and mental abilities. Presentations should be interactive and include questions, soliciting input, and looking for audience participation frequently. Printed material should have larger print and portray older adults in a positive manner.

Reynolds (2005) discusses how to teach older adults. The older adults learn in the same manner as other adults, i.e., they tend to learn when motivated because of a need for information. Building on prior knowledge causes cognitive change when the information is in small portions. Therefore, three to five points in a presentation is a maximum. Treating them with respect and dignity is a must.

The CDC (2002), with cooperation from the National Fire Protection Association (NFPA) and other partners, developed *Remembering When™* specifically for older adults to prevent falls and fires. It comprises 16 lessons and uses outlines, brochures, fact sheets, and props, such as game cards.

Some departments have posted information on web sites and have developed programs specifically for high-rises. Pueblo, Colorado, Fire Department, offers programs about fire and fall prevention to older adults which include *Remembering When™*, and *Fire Risks for the Older Adult* through the U.S. Fire Administration. Another is *Fire and Life Safety for Seniors* by the Phoenix, AZ, Fire Department (C. Riley, personal communications, November 21, 2006).

Another, Seattle, WA, (Seattle, n.d.) has developed a fact sheet for occupants of high-rise buildings and which is available online. Topics include evacuation planning and routes, floor warden responsibilities, sounding alarms, fire extinguishers, fire protection systems, and safe meeting places. The fact sheet discusses what to do if a fire is discovered and the occupant is unable to leave. Additional information is provided regarding built-in fire and life safety features such as fire alarm systems, elevators, standpipes, stair exits, smoke controls, sprinklers, emergency generators, and staff training.

Seattle Fire Department (2004) has also developed an emergency handbook for high-rise residents. It provides general information on fire prevention, safety planning, civil disturbances, medical emergencies, earthquakes, and severe weather. Designed for building owners and managers, the handbook enables development of a fire and life safety plan.

Kevin R. Carter's, West Palm Beach, FL, Fire Department EFO paper, *Reaching the Disabled Population with Fire Safety Programs*, (2004), discusses programs available to disabled adults. Many programs available for the disabled can be used for older adults living in high-rises. One such resource Carter discusses, *Evacuation Issues for People*

*With Disabilities and Other Activity Limitations: A First Responder's Training Guide*, exemplifies direct involvement of the first responder in delivering fire safety programs.

Arlington, VA, Fire Department bases all high-rise fire safety plans on built-in protection and use. Fire department review of evacuation plans assists building management in the determination of evacuation strategies. When agreement is reached on the fire safety plan, a presentation is provided for occupants and time is allowed for any questions (K. Van Graafeiland, personal communications, December 1, 2006).

Literature review provided sufficiency of information regarding high-rise fires and consequences. The emphasis on elderly population basically confirms common behavior patterns similar to the inhabitants of Solomon Towers and Cape Fear Hotel Apartments. Absence of built-in protection such as fire sprinklers, malfunctioning equipment, inadequacy of education and training, and general high-rise characteristics form a commonality of negative issues.

On the other hand, available literature provided a strong positive influence to continue the project. Several programs developed by departments and agencies have produced viable programs to specifically address the high-rise/elderly question. It must be assumed that such programs can reduce such risk factors and improve negative implications to the fire department and increase survivability rates.

### **Procedures**

This applied research was formatted according to the *Publication Manual of the American Psychological Association, 5<sup>th</sup> Edition*, and used a descriptive method to answer research questions.

A literature search on high-rise safety and related subjects was conducted at the Media Resource Center of National Fire Academy, Emmitsburg, Maryland, and in Wilmington, North Carolina. The search included applied research projects, periodicals, manuals, standards, books, the internet, and personal communication.

Information on the development of high-rise fire and life safety education was requested from cities of similar size in North Carolina. Fire departments contacted were: Asheville, Concord, High Point, Fayetteville, Rocky Mount, and Wilson. Requests were made by electronic media and phone. North Myrtle Beach, SC, North Charleston, SC, and Charleston, SC, were also contacted. An electronic request was sent to graduates and students of the National Fire Academy (NFA) Executive Fire Officers' Program through a Yahoo Group. An additional electronic request was sent to EPARADE Yahoo Group.

A survey was conducted at Solomon Towers (Appendix A) and Cape Fear Hotel Apartments (Appendix B) during October 2006, to determine the knowledge level relating to fire alarm activity and reaction of occupants in each building. The seven question survey asked closed-ended questions for specific responses such as knowledge of evacuation plans, participation in fire drills, use of stairs, audibility of alarm systems, reactions, use of elevators, and restrictive disability. The survey was distributed to 150 residents at Solomon Towers. Ninety surveys were distributed at Cape Fear Hotel Apartments. Seventy-nine (52%) were returned at Solomon Towers; 42 (47 %) were returned from Cape Fear Hotel Apartments. Information was compiled in spreadsheets and provided a breakdown of the data.

Personal communication with management at Solomon Towers and Cape Fear Hotel Apartments was conducted on November 20, 2006. This information was

compared with occupants' response to survey questionnaires. Conversation with management determined types of built-in protection, safety features, building design, fire drills, and employee and resident training.

Limitations were experienced when compiling survey data from the high-rises. Surveys from both groups were returned with some questions unanswered. There was no consistency as to which questions were not answered from the list. A high number of surveys were not returned—71 (48%) at Solomon Towers; 48 (53%) at Cape Fear Hotel Apartments. Another limitation existed in specifics relating to disability and special needs. Respondents noting a disability did not state the nature.

Responses through electronic media (email) were disappointing because only four were returned.

*Definitions and Clarification of Selected Terms:*

Addressable Fire Alarm System – Fire alarm system that indicates at the fire alarm panel the specific location of the alarm.

Floor warden – Person trained to assist occupants to evacuate a building during and emergency event.

Non-monitored fire alarm panel – Fire alarm panel not monitored by an alarm company.

Quint – Fire apparatus that has a fire pump, water tank, hose bed, ground ladders, and aerial ladder.

Squad – Unit used by the WFD to carry supplemental manpower (3 to 4) during fire incidents, respond to medical incidents, provide vehicle extrication, and other general responses.

Class III Standpipes – System providing 1.5-inch hose stations to supply water for use by building occupants and 2.5-inch hose connections to supply a larger volume of water for use by the fire department and those trained in handling heavy hose streams (North Carolina Building Code: Fire 2006, p. 68).

## **Results**

The survey determined fire and life safety education and knowledge level of residents at Solomon Towers and Cape Fear Hotel Apartments is inadequate. Additionally, contrasting views and perceptions between management and occupants conflicted. There are indications of fire drills having been conducted at both residential buildings, though there is an interval of five years without a fire drill at Cape Fear Hotel Apartments (B. Bailey, personal communication, November 20, 2006).

The following data is based on surveys returned from each building:

### **Solomon Towers (Appendix C)**

- Familiar with evacuation plans--90%; 8% are not; 2% no response (see Figure C1).
- Participation in fire drill--83%; 12% responded they do not; 5% no response (see Figure C2).
- Stair usage--71%; 24% do not; 5% no response (see Figure C3).
- Alarm audibility--93%; 7% no response (see Figure C4).
- Course of action--6% stay in room; 9% check hallway; 69% evacuate; 16% no response (see Figure C5).
- Elevator usage--4% use elevator; 94% do not; 2% no response (see Figure C6).
- Disability--44% knowledge a disability; 56% no disability (see Figure C7).

### **Cape Fear Apartments (Appendix D)**

- Familiar with evacuation plans--62%; 33% are not; 5% no response (see Figure D1).

- Participation in fire drill--47%; 43% responded they do not; 10% no response (see Figure D2).
- Stair usage--43%; 55% do not; 2% no response (see Figure D3).
- Alarm audibility--96%; 2% do not; 2% no response (see Figure D4).
- Course of action--7% stay in room; 29% check hallway; 57% evacuate; 7% no response (see Figure D5).
- Elevator usage--5% use elevator; 93% do not; 2% no response (see Figure D6).
- Disability--52% acknowledge a disability; 36% no disability; 12% no response (see Figure D7).

Contrasting to occupant survey results regarding behavior in both buildings was non-concurring information from both management groups which conflicted with occupant survey responses.

The question, “How does lack of fire education training elevate risk factors of two residential high-rise buildings in Wilmington?” is satisfied by a demonstrated lack of knowledge, basic fire prevention education, and defined fire and life safety training programs. Survey results indicate significant numbers of occupants who are misinformed, confused, or unable to follow instructions. Fire drill participation is limited due to infrequency of such drills and is essentially not existent. Risk factors for the fire department are elevated and proportional to the lack of fire and life safety education of the occupants. This indication is more critical when considering expanded resource requirements and procedural challenges. Any high-rise event can potentially overwhelm resources. With 44% of the population reporting disability at Solomon Towers and 52%

at Cape Fear Hotel Apartments, immediate overwhelming requirements wrought by necessities must be recognized as a consequence.

Identified was a significant number of individuals who either have not been educated in fire drill procedure or have forgotten instructions—14 at Solomon Towers; 22 at Cape Fear Hotel Apartments. The total number equals 28% of the survey population.

The second question, “How do other fire departments address elderly residential high-rise safety?” is met by literature review. Of particular note is information received from the Seattle Fire Department, Pueblo Fire Department, West Palm Beach Fire Department, and Alexandria Fire Department which maintain programs relative to elderly populations in high-rises.

The answer to the third question, “How do North Carolina Fire Code requirements effect emergency planning for high-rises?” is disclosed in Chapter 4 of the NCFC (Appendix C and Appendix D). High-rise emergency planning is required and plans are required to be reviewed by fire officials before implementation. Employee training is a requirement of Chapter 4 of the NCFC (2006). Additionally, employers are required to deliver training during employment orientation and annually thereafter. Required training includes measures of fire prevention, evacuation procedures, and use of fire extinguishers or other fire-fighting equipment. Documentation is a requirement and must be available for review by the code official.

Chapter Four of the NCFC (2006) addresses occupant actions, and includes commentary from the 2003 IFC (2004) which explains why such requirements are essential.

Question four, “How can fire and life safety education assist residents in similar high-rises?” Programs provide educators and inspectors necessary tools. Confusion of purpose for occupants and staff can be eliminated, a better understanding and appreciation of correct occupant response can be initiated, and a higher level of consistent information can be conveyed. The education process will identify building deficiencies, hazards, and will help in the production of action plans. Every identified occupant need and building deficiency represents an incremental reduction in recognized response overload.

### **Discussion**

Building deficiencies, hazards, and other identified conditions contributing to fire danger become knowledgeable. Without intervention such as education and training, they continue to exist; and therefore, disastrous events can be predicted. If they can be predicted, they can be prevented. As a result of this research, a lack of education for elderly residents living in two residential high-rises in Wilmington, North Carolina, was discovered. Also discovered were measures of cross purpose between residents and management. Surveys and communications indicated residents and management need to fully comprehend procedures for building evacuation, use of stairs, and elevator usage. Residents provided inconsistent answers with respect to procedures during fire alarm activations, and management perceptions conflicted with those of residents. There was no consistent strategy for occupants of either building which further verified the need for fire and life safety education.

Non-returned responses by the occupants is also a matter of concern. Data not received may illustrate a lack of understanding, an element of apathy, or an inability to

understand emergency planning. This remains as an unknown factor. It is apparent that management needs further training and assistance in development of emergency planning. Lack of fire drill documentation from both buildings also poses concern regarding staff and occupant training.

Emergency planning is not adequately enforced as per NCFC requirements, particularly with regard to training and documentation. Currently, the WFD has no coordinated fire and life safety educational programs to assist residents and occupants in high-rises. This deficit matches needs expressed in literature review and it does not address issues discovered by the survey results such as disabilities, lack of drill experience, or simply not doing the right thing. Combined, these factors pose the potential to quickly overwhelm arriving first responders.

Minimal response to email from other fire services was unexpected. Results were disappointing as only four were returned out of several hundred requests.

Input from Seattle, WA, Fire Department High-Rise Fact Sheet (Seattle, n.d.) and Seattle Fire Department Emergency Handbook (Seattle, 2003) is indicative of what can be developed specifically for these occupancy types. Carter's EFO paper (2004) on disabled and elderly residents offers good information on fire and life safety.

Work by others also identifies hazards. Blossom's article, "High Rise Safety: Have We Missed the Obvious," is more poignant when the elderly is included in high-rise thought processes. Proulx's article on elements of evacuation planning is a good example of needed attention to planning and education processes. Bennett's and Forsman's chapter on fire risk analysis revealed interesting implications called

“unprotected risk” which can be applied to the subject of high-rises. The same implications are apparent for the WFD.

Other scenarios which acknowledge an unsatisfactory level of staff training include the CDC and LANNE. Norman’s WNYF article, Holliday’s page report, Vincent Dunn’s high-rise information and the results of Proulx’s survey present strong arguments for a more aggressive approach to fire education.

As findings become apparent, the role of management becomes paramount. Included in that role is contingency planning that should encompass other types of emergencies. These factors apply to both Solomon Towers and Cape Fear Hotel Apartments since little training or planning has occurred.

Literature review confirms Solomon Towers and Cape Fear Hotel Apartments are comparable to other elderly residential high-rise buildings. Comparable findings include lack of built-in protection, absence of planning, no fire and life safety education, and elements contributing to unprotected risks. A common problem found is a lack of fire and life safety education designed specifically for older and disabled adults.

Limited on-site management cannot provide adequate supervision or training for residents in the event of an emergency. Perception conflicts between management, occupants, and uncertainty indicated by widely different responses from the same population presents a confused state on the order and dependability of fire drill procedure.

The WFD needs to improve fire and life safety education. Unprotected risks have been recognized in this paper. There are programs which the department can adopt to reduce these unprotected risks. Departmental growth must keep abreast for more

effective programs of fire and life safety education and training. While the department strives to work diligently, current limitations of the organization, brought on by a rapid municipal growth phenomenon, stymie the ability to successfully provide what is needed. Nevertheless, a solution must be acted upon if there is knowledge, if there is predictability, and if there is to be a measure of prevention. An unsatisfactory alternative is a repeat of headlines expressed in 1983 with the Solomon Towers fire.

### **Recommendations**

The WFD can reduce unprotected fire risk for the elderly in its two residential high-rise buildings. The WFD Division of Fire and Life Safety can accomplish this by focusing attention to the development of fire and life safety education programs for the elderly and disabled adults in those high-rises. This attention will involve a systematic assessment of each building and its occupants. To accomplish this, the author recommends division personnel initiate additional training specific to the tasks.

Additionally, it is recommended the community fire and life safety educator become more involved in developing programs specifically for older and disabled adults living in residential high-rises. Implementing *Remembering When™* at Solomon Towers and Cape Fear Hotel Apartments can be a start.

Further recommendations are that code required fire and building evacuation drills include assistance from the district inspector and suppression division personnel. To this, drills must be more frequent with proper documentation. Fire safety planning is recommended and information is to be passed to building management that will assist in developing a fire safety plan specific to their building. It is recommended that fire

inspectors enforce fire code requirements and that all requirements have been addressed and met before approving a building's fire safety and evacuation plan.

Surveys indicate more education is needed at Solomon Towers and Cape Fear Hotel Apartments. Responses may not adequately represent the actual knowledge level of residents, leaving unknown factors. Therefore, the author recommends more one-on-one contacts with management and occupants to provide data when developing fire and life safety programs for specific buildings. This will include observing fire evacuation drills in process from which information important to the development of fire safety plans can be derived.

After assessments are completed, the planning process will follow a prescribed schedule. Implementation of new fire and life safety educational programs is recommended which should commence immediately.

Meetings of the community fire and life safety educator and management from each residential high-rise to assess needs will be necessary. Planning, building inspections, fire drill, and fire and life safety education will require coordination with building management, the district inspector, and suppression personnel.

Follow-up evaluation in the form of new surveys to detect behavioral changes and additional needs that may have been undetected in the prior survey is recommended. Limitations experienced in the original survey need to be avoided. This information will be used by the community fire and life safety educator in developing presentations for residential high-rises or similar occupancies.

It is recommended that future research on this topic should include more personal contact with other fire departments. Emails to Yahoo groups did not elicit a large number

of responses. Hence a dependence of electronic return inquires is not recommended. Improved communication and collaboration with building management prior to distribution of a survey is recommended to increase responses.

The expected outcome is that unprotected fire risk factors be reduced by following these courses of action. The implications for the organization are clear: Repeat headlines of February, 1983, about Solomon Towers or in the case of most success stories, a back page article of little significance.

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## Appendix A

## Fire Safety Survey – Solomon Towers

**Fire Safety Survey**

This is an anonymous survey to help the fire department set up a fire safety program for Solomon Towers. Please return them by Thursday, Oct. 26<sup>th</sup>.

Do you know the fire evacuation plan for Solomon Towers?

- Yes  No

Have you ever participated in a fire drill at Solomon Towers?

- Yes  No

Have you ever used the stairs during a fire drill?

- Yes  No

Can you hear the fire alarm when it sounds?

- Yes  No

What do you do when the fire alarm sounds?

- Stay in my room  Evacuate the building  
 Check the hallway

Do you try to use the elevator when the fire alarm sounds?

- Yes  No

Do you have a disability or injury that would stop you from using the stairs during a fire drill?

- Yes  No

## Appendix B

## Fire Safety Survey – Cape Fear Hotel Apartments

**Fire Safety Survey**

This is an anonymous survey to help the fire department set up a fire safety program for Cape Fear Hotel Apartments. Please return them by Thursday, Oct. 26<sup>th</sup>.

Do you know the fire evacuation plan for Cape Fear Hotel Apts?

- Yes  No

Have you ever participated in a fire drill at Cape Fear Hotel Apts?

- Yes  No

Have you ever used the stairs during a fire drill?

- Yes  No

Can you hear the fire alarm when it sounds?

- Yes  No

What do you do when the fire alarm sounds?

- Stay in my room  Evacuate the building  
 Check the hallway

Do you try to use the elevator when the fire alarm sounds?

- Yes  No

Do you have a disability or injury that would stop you from using the stairs during a fire drill?

- Yes  No

## Appendix C

## Fire Safety Survey Figures – Solomon Towers

Figure C1 - Do you know the fire evacuation plan for Solomon Towers?

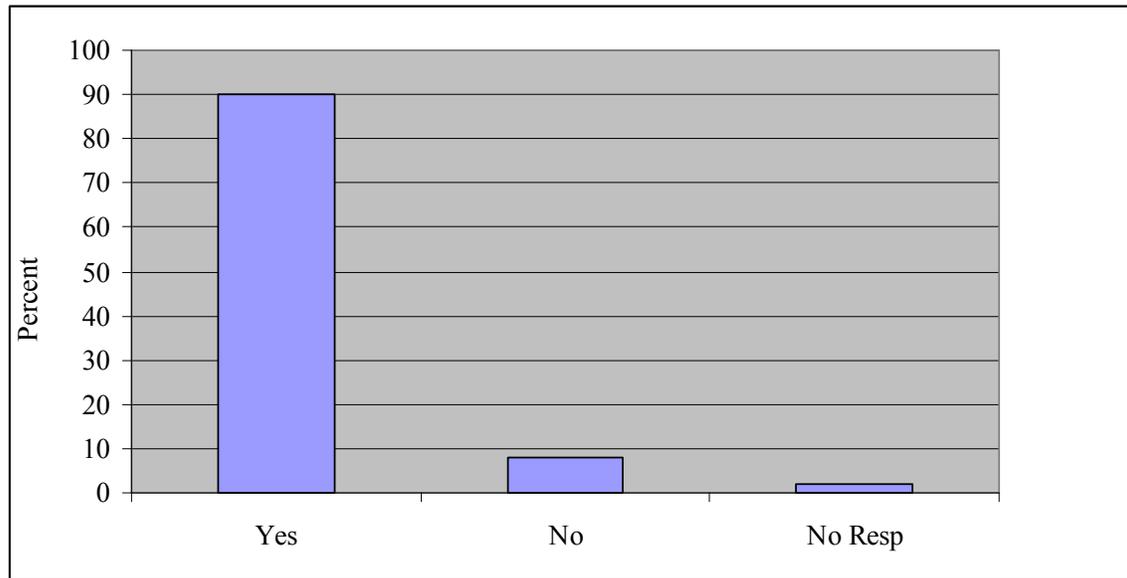


Figure C2 - Have you ever participated in a fire drill at Solomon Towers?

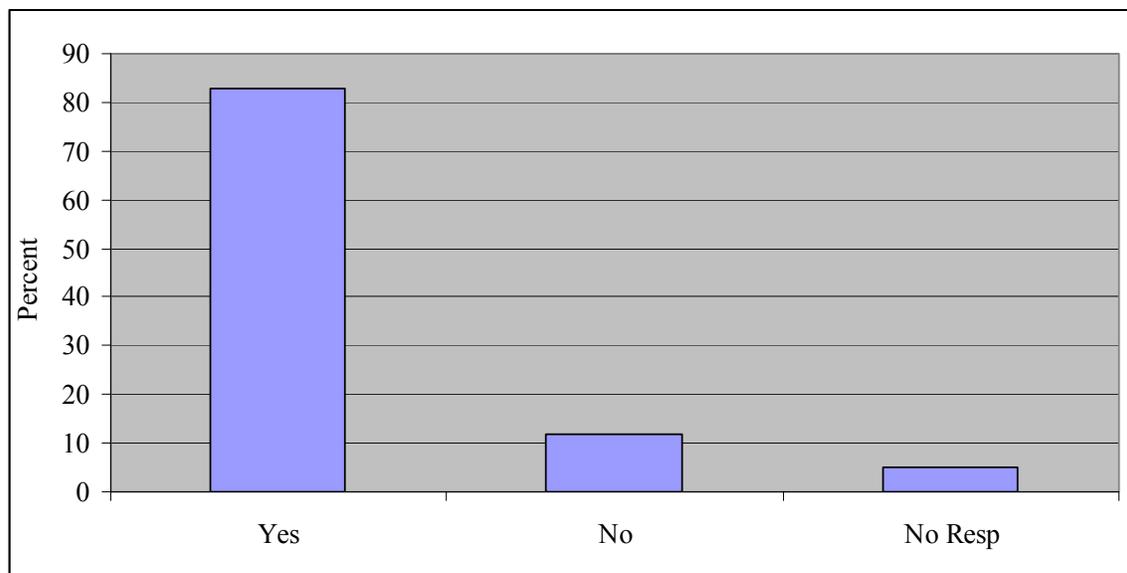


Figure C3 - Have you ever used the stairs during a fire drill at Solomon Towers?

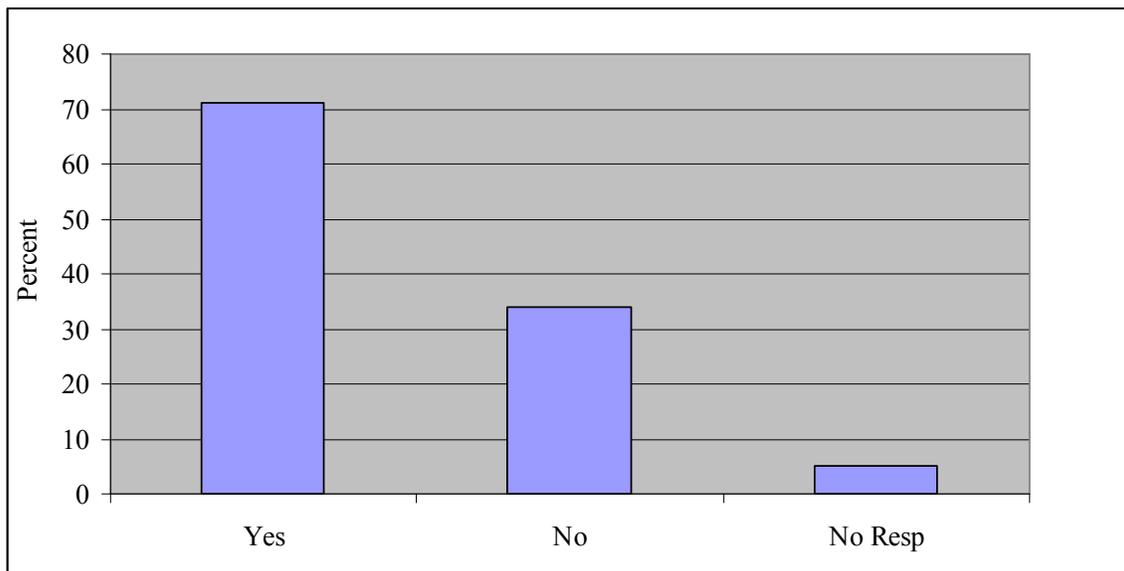


Figure C4 – Can you hear the fire alarm when it sounds at Solomon Towers?

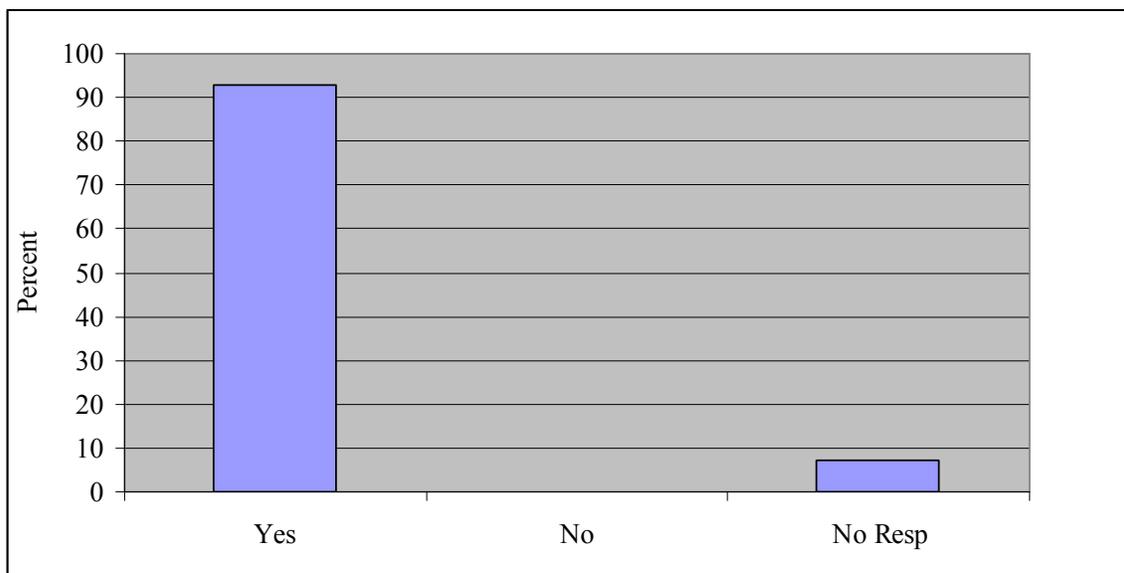


Figure C5 - What do you do when the fire alarm sounds at Solomon Towers?

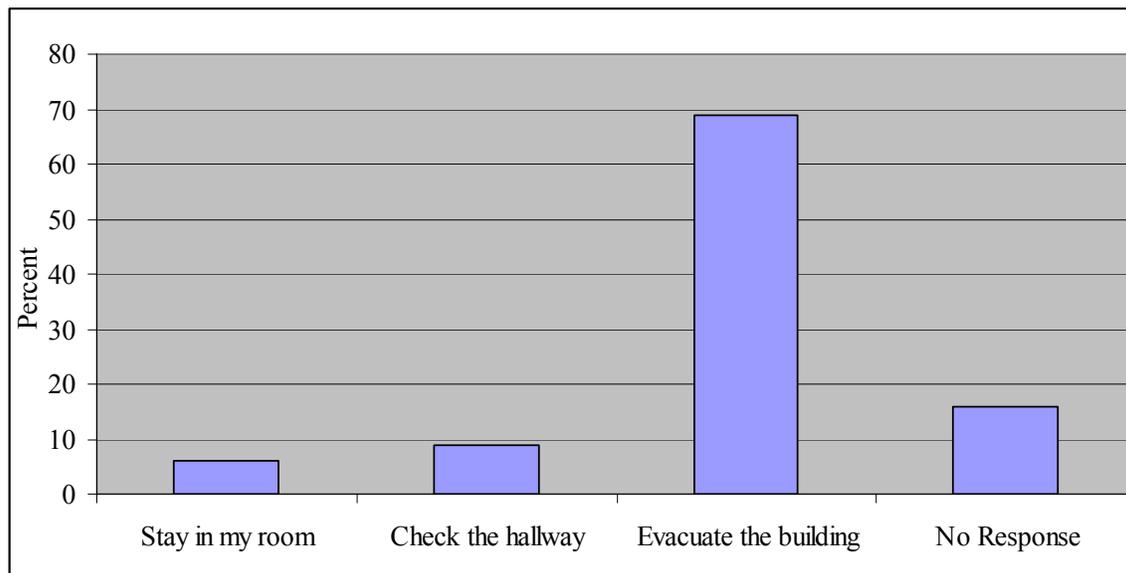


Figure C6 - Do you try to use the elevator when the fire alarm sounds at Solomon Towers?

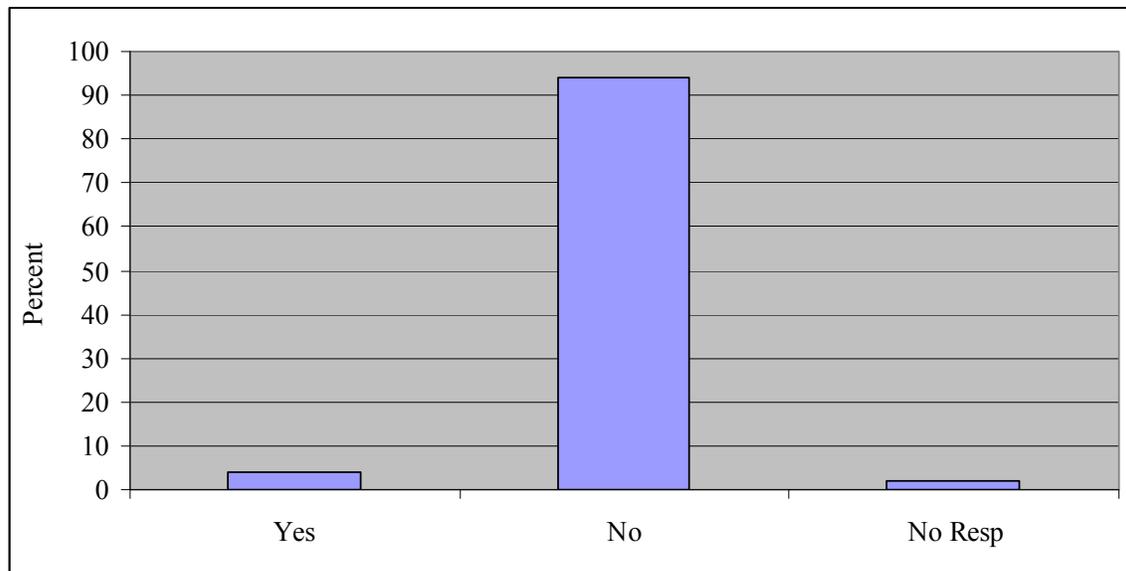
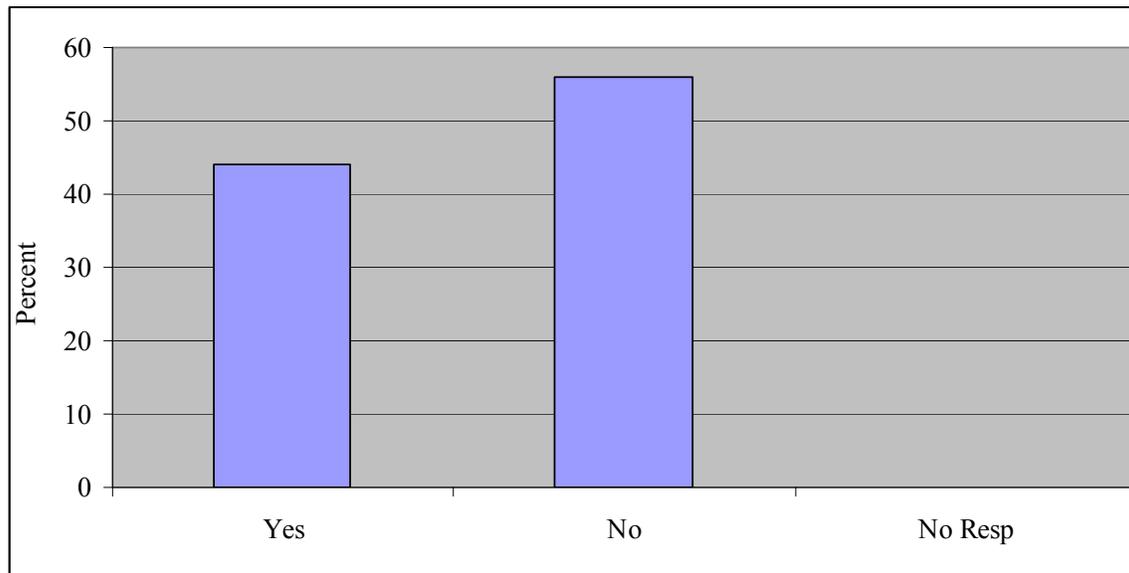


Figure C7 - Do you have a disability or injury that would prevent you from using the stairs during a fire drill at Solomon Towers?



## Appendix D

## Fire Safety Survey Figures – Cape Fear Hotel Apartments

Figure D1 - Do you know the fire evacuation plan for Cape Fear Hotel Apartments?

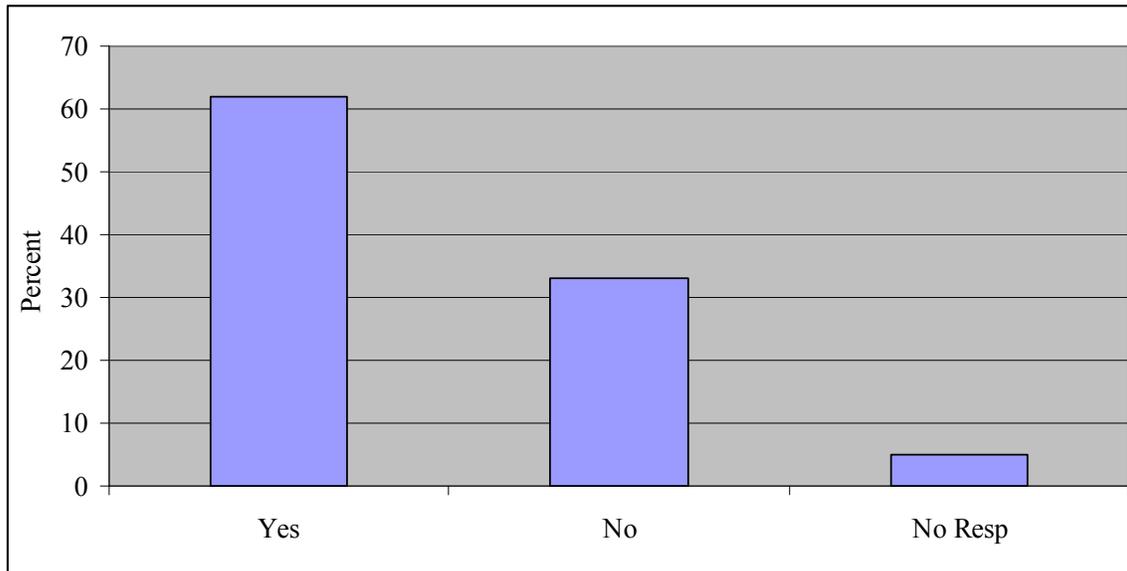


Figure D2 - Have you ever participated in a fire drill at Cape Fear Hotel Apartments?

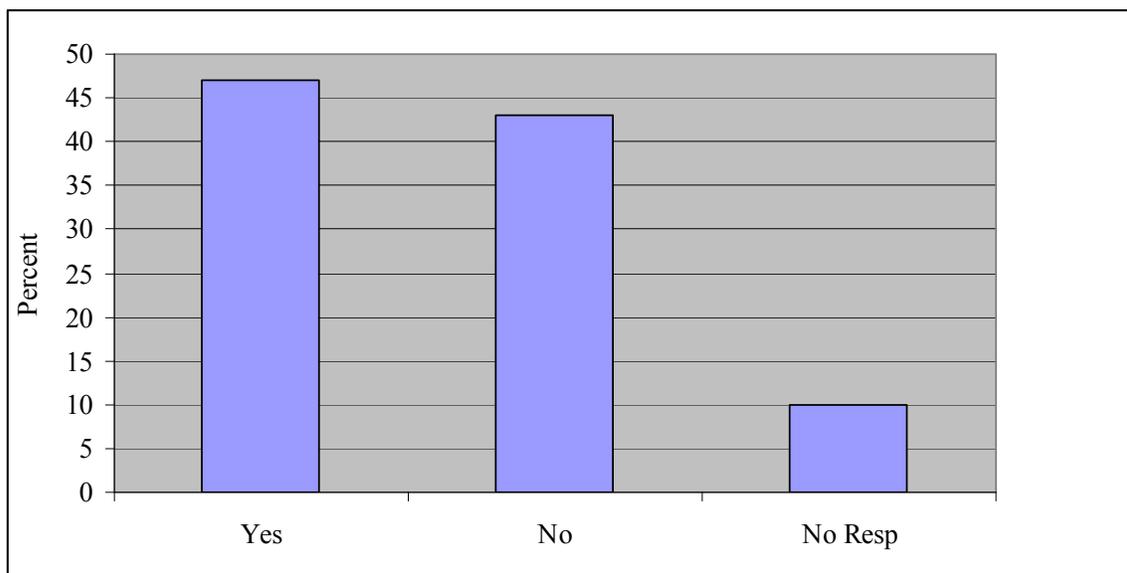


Figure D3 - Have you ever used the stairs during a fire drill at Cape Fear Hotel Apartments?

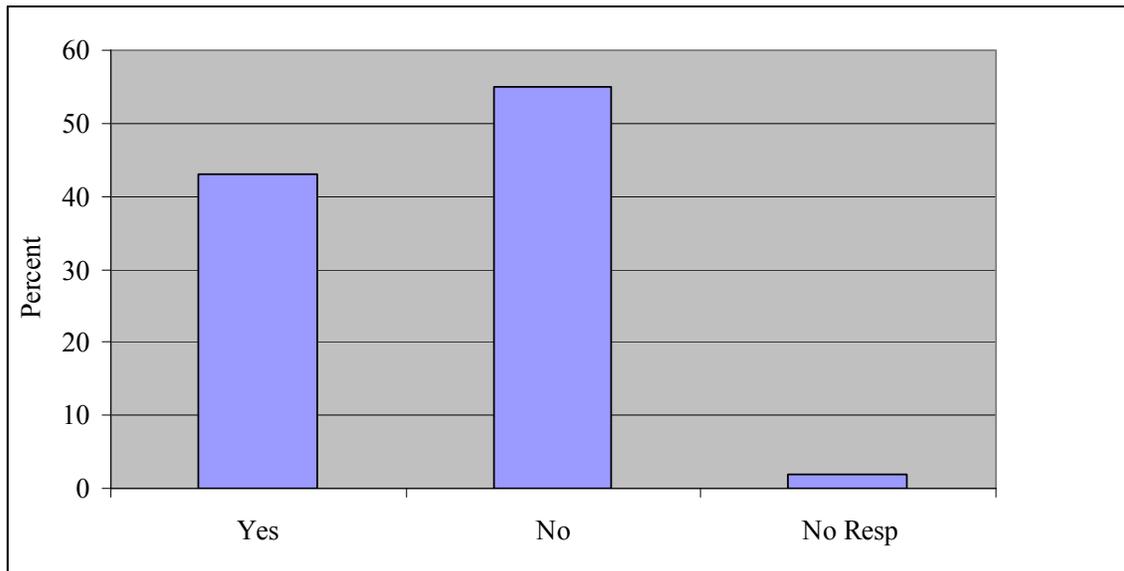


Figure D4 – Can you hear the fire alarm when it sounds at Cape Fear Hotel Apartments?

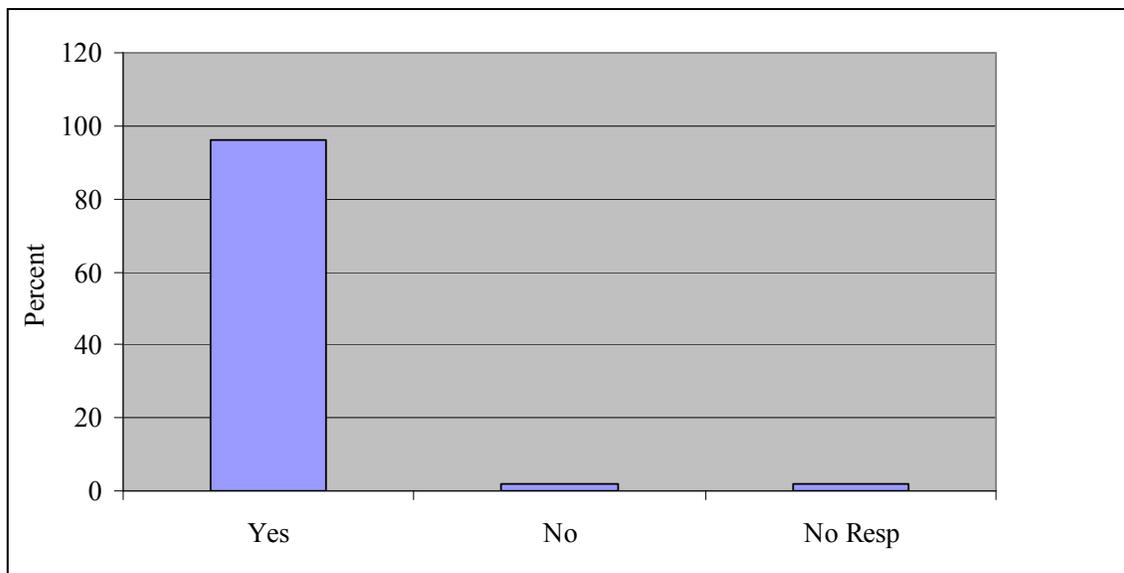


Figure D5 - What do you do when the fire alarm sounds at Cape Fear Hotel Apartments?

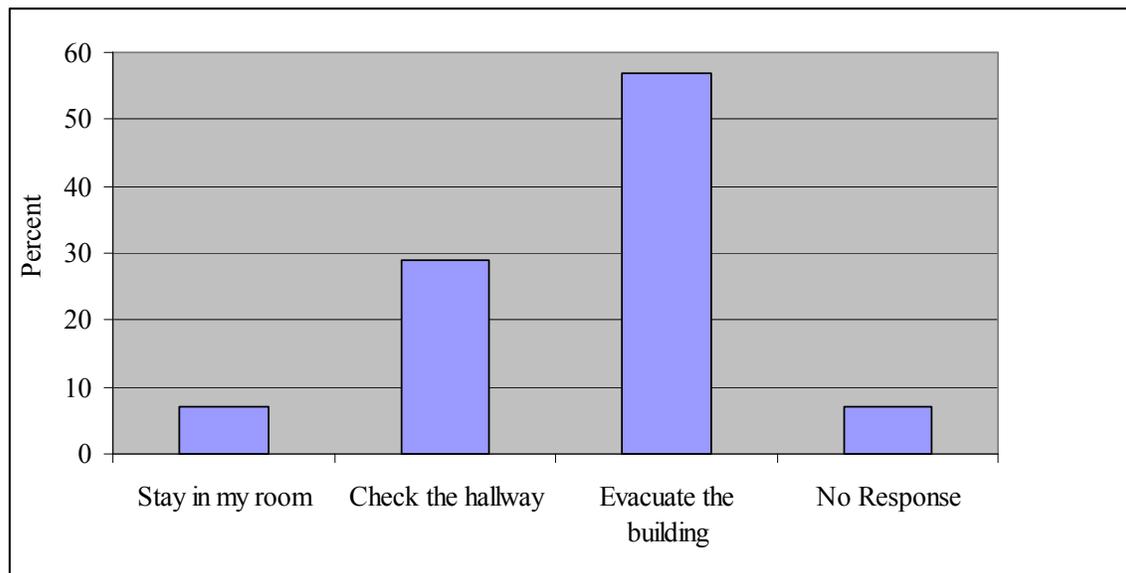


Figure D6 - Do you try to use the elevator when the fire alarm sounds at Cape Fear Hotel Apartments?

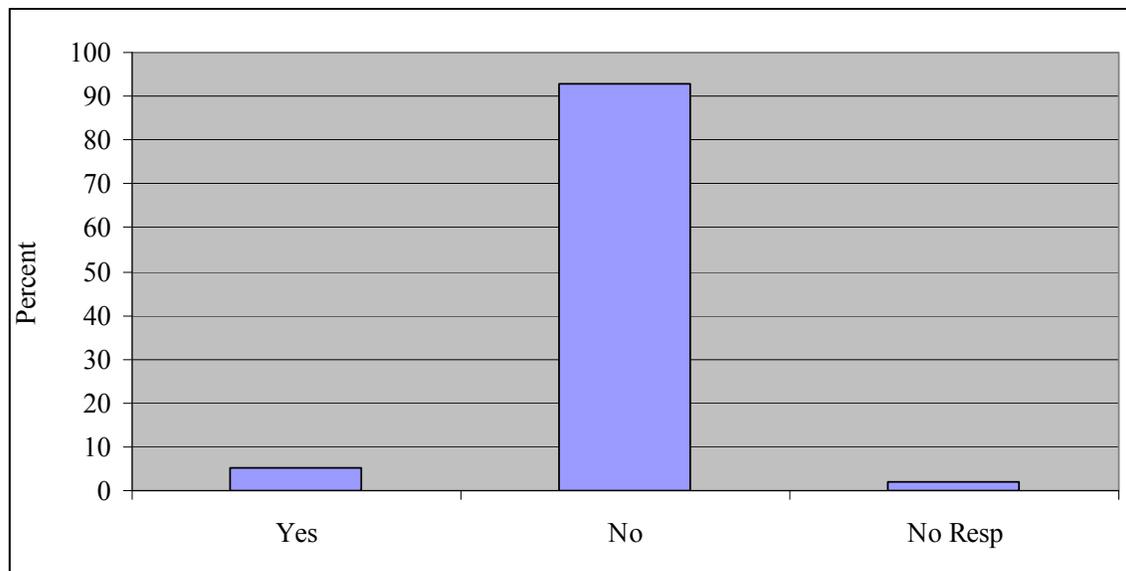
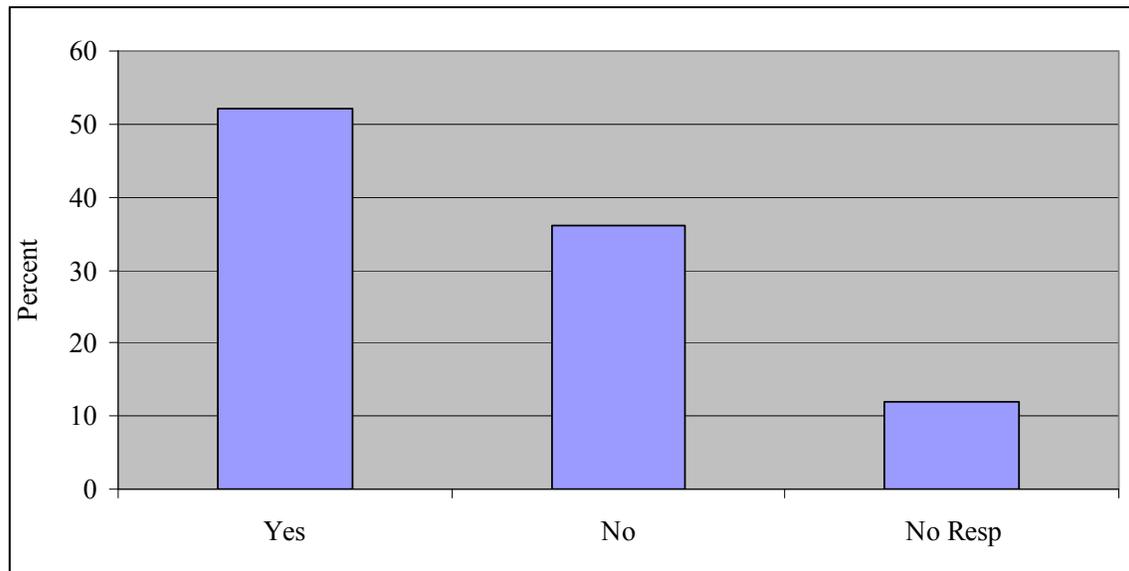


Figure D7 - Do you have a disability or injury that would prevent you from using the stairs during a fire drill at Cape Fear Hotel Apartments?



## Appendix E

### North Carolina Fire Prevention Code Fire Safety Plan Requirements

Fire safety plans shall include the following:

1. The procedure for reporting a fire or other emergency.
2. The life safety strategy and procedures for notifying, relocating, or evacuating occupants.
3. Site plans indicating the following:
  - 3.1. The occupancy assembly point.
  - 3.2. The locations of fire hydrants.
  - 3.3. The normal routes of fire department vehicle access.
4. Floor plans identifying the locations of the following:
  - 4.1. Exits.
  - 4.2. Primary evacuation routes.
  - 4.3. Secondary evacuation routes.
  - 4.4. Accessible egress routes.
  - 4.5. Areas of refuge.
  - 4.6. Manual fire alarm boxes.
  - 4.7. Portable fire extinguishers.
  - 4.8. Occupant-use hose stations.
  - 4.9. Fire alarm annunciators and controls.
5. A list of major fire hazards associated with the normal use and occupancy of the premises, including maintenance and housekeeping procedures.
6. Identification and assignment of personnel responsible for maintenance of systems and equipment installed to prevent or control fires.
7. Identification and assignment of personnel responsible for maintenance, housekeeping and controlling fuel hazard sources.

## Appendix F

### North Carolina Fire Prevention Code Evacuation Plan Requirements

1. Emergency egress or escape routes and whether evacuation of the building is to be complete or, where approved, by selected floors or areas only.
2. Procedures for employees who must remain to operate critical equipment before evacuating.
3. Procedures for accounting for employees and occupants after evacuation has been completed.
4. Identification and assignment of personnel responsible for rescue or emergency medical aid.
5. The preferred and any alternative means of notifying occupants of a fire or emergency.
6. The preferred and any alternative means of reporting fires and other emergencies to the fire department or designated emergency response organization.
7. Identification and assignment of personnel who can be contacted for further information or explanation of duties under the plan.
8. A description of the emergency voice/alarm communication system alert tone and preprogrammed voice messages, where provided.