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Creating Efficient High-Rise Pre-Fires for the Bellevue Fire Department

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CERTIFICATION STATEMENT

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

Signed: _____

Abstract

High-rise pre-fire plans used by Bellevue firefighters were not standardized and did not convey as much information as was needed when responding to high-rise building emergencies. The process of collecting data for these high-rise pre-fires was inefficient and not as accurate as it could be. This Applied Research Project created a template for a new high-rise pre-fire that presents information in such a manner that it is easy to understand even by firefighters who may be unfamiliar with the response building. Action research, combined with a literature review, personal interviews, a survey and a trial test of a new high-rise pre-fire were used to answer the following questions: a) What standards are in place regarding the creation of prefires?, b) How is high-rise building information routinely collected by the fire department for inclusion in a pre-fire?, c) What information is most useful in a high-rise pre-fire?, d) What degree of involvement can be expected of private entities in this process? The recommendations of this research project included: 1) The department should begin following NFPA 1620 and NFPA 170 guidelines, 2) Initiate better communications between high-rise building managers, Bellevue Fire Prevention personnel and fire suppression personnel when creating pre-fires, 3) Create a new high-rise pre-fire similar to the one proposed in this research paper, 4) Replace Canvas 8 with a drawing program more suitable to the creation of pre-fires.

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Creating Efficient High-Rise Pre-Fires for the Bellevue Fire Department

Introduction

The City of Bellevue has seen a tremendous growth in the number of high-rise buildings within the past 10 years. In 1999 there were 25 high-rise buildings in Bellevue and by 2009 there were 52 high-rises that were built and occupied (T. Allen, personal communication, October 8, 2009). To assist responding firefighters in finding their way around high-rise buildings and to help identify critical building systems, a pre-fire has been created for every high-rise in Bellevue. The author uses the term "high-rise pre-fire" in this Applied Research Project (ARP) to refer to building information that is most often contained on a single sheet of paper, or computer screen, that first-responding units refer to en route to, or on-site at, a high-rise incident. This is distinct from the term "pre-fire planning" which entails the systematic gathering and recording of all useful data about a building which is often contained in book or binder form and is multiple pages in length.

All pre-fires, including high-rise pre-fires, used by the Bellevue Fire Department (BFD) are created by suppression firefighters on Canvas 8, a computer aided design (CAD) program. The BFD Pre-Fire Coordinator has a difficult time finding firefighters willing to learn the complex Canvas 8 program and also reported that there is no drawing standardization (K. Guitron, personal communication, September 10, 2009). The process of gathering building information prior to the creation of a pre-fire is not a coordinated event and there is often a disconnect between Bellevue fire prevention officers and Bellevue firefighters in regard to the transfer of building systems information (S. Nichols, personal communication, October 1, 2009).

The problem is that the Bellevue Fire Department does not have an efficient system in place to create comprehensive and accurate high-rise pre-fires. The purpose of this ARP is to

begin the process of creating useful and accurate pre-fires by coordinating efforts between private high-rise building managers and the Bellevue Fire Department.

Action research, combined with a literature review, personal interviews and a survey of the use of pre-fires in fire departments who have 20 or more high-rise buildings will be used to answer the following questions: a) What standards are in place regarding the creation of pre-fires?, b) How is high-rise building information routinely collected by the fire department for inclusion in a pre-fire?, c) What information is most useful in a high-rise pre-fire?, d) What degree of involvement can be expected of private entities in this process?

Background and Significance

Once a considered a suburb of Seattle, Bellevue is now known as the metropolitan hub of the Eastside and is a major player in the global marketplace (Community Profile Network, 2008). Bellevue was incorporated in 1953 and remained a relatively small, residential community for many years. The first high-rise building in Bellevue was not built until 1968. In the past two decades, the city has grown to skyscraper heights and shed its 'suburban' status to become a thriving metropolis and a high-tech hub (City of Bellevue [COB], 2006, ¶ 6). Bellevue continues to grow dramatically, providing office space for thousands of professionals as well as condominiums and apartments for people who want to live in an urban setting (COB). As of October 2009, there were 52 high-rises built and occupied in Bellevue with an additional five high-rises due to be completed in 2010 (T. Allen, 2009).

As the number of high-rise buildings have increased, so too has the scope and complexity of the building systems contained in these high-rises. The first high-rise built in Bellevue was not sprinklered, did not have pressurized stairwells, or contain the complex fire protection and detection systems we now find in high-rise buildings (T. Allen, 2009). High-rise buildings used

to have a single alarm panel in the lobby while today firefighters responding to a high-rise must often locate a separate room with an entire fire command center (FCC) (McGrail, 2007, p. 27).

The Bellevue Fire Department has a standard operating procedure (SOP) for the creation of pre-fires. The stated purpose of creating pre-fires for the BFD is to: "Make firefighters more familiar with the operations, building configurations and problems that may be encountered in fighting fires or other emergencies in buildings and complexes in the Bellevue Fire Department's service areas" (BFD, ¶ 1). As a general rule, all buildings over 10,000 square feet, schools, churches, hazardous occupancies and apartments require a pre-fire drawing (BFD). The Pre-fire Planning SOP for the BFD is intended to cover all types of pre-fire planning and does not specifically address the numerous, and often unique, features of high-rise buildings. Terpak states that a high-rise pre-fire is the documentation of specific incident information that greatly enhances a firefighters' ability to make sound decisions at the scene of an emergency (Terpak, 2002, p. XIII). The author notes that the term "high-rise pre-fire" used in this ARP refers specifically to critical building information contained on a single piece of paper, or computer screen, that firefighters may refer to when responding to a high-rise emergency.

Line firefighters are charged with creating all pre-fires for the BFD, under the direction of a station captain. When the station captain decides to create a pre-fire for a building in the station's response area, BFD firefighters visit a building, take measurements and note the placement of various building elements such as standpipes, stairwells, elevators, and fire alarm room location. During this process of creating high-rise pre-fires there is generally little or no contact with either Bellevue fire prevention personnel or building engineers and contractors (S. Nichols, personal communication, October 1, 2009). This background information is important because while a tremendous amount of building information is being passed along from the

building owner or contractor to BFD fire prevention personnel, there is a disconnect in communication from fire prevention personnel to line firefighters who are creating the pre-fires for these buildings.

Once pre-fire information is collected by firefighters it is transferred into a CAD program. The Canvas 8 program, currently in use by the BFD, is very robust, and covers all aspects of drawing such as technical, bitmap and vector illustration, but the trade-off for all this functionality is a steep learning curve (Surveyer, n.d.). Relatively few of the drawing functions of Canvas 8 are used by Bellevue firefighters in the creation of pre-fires, in part because pre-fires are relatively simple drawings (K. Guitron, personal communication, September 10, 2009). The BFD began using the Canvas drawing program in 1987. Each installation of Canvas costs the department $281.30. Currently the department has 37 installations of Canvas 8 for a total investment of $10,408.10 (D. McAuley, personal communication, October 1, 2009).

The significance of having accurate high-rise pre-fires is becoming more important because as the cost of land rises, builders have found it less costly to build up rather than spread out (Norman, 2005, p. 326). The result has been that high-rises are being built in districts of almost every size throughout the United States and the world (Norman). A high-rise incident can be a challenge for even the largest fire department.

The potential for the loss of life during a high-rise fire is a very real possibility. A high-rise fire in Los Angles, California cost one person his life, injured 14 firefighters and caused over 50 million dollars in damage to the First Interstate Bank in 1988 (Routley & Anthony, 1988, p. 4). In 1991 three Philadelphia firefighters were killed when fire burned eight floors of the 38-story One Meridian Plaza building (Norman, p. 330). Six people died and several others were

seriously injured during a fire on the 12th floor of the 37-story Cook County Administration Building in Chicago, Illinois in 2003 (Lakamp, 2007, p. 7).

The total number of response requests within the City of Bellevue city limits in 2008 was 11,854 with 134 (1%) of those responses being to high-rise buildings (W. Lie, personal communication, October 3, 2009). The total number of calls for 2009, thru September, was 8,724 with 118 of those calls being high-rise responses, which is roughly the same 1% ratio as was found in 2008 (W. Lie, 2009).

This research paper directly relates to the Executive Analysis of Fire Service Operations in Emergency Management (EAFSOEM) curriculum by addressing the limiting factors of preparedness and response as discussed on page 4-33 of the 2009 EAFSOEM student manual. The preparedness factor will include the creation of a detailed yet understandable pre-fire that allows BFD fire personnel, as well as department responding on automatic or mutual aid, rapid access to critical building systems. The response factor will enable firefighters who may or may not be familiar with a high-rise building to quickly abate a fire while it is small enough to handle.

This project will identify improvements that can be made in high-rise pre-fires for the City of Bellevue. These improvements will enable firefighters, responding to a high-rise incident, to locate and understand critical building systems faster and more accurately than is presently the case. The investigation will use the action research method to develop a new pre-fire design that is more effective than the one currently in use.

Utilizing inaccurate pre-fires and the likely chance that firefighters will not be familiar with every building system in a high-rise may lead to firefighter and/or civilian casualties in the event of a high-rise incident. The topic of this ARP directly relates to the third, fourth and fifth organizational objectives of the United States Fire Administration's (USFA) operational

objectives to “improve local planning and preparedness”, “improve the fire and emergency services’ capability for response and recovery from all hazards” and “improve the fire and emergency services’ professional status” (National Fire Academy [NFA], 2009, p. II-2).

Literature Review

The literature review for this ARP began at the Learning Resource Center (LRC) at the National Fire Academy (NFA) in Emmitsburg, Maryland in June 2009. Literature on pre-fire planning, high-rise strategy and tactics as well as fire prevention information was collected from existing ARP’s, periodicals and text books found by the researcher and staff of the LRC. Interviews were conducted with personnel from the Bellevue Fire Department in order to gather data and other information related to the BFD. The author also collected information from several internet sites.

While there are several published definitions of what constitutes a high-rise building, the author has found that many sources, including the BFD, consider a building to be a high-rise if it is in excess of 75 feet in height from the lowest level of fire department access to the floor of the highest occupiable story (McGrail, 2007, p. 18; Quiter, 2008, ¶ 5; BFD, p. 2). For this ARP the author will consider a building to be a high-rise if it fits the aforementioned criteria.

Pre-fire planning is not a new concept for the fire service. The International Fire Service Training Association (IFSTA) published a manual in 1970 that explained the rationale and general requirements for a fire service pre-fire (Hudiburg & McCoy, 1970). The manual states that the sole purpose of pre-fires is to increase firefighting efficiency (Hudiburg & McCoy, p. 38). Massey asserts that pre-plans can make or break the incident, whether it’s in a chemical plant, hospital or high-rise building (Massey, 2004, p. 96). Major (2008) states that most

organizations realize the benefits of an effective pre-incident planning program and that pre-fires of target hazards can reduce the risk to emergency responders and citizens.

A special report by the Federal Emergency Management Agency (FEMA) cited reflex time as a specific challenge in high-rise firefighting operations (Bush & Routley, 1996, p. 1). Reflex time is the amount of time it takes to travel from the ground floor to the fire floor, which if often much longer in high-rise buildings than in non-high-rise buildings (Bush & Routley, p. 1). McGrail (2007) states that while it might take a good engine company one or two minutes to stretch an attack line at a single-family dwelling, it is possible that it might take as much as 15 to 20 minutes to do same thing at a serious high-rise fire.

Lakamp asserts that one of the keys to success on a high-rise operation is good pre-fire planning (Lakamp, 2007, p. 12). A preincident plan gives incident commanders better information about a building and allows fire officers to use resources more efficiently thus improving fireground strategy, tactics and application of risk management (Murphy, 2009, p. 85). Pre-fire plans are essential for high-rise buildings and that these plans should include at a minimum the types of mechanical fire protection systems, building layout, location of stairwells and elevators and evacuation considerations (Bush & Routley, 1996, p. 2). Before attempting to visit a building site to gather pre-fire information it is important to make contact with the property owner. Once firefighters have explained the benefits of having a good pre-fire, a business owner will be glad to cooperate (Godshall & Seasholtz, 2009, p. 41).

The National Fire Protection Association (NFPA) publishes two standards that specifically relate to prefires: NFPA 170 – Standard for Fire Safety and Emergency Symbols and NFPA 1620 – Recommended Practice for Pre-Incident Planning. Chapter 5 of NFPA 170 recommends specific symbols to be used for the identification of standpipes, fire hydrants and

electrical panels that could be used in a high-rise pre-fire (National Fire Protection Association [NFPA], 2009). A specific safety color (red) is also assigned to these symbols (NFPA). Chapters 1 through 10 of NFPA 1620 offer suggestions for general pre-planning information that may or may not be applicable to all occupancies, while chapters 11-20 provide information that addresses the needs of specific occupancy classifications (National Fire Protection Association [NFPA], 2003, p. 1620-5). The author could find no reference to the specific classification of high-rise buildings in NFPA 1620.

Lockwood developed firefighter access plans (FAP's) that were originally placed behind plexiglass on the walls of stairwells and common areas in large hotels (Lockwood, 2004). These plans give detailed layouts of specific floors and large open areas. The FAP was developed to show firefighters, who may be unfamiliar with a structure, how to enter and safely navigate the interior of the building (Lockwood, p. 86).

Godshall and Seasholtz (2009) suggest that a standardized set of symbols such as those found in NFPA 170 are important in a well-constructed pre-fire. Graphics software should be compatible with current fire department software, computer user expertise and pre-fires should be formatted to 8 ½ x 11 inch paper (Godshall & Seasholtz, p. 15). The FAP's created by Lockwood are currently being printed by the business owner on 8 ½ x 14 inch paper using a color laser printer and given to incoming units (Lockwood). Shupe states that prefires should be in hard copy form and kept on all responding apparatus (Shupe, 2006, p. 62). Pre-fire plans should be periodically updated (Shupe, 2006; Tempe Fire Department, 2005).

Godshall and Seasholtz (2009) recommend that pre-fires contain three types of drawings. Depending on the complexity of the site these drawings are, in descending size: site; footprint;

and floor plans. Shupe suggests that pre-fires can show the building and its proximity to streets, other building access information and hydrant locations (Shupe, 2006, p. 63).

The Johnson City (Tennessee) Fire Department uses large color-coded maps to help its firefighter's pinpoint specific buildings on the campus of East Tennessee State University (Finucane & Price, 2002). Once firefighters started using the color-coded maps, the university's public safety officers no longer had to escort them to the incident site on campus (Finucane & Price, ¶ 5). Finucane stated that by using different colors for groups of buildings in a large complex firefighters are able to respond faster, saving time and increasing accuracy (M. J. Finucane, personal communication, July 1, 2009). The colors used in Finucane's pre-fires were based on specifications by the Johnson City Fire Department. Finucane stated that he was not aware of any existing specifications for the use of color in a pre-fire drawing (M. J. Finucane).

In an effort to improve the identification and use of high-rise elevators, Kroon developed a job-aid for high-rise elevator operations (Kroon, 2009). Line drawings and colors were used to highlight different elevator banks in a building and conducted a field test to rate its effectiveness. Feedback from those who participated suggested that the use of colors was very beneficial and that they would like to see more use of colors in similar applications (Kroon, 2009, p. 33).

A job aid is designed to provide the user with immediate information they can use to make a sound decision quickly (Kroon, 2009). Terpak states that a high-rise pre-fire is the documentation of specific incident information that greatly enhances a firefighters' ability to make sound decisions at the scene of an emergency (Terpak, 2002, p. XIII). Rossett & Gautier-Downes state that a job aid should be used when the following criteria are met:

1. When the performance is infrequent;
2. When the situation is complex, has multiple steps or has multiple attributes;

3. When the consequences of errors are high;
4. When performance depends on a large body of information;
5. When there is little time or few resources to devote to training (Rossett & Gautier-Downes, 1991, p. 31)

There are three broad categories of type: serif, sans serif and script (Frank, 1996, p. 14). A serif type, such as Times New Roman, is typically easier to read for most people since we tend to see it most (Frank). Frank suggests that no more than two types of typefaces be used on any one page and further suggests that if two typefaces are used, one should be a serif and one should be a sans-serif (Frank, p. 16).

The development of a pre-fire plan should be a cooperative effort that includes the facility staff, responding personnel and technical experts (NFPA, 2003, chap. 4.1.1). When collecting data for a pre-fire it is important to consult with other professionals involved in the site or facility construction such as fire protection engineers, sprinkler contractors, building architects or engineers and insurance professionals (NFPA, chap. 4.3.1.1).

In 1978 Factory Mutual System (now known as FM Global) published a brochure stating that pre-fire planning by the property owner in cooperation with the local fire department was a mutually beneficial strategy (Factory Mutual System, 1978, ¶ 2). The brochure suggests that by becoming familiar with a private property, firefighters are able to confidently and effectively attack a fire when the need arises (Factory Mutual System). The brochure further states that "at its best, pre-fire planning meshes the roles of the public firefighter and the private emergency organization member" (Factory Mutual System, ¶ 2). FM Global continues to emphasis the importance of public and private cooperation in a current version of the brochure originally

published in 1978 by stating that the development of a pre-fire plan must be a team effort between the public fire service company-trained personnel (FM Global, 2007, p. 2).

NFPA 1620 states that a pre-fire plan is a document that is developed by gathering general and detailed data and is used by responding firefighters to determine the resources and actions necessary to mitigate anticipated emergencies at a specific facility (NFPA, 2003, chap. 3.3.20.4). It is further stated in NFPA 1620 that "It is important to consider the intended audience for the final pre-fire plan and to understand the threshold of information that the pre-fire plan user can effectively utilize once the incident has occurred" (NFPA, chap. C.1). Taylor (2009) states that a high-rise pre-fire should include information such as: lockbox location, fire control room location, fire pump location, elevator and elevator control room location, stairwells, standpipe/sprinkler systems, windows, access, and compartmentalization. Clark contends that a pre-fire should include the building features, sprinkler and standpipe identification, water supply limitations and notes on structural strong point and weaknesses (Clark, 1991, p. 286). Murphy suggests that a pre-fire plan should include a building plot plan, fire department connections, stairs and elevator locations and unique building characteristics that pose a potential threat to responding firefighters (Murphy, 2009, p. 91).

Massey (2004) incorporates the locations of stairwells, escalators, standpipe and sprinkler connections, hydrants, gas valves and other specific information in detailed, CAD drawn, pre-fire plans that are often several pages in length and provide great detail. Lockwood (2004) uses a CAD program that produces a detailed floor plan outline that includes standpipe locations, elevators, room numbers, places of refuge for firefighters and total length of hallways and large meeting rooms in his FAP's.

Procedures

Research Methodology

This ARP employs action research in order to help address the problem of efficiently creating a comprehensive pre-fire that is easy to use and accurate. The procedures used in this research proposal include information gathered from the Internet, interviews conducted with many different individuals and a survey that was sent to selected fire departments that have 20 or more high-rises in their jurisdiction. A template for a new high-rise pre-fire that was comprehensive, yet easy to understand, was created and field-tested on 126 firefighters.

Literature Review

The research for this ARP began at the LRC at the NFA in Emmitsburg, Maryland in June of 2009. Information for this ARP was found in existing ARP's, brochures, text books, Internet sites and personal interviews. The focus of the literature review was to find information on any existing standards for creating pre-fires, determine what information is considered important for inclusion in a pre-fire, and determine what type of cooperation can be expected from private entities in the creation of a pre-fire.

Interviews

Travis Allen, Assistant Fire Marshal, Bellevue Fire Department, provided background and information on fire and building codes at both the local and national level as well as detailed information on the construction and development of high-rises in the City of Bellevue (T. Allen, 2009).

William Lie, EMS Data Analyst, provided the author with run totals and other information regarding responses to high-rise buildings in the City of Bellevue (W. Lie, 2009).

Sean Nichols, Lead Fire Prevention Officer, provided background information on how information was collected and passed along from private building owner to the fire department from the time of permit application to the creation of a high-rise pre-fire (S. Nichols, 2009).

Survey Population

An 11-question survey was sent to 25 fire departments in North America. The primary criterion was that each department must have at least 20 high-rise buildings in their response area. The author believes that a fire department that serves and area with 20 or more high-rises would very likely have established pre-fires for these challenging buildings. While the overall number of respondents to the survey was small, the author believes the fire departments chosen were a good cross-representation of fire departments across North America. The departments selected for the survey all face the unique challenges of high-rise building emergencies. A list of the 25 fire departments that were sent a survey can be found in Appendix A. The survey was sent by e-mail to a specific individual at each department. The author believed that by making direct contact with an individual, instead of a using an impersonal shotgun approach, a greater percentage of the surveys would be returned. Of the 25 surveys sent out, 21 were returned, all by e-mail.

The survey, shown as Appendix B, contained 11 questions designed to determine to what extent different fire departments use pre-fires for high-rise buildings, what form they come in, who creates them, what standards are used and what information is most important on the pre-fire. The author wanted to find out what similarities or differences there were between the respondents and the BFD regarding the way in which high-rise pre-fires are created and used. The author believed that the departments contacted for this survey likely have more experience

facing the challenges of high-rise buildings than does the BFD since the first true high-rise in Bellevue wasn't built until 1968.

High-Rise Pre-Fire

Based on information gathered from a literature review and a survey, a newly designed high-rise pre-fire was created for use at a regional high-rise drill at Tower 4 of the Bravern complex, in Bellevue, on October 25, 2009. The pre-fire used for the drill is shown in Appendix C. The author first contacted BFD Fire Prevention Officer Sean Nichols regarding pre-planning information on the Bravern Tower 4 building (S. Nichols, 2009). In order to stream-line and improve the information gathering process, the author made direct contact with Bravern project manager Jason Goetz. The author gave Goetz a blank template of the proposed pre-fire and asked that Goetz enter all required building information on the form (J. Goetz, personal communication, October, 2009).

The pre-fire was formatted to fit on 8 ½ x 11 inch paper and is two-sided. The front side of the pre-fire is primarily graphics. The top portion of the front side shows a cut-away view of the building using colors to highlight the floors served by all elevators and stairs. The bottom portion of the front side is an over-head plot map showing the general location of the fire alarm room, Knox box, elevator banks, stairs, and surrounding street names. Symbols currently used in BFD pre-fires, and not those recommended by NFPA 170, were used to indicate building components. Color was employed to show key building components. The back side of the pre-fire consists of all text. Information about specific building systems and response guidelines are contained in pre-assigned boxes for easy reference.

The new pre-fire utilized two font types: Times New Roman and Arial. Titles, major headings and text used for the standardized information on the back of the pre-fire used the

Times New Roman font. Information unique to the building or data that changes with each pre-fire used the Arial font. The size of the font varied, depending on the space available, from 8-14. The pre-fire was created with Microsoft Word and Microsoft Publisher programs.

The high-rise pre-fire for Bravern Tower 4 was field-tested on 126 firefighters on October 25, 2009. The pre-fire field test took place in Bellevue during a region-wide high-rise drill sponsored by the Bellevue Fire Department. Participants in the field-test represented the BFD, Central Pierce, Eastside Fire & Rescue, Kent, Kirkland, Mercer Island, Redmond, Renton, Seattle, and Woodinville Fire Departments.

A copy of the high-rise pre-fire along with an eight-question questionnaire was given to each company officer and every chief officer attending the drill as they passed through Lobby Control on their way to Staging. A total of 45 questionnaires were given to company officers and chief officers. The questionnaire can be seen in Appendix D. Participants were asked to use and evaluate the pre-fire as they proceeded through the remainder of the high-rise drill. Company officers were asked to review the pre-fire with their crew and answer the questionnaire based on crew feedback. Questionnaires were collected as drill participants passed through Lobby Control on their way out of the building. The evaluation process took place between 9 a.m. and 5 p.m. on the day of the high-rise drill.

Assumptions and Limitations

All published research information used in the ARP is assumed to be authoritative and unbiased in nature. It is further assumed that the responses to personal communications, surveys and questionnaires are factual. The author acknowledges that the small sample size of the high-rise pre-fire survey does not represent all fire departments that have 20 or more high-rises in their

response area. The sample population represented departments on the west coast of North American as well as departments in the central and eastern United States.

A limiting factor to the high-rise survey was that not all respondent answered all questions or completed their survey fully. For example, Seattle and Vancouver, BC did not answer question 11, making the response population to that question smaller. Surveys not returned to the author also limited the information available to this researcher.

The new high-rise pre-fire, designed by the author, was tested on 126 firefighters participating in a high-rise drill on October 25, 2009. Although the sample size is limited, several local fire departments, in addition to the BFD, were represented and it was assumed that this mix of firefighters from different departments was representative of the firefighters for the responding departments. The author received 30 of 45 questionnaires issued at the high-rise drill. Questionnaires not returned by participants limited the information available to this researcher.

Results

The research for this ARP was completed by utilizing a literature review, personal interviews, a survey sent to 25 fire departments that have at least 20 high-rise buildings, and a field-test of a newly designed high-rise pre-fire. Of the 25 surveys sent out to fire departments around the United States and Canada, 21 were returned, all via e-mail correspondence. The results of the survey can be found in Appendix E. Thirty of the 45 pre-fire questionnaires were returned to the author on the day they were handed out. The results of the pre-fire questionnaire can be found in Appendix F.

Survey Results

Question one asked how many high-rise buildings each fire department has in their city or jurisdiction. The purpose of the question was to try and determine if the number of high-rise buildings in a city impacted what form of high-rise pre-fire was used and the importance assigned to these pre-fires. This researcher was trying to determine if departments who have between 20 and 50 high-rise buildings had a different approach to the use of high-rise pre-fires than do cities with 51 to 100 or departments with more than 100 high-rises. Six departments responded that they had between 20-50 high-rises, two departments reported having between 51-100 and 12 departments reported having over 100 high-rise buildings.

Question two asked respondents if their departments employed the use of a pre-fire for their high-rise buildings. All but two of the 21 respondents reported that they used high-rise pre-fires. Only Madison, Wisconsin and Austin, Texas Fire Departments reported that they did not currently employ the use of high-rise pre-fires.

Question three sought to find out where respondents kept their pre-fires. The author wanted to determine if departments transported their pre-fires to the high-rise in responding vehicles or if the pre-fires were kept at the high-rise building itself. 18 of the respondents reported that copies of their high-rise pre-fires are kept on responding apparatus. Eleven stated that they keep a hard copy and seven reported that they keep an electronic copy on their responding apparatus. Six of the respondents reported that a hard copy of each high-rise pre-fire is kept in the alarm room of each high-rise. Five of the responding departments reported that they carry a copy of the high-rise pre-fire on responding apparatus and also keep copies in the fire alarm rooms.

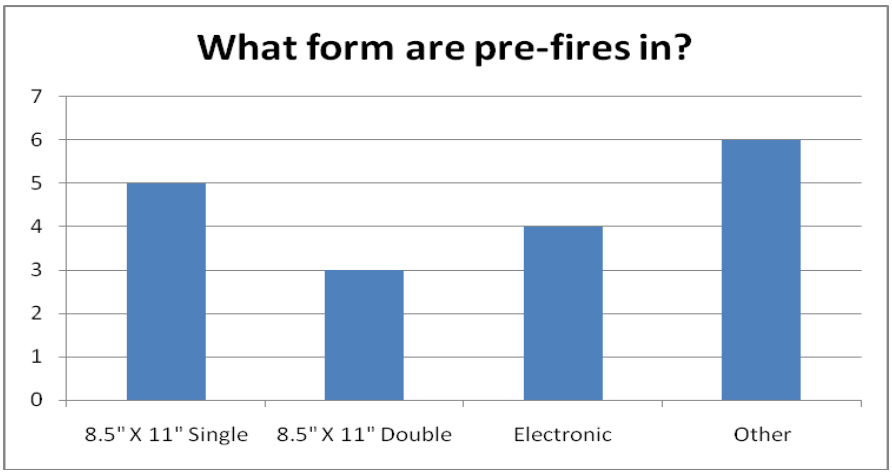
Question four asked the respondents if they routinely provided their high-rise pre-fires to surrounding fire departments who may respond into their jurisdiction on automatic or mutual aid. The purpose of this question was two-fold: 1) Try to determine the level of cooperation between adjacent departments, 2) try to determine if pre-fires are standardized to enable use by other entities. Only three departments: Houston, Texas, Clark County, Nevada and Burbank, California, reported that they routinely share this information with surrounding jurisdictions.

The fifth question sought to find out who is responsible for the creation of each department's pre-fires. The author was interested in finding out how many fire departments relied on firefighters to create their pre-fires. All but two of the respondents reported that firefighters were responsible for the creation of their departments' pre-fires. San Francisco and Vancouver, British Columbia fire departments reported that they utilize a private contractor to create their pre-fires.

Question six asked what each departments' pre-fire looked like. In other words this researcher want to know if responding departments used pre-fires on 8 ½ x 11 inch paper, if they are single sided or are re they double-sided? Are the pre-fires only used electronically via a computer or is there some other way of presenting the information? Table 1 shows the responses to question six.

Table 1

What form do pre-fires take?



Five departments said their pre-fires are on 8 ½ x 11 inch paper and single sided. Three departments said their pre-fires are on 8 ½ x 11 inch paper and double sided. Four departments reported that they use pre-fire in an electronic version only. Of the six departments who answered "other" to this question only San Francisco and El Segundo reported that their pre-fires are on paper larger than 8 ½ x 11 inches. The remaining four departments reported that their high-rise pre-fires were often multiple pages depending on the complexity of the building.

Question seven sought to find out if graphics, text, or a combination of both, are used in high-rise pre-fires. Of the 19 respondents who answered this question 14 reported that they use both text and graphics in their high-rise pre-fires. Thirteen respondents reported that they use an overhead, or plot map, view on their pre-fire while only four respondents reported using a side-view or cut-away map. Pasadena reported that their high-rise pre-fires contained graphics only. Burbank and Salt Lake City reported that their high-rise pre-fires use text only.

Question eight sought to find out if responding departments had a policy in place for updating their high-rise pre-fires. Of the 18 respondents who answered this question, five reported that they update their pre-fires annually. Four respondents said they did not know how

often their pre-fires were updated. The other nine departments responded that they updated their high-rise pre-fires on an "as needed" basis and did not report a specific time table for updates.

The perceived usefulness of high-rise pre-fires to fire personnel responding to a high-rise emergency was of great interest to this researcher. Question nine tried to gauge the level of usefulness respondents gave to their high-rise pre-fires. Twenty respondents chose to answer this question. Five departments reported that they felt that high-rise pre-fires were "somewhat useful" to them when responding to an alarm while 15 respondents reported that the thought pre-fires were "very useful".

Question ten tried to ascertain the level of standardization in pre-fires within the survey group. The question wanted to know if the departments followed the guidelines of either NFPA 1620 (Recommended Practice for Pre-Incident Planning) or NFPA 170 (Standard or Fire Safety and Emergency Symbols). Most respondents reported that they did not know if their pre-fire procedures followed either NFPA 1620 or NFPA 170. Tables 2 and 3 show the results for this question.

Table 2

Does your department follow NFPA 1620 guidelines?

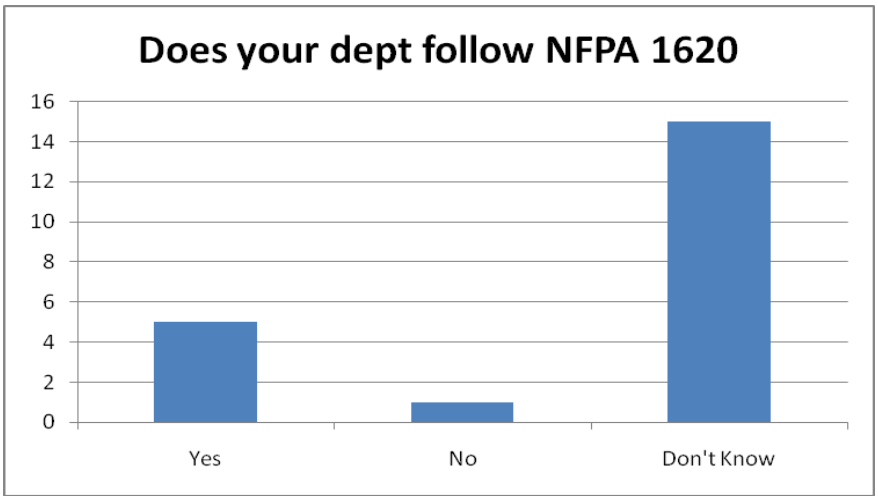
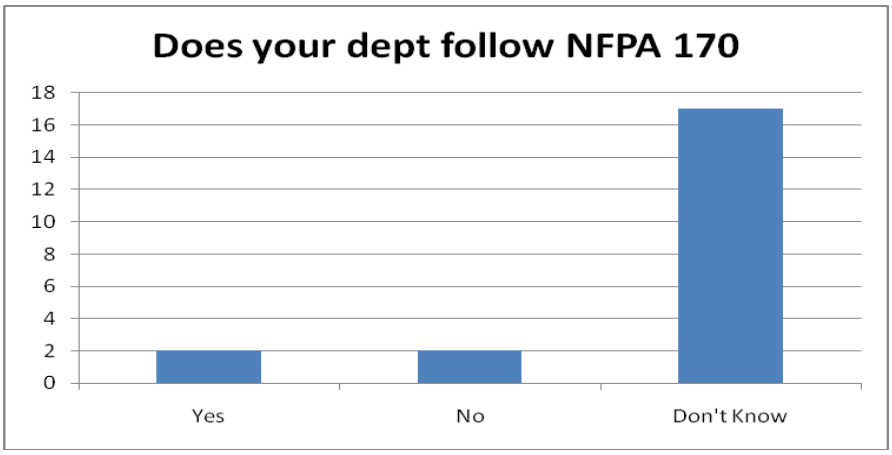


Table 3

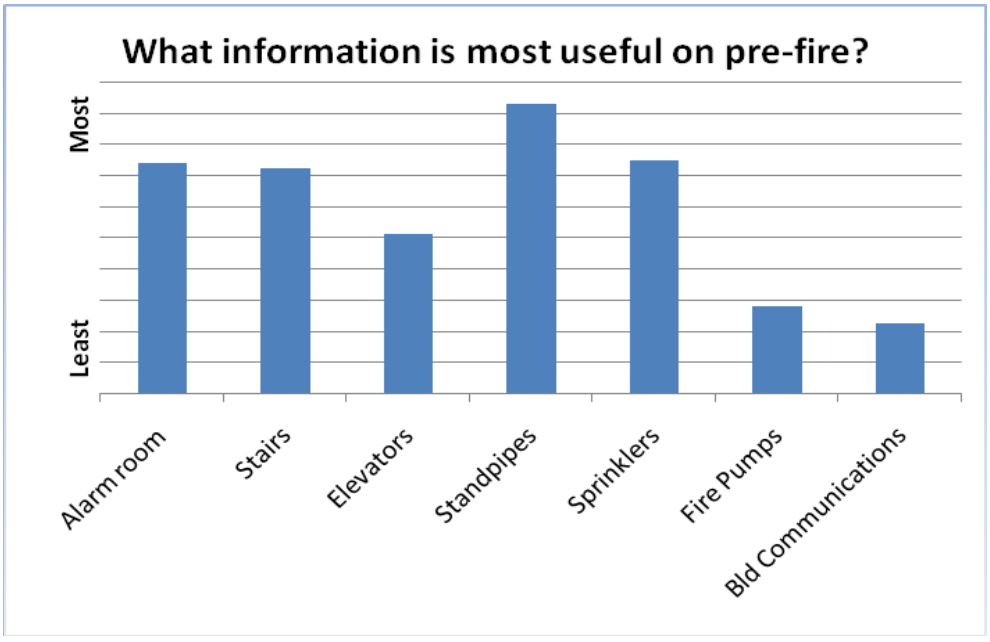
Does your department follow NFPA 170 guidelines?



Question eleven sought to find out what information respondents felt was the most important on a pre-fire. The question asked respondents to rank order their choices with one being most important and eight being least important. Table 4 presents the responses to this question.

Table 4

What information is most important on a high-rise pre-fire?



There was a three-way tie for the next most important item. The tie was between the locations of: the alarm room, stairs and sprinklers. In fifth place, as far as pre-fire importance, is the location of elevators. Fire pumps and building communication systems were both ranked low on their relative importance on a high-rise pre-fire. The location of the alarm room actually had more 1st place, or "most important" votes (8) than did the location of standpipes (4), but the average ranking for the location of standpipes was lower than that for the location of alarm room.

Pre-Fire Questionnaire Results

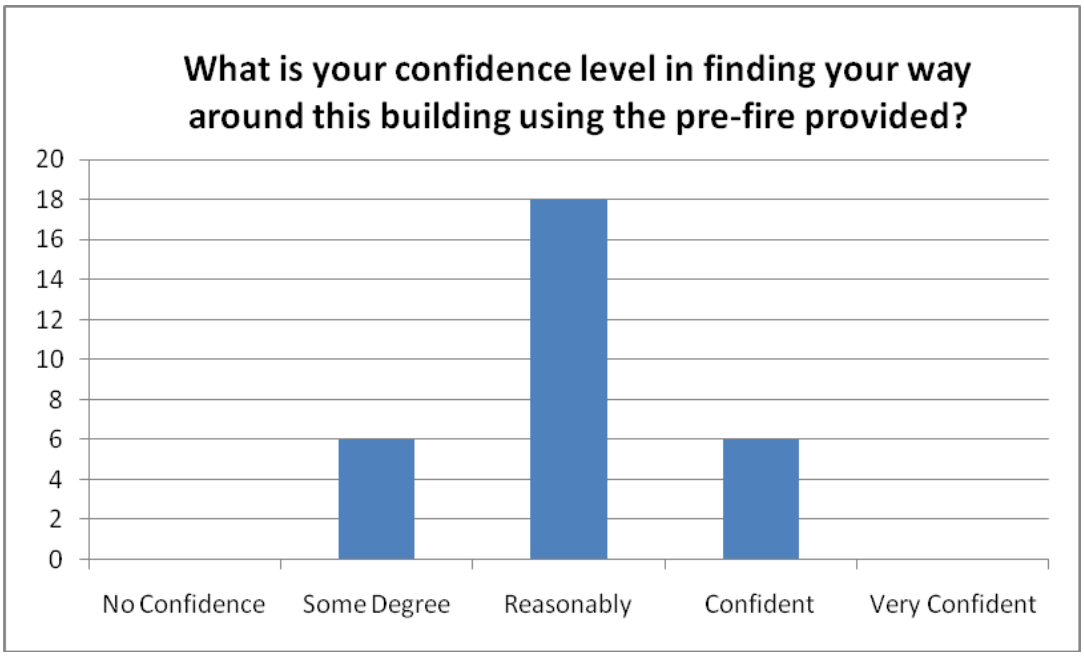
The first question asked the affiliation of the person(s) filing out the survey. This was done to see if there were any noticeable variances in the answers between Bellevue fire personnel and fire personnel from other departments. Twenty of the respondents reported being with the BFD and ten reported being from another fire department.

Question two asked respondents if they were familiar with the Bravern Tower 4. Six of the respondents responded that they were familiar with the building while 24 responded that they were not familiar with Bravern Tower 4.

The purpose of question three was to try and gauge the level of confidence the pre-fire gave respondents. Respondents were asked to rate how confident they were in navigating the building with the use of the pre-fire if they had to return to the Bravern Tower 4 that same evening for an actual alarm. Table 5 shows the results of this question. Six respondents said they would have some degree of confidence and six said they were confident that they could

Table 5

Rating confidence level with use of pre-fire



find their way around the building with the pre-fire. Seventeen of the respondents reported that they had a reasonable amount of confidence by using the pre-fire.

The fourth question asked if the respondents liked the use of color in the pre-fire. All 30 questionnaire respondents reported that they did like the use of color in the pre-fire. Question five asked if the use of colors made it easier to identify critical building components such as elevators and stairs. All 30 respondents reported that the use of colors made it easier identify unique building components.

Question six asked respondents if they would rather keep the design of their current pre-fire or switch to the design of the pre-fire used for the drill. Six reported that they would prefer to keep the pre-fires they currently use and fourteen reported they would like to switch to the pre-fire used at the drill. Ten respondents chose not to answer the question, however several of

those respondents who chose not to answer question six said they would like to use the pre-fire provided at the drill in addition to their current pre-fire.

Questions seven and eight were open ended questions that asked what the respondents most like and least liked about the pre-fire. Those that chose to answer these questions reported that what they liked most about the pre-fire was the use of color, it was easy to read, and simple to understand information. Those respondents that had criticism of the pre-fire stated that some of the fonts used were hard to read, the plot map didn't show enough of the surrounding area and the pre-fire needed a better legend.

Discussion

This author found that high-rise pre-fires: increase firefighting efficiency (Bush & Routley, 1996), are one of the keys to success on a high-rise operation (Godshall & Seasholtz, 2009), and that pre-plans can make or break an incident at a high-rise building (Massey, 2004). The author discovered that reflex time is the amount of time it takes to travel from the ground floor to the fire floor (Bush & Routley, 1996). Reflex time is often much longer in high-rise buildings and is a specific challenge in high-rise firefighting operations (Bush & Routley). The author believes that reducing reflex time at a high-rise operation is very important.

A survey of fire departments with 20 or more high-rise buildings found that almost all departments used a pre-fire when responding to high-rise incidents. Of the 21 departments surveyed, only two did not employee a high-rise pre-fire. The same survey asked respondents to rate the usefulness of high-rise pre-fires. Five respondents reported that pre-fires are "somewhat useful" and fifteen reported they believed pre-fires were "very useful". No respondents reported that they believed that pre-fires were "not at all useful". The author believes the responses from these two questions suggests that high-rise pre-fires are used by a majority of fire departments

with high-rise buildings and that these pre-fires are perceived to be useful for responding companies.

This same survey found that there is no standard size or format for pre-fires. Eight departments reported that they use 8.5 x 11 inch paper pre-fires and four reported using electronic pre-fires exclusively. Six of the respondents reported using either large format paper or a combination of paper and electronic pre-fires. The author believes there are benefits to having both a paper and electronic pre-fire available to responding fire personnel, however it is not possible to take an electronic copy into the building and therefore a hard copy should be provided.

The survey also discovered that the manner in which information is presented on a pre-fire varies widely from department to department. The survey found that 14 out of 18 respondents used both text and graphics on their pre-fires and that 13 of these same respondents included some sort of plot map, or overhead view, of the building. Only four of the respondents to this question reported that their pre-fires contained text only. The author believes that results from the survey indicate that having both graphics and text on a pre-fire is useful for responding fire personnel.

The author found that a systemized approach to the creation of pre-fires and the practice of using standardized symbols in those pre-fires is a recommended practice (Godshall & Seasholtz, 2009; NFPA, 2003). The BFD currently does not have a specific standard for pre-fire drawings and that the symbols used are unique to the BFD (K. Guitron, 2009). The author believes that the effectiveness and efficiency of pre-fires is reduced when there is no consistency in the use of symbols. This is especially true when neighboring fire departments are given a pre-

fire on a mutual response and the symbols on the pre-fire do not match those that they are familiar with.

There appears to be no standard for the use of color in order to highlight building systems such as stairs and elevators (T. Allen, 2009). NFPA 170 assigns a specific color of red for the use in some fire symbols, but does not suggest assigning a color to define structural elements of a building (NFPA, 2009). Lockwood (2004) uses colors in FAP's but does not specify how the colors were assigned. Finucane reported that the use of colors in pre-fires enabled firefighters in Johnson City to respond faster, save time and improve accuracy to alarms on the campus of East Tennessee State University (M. J. Finucane). Finucane also stated that he was not aware of any standards or specifications for the use of color in pre-fires. Kroon (2009) received positive feedback regarding the use of color in a job aid created to improve the effective use of high-rise elevators.

A majority of respondents to a high-rise survey reported that their department did not follow, or were not aware if their department followed, NFPA 1620 or NFPA 170 guidelines in the creation of their high-rise pre-fires. Five respondents reported that their departments followed NFPA 1620 guidelines; one reported that they did not follow these guidelines and fifteen respondents reported they did not know if the guidelines were followed. Only two respondents said their departments followed NFPA 170, two said they did not follow the guidelines and seventeen responded they did not know if the guidelines were followed. The author believes that it is difficult to determine from these answers if NFPA guidelines are being followed by the responding departments, but the fact that respondents did not know if the guidelines were followed suggests that it is likely that very few departments use either NFPA 1620 or NFPA 170 in the creation of their high-rise pre-fires.

The author found a disconnect in communications between high-rise building management, Bellevue Fire Prevention personnel and Bellevue firefighters in regards to the collection and dissemination of pre-planning information for high-rise buildings (S. Nichols, 2009; T. Allen, 2009). A large amount of information was being passed from building managers to BFD Fire Prevention personnel in the construction process. Building managers are required to provide several sets of drawings, as well as information on building systems and life safety equipment to the fire department. This information is used by BFD Fire Prevention personnel to ensure that buildings are being built to the current fire and building codes. The author found that while Fire Prevention personnel did attempt to notify fire station personnel of the building status there was little or no follow-up communications in order to try and capture the significant amount of information being passed between building managers and Fire Prevention personnel.

A survey found that most fire departments rely on firefighters to create their high-rise pre-fires. Seventeen of the nineteen departments who responded to this question said that suppression personnel created their high-rise pre-fires. The two departments that did not rely on firefighters to create their high-rise pre-fires, San Francisco and Vancouver, BC, use a private contractor for that purpose.

The author found that there are many suggestions as to what information should be found in a high-rise pre-fire. NFPA 1620 (2003) recommends general and occupancy-specific criteria necessary for the development of a pre-incident plan for most buildings, but does not specifically addresses the unique concerns of high-rise buildings. The author believes that the information provided in NFPA 1620 gives enough guidance for fire department personnel to create a useful high-rise pre-fire. Bush & Routley (1996) suggest that mechanical fire protection systems, building layout, and the location of stairwells and elevators should be included in a high-rise pre-

fire. In addition to the items listed by Bush & Routley, Taylor (2009) adds lockbox location, fire control room location, and standpipe/sprinkler systems to the list of items necessary for a good high-rise pre-fire. The author found the items most often cited as important on a good pre-fire are: building layout/plot plan, location of stairwells and elevators, unique building characteristics, and sprinkler/standpipe locations.

A survey of fire departments with over 20 high-rise buildings in their jurisdictions found that the most useful piece of pre-fire information for respondents was the location of standpipes. Respondents rated the importance of information on a scale of 1-7, with 1 being the most important. The responses were then ranked with the item receiving the lowest average number denoting it as the most useful. There was a three-way tie for the second most useful type of information between the location of the alarm room, stairs and sprinklers. The location of elevators was fifth, fire pumps location was sixth and building communications systems was ranked seventh overall. The author believes that information collected from the literature review and a survey suggests that standpipes, stairs, sprinklers, elevators and alarm room identification should be included in any high-rise pre-fire.

NFPA 1620 (2003) recommends that the development of a pre-fire plan should be a cooperative effort between facility staff, responding personnel and technical experts. The author discovered that building managers are indeed willing to work cooperatively and share information with fire department personnel, including line-personnel. NFPA 1620 (2003) further recommends that process of data collection should be expanded to involve fire protection engineers, sprinkler contractors, architects or engineers and insurance professionals. The author agrees that information collected from professionals working directly on a specific project is a

faster and more accurate way to collect this information than is now currently the practice in the BFD.

Factory Mutual System (1978) stated that cooperation between private property owners and local fire department personnel was a mutually beneficial strategy. FM Global (2007) continues to emphasis this same sentiment and strongly encourages private organizations to conduct on-site visits and share site-specific information with public agencies that will help mitigate fires and explosions at a facility. Godshall & Seasholtz (2009) suggest that business owners will gladly cooperate with fire personnel once the benefits of having a good pre-fire is explained to them. The author agrees with both FM Global and Godshall & Seasholtz. Private building owners and public fire agencies both benefit when they cooperate in the creation of an accurate pre-fire. The author found that this cooperation exists and that opening lines of communication was the key to establishing the critical exchange of information.

Questionnaire results of the field-test on a pre-fire, designed for the Bravern Tower 4 building, appear to suggest that the use of color is a very important feature on a pre-fire. Every respondent to the questionnaire reported that they liked the use of color in the pre-fire and that the use of color helped them to identify critical building components. Most respondents to the questionnaire reported that they felt “reasonably confident” that they could navigate the building with the pre-fire provided to them. Only six of the thirty respondents to the questionnaire reported that they were familiar with the Bravern Tower 4 building prior to the field test. The author concludes from these results that even without prior knowledge of the building, a pre-fire that uses graphics and color enables responding fire personnel a beneficial degree of confidence in finding their way around and unfamiliar building.

Recommendations

The BFD needs to adopt the following recommendations: 1) Begin the process of following NFPA 1620 and NFPA 170 guidelines in the creation of all BFD pre-fires; 2) Initiate better lines of communications between high-rise building managers, Bellevue Fire Prevention personnel and fire suppression personnel in the process the creation of pre-fires; 3) Create a pre-fire similar to the Bravern Tower 4 pre-fire for every high-rise in the City of Bellevue; 4) Discontinue the use of Canvas 8 for pre-fire design and replace with a drawing program more suitable for the creation of pre-fires.

The adoption of these recommendations will increase the efficiency of BFD high-rise pre-fires in two ways: 1) The assimilation of information for the creation of a high-rise pre-fire will be improved and 2) The completed pre-fires will be more accurate and useful to firefighters responding to high-rise incidents. These recommendations will have little impact on the BFD budget yet the benefits to the department will be great. The only "cost" associated with these recommendations is to purchase a drawing program that is more suitable for pre-fire drawing than is the Canvas8 program currently use. The BFD Pre-Fire Coordinator is currently working on a recommendation to initiate the change.

The guidelines recommended in NFPA 1620 and NFPA 170 give a wide latitude to create pre-fires that are useful and appropriate for any building. These guidelines are not restrictive and can be utilized immediately by BFD personnel. Additionally the use of these guidelines will help create a standardized pre-fire that can be utilized not only by BFD personnel, but also other fire departments who may find themselves responding to a high-rise emergency in Bellevue.

The author found the managers of private buildings to be very receptive to the idea of working with BFD fire personnel in the creation of high-rise pre-fires. Bellevue Fire Prevention

already work closely with building managers to ensure that all fire and building codes are followed. Having suppression personnel, who are creating the pre-fire they will be using to respond to these same buildings, involved in the process is a logical step and will insure a better end product.

The pre-fire created by the author for the Bravern Tower 4 building was well-received by those who answered a questionnaire. The use of color was mentioned by many as one of their favorite features of the pre-fire. Several respondents reported that the pre-fire was easy to read and understand. A few respondents reported that the plot view of the building was too small and that not enough detail was given of surrounding streets for incoming units.

By the end of 2010 the City of Bellevue will have 57 high-rise buildings built and occupied. It is imperative that the BFD enable responding fire personnel with a high-rise pre-fire that is easier to create and more accurate once in use. Having an improved high-rise pre-fire will benefit Bellevue firefighters, firefighters from outside departments responding on automatic or mutual aid and the public by reducing reflex time and improving firefighter confidence in our ability to respond safely and quickly to a high-rise incident.

References

BFD (April 3, 2007). *Standard Operating Procedure*. (Available from the Bellevue Fire Department, 450 110th Ave NE, Bellevue, WA 98004)

Bush, R., & Routley, J. G. (1996, April). *Special report: operational considerations for highrise firefighting*. Retrieved from: http://www.usfa.dhs.gov/downloads/pdf/publications/tr-082.pdf

City of Bellevue (2006). *City profile history*. Retrieved October 3, 2009, from http://www.ci.bellevue.wa.us/history/html

Clark, W. E. (1991). *Firefighting Principles and Practices* (2nd ed.). Saddle Brook, NJ: Fire Engineering Books and Videos.

Community Profile Network (2008). *Booming Bellevue*. Retrieved September 29, 2009, from http://www.villageprofile.com/washington/bellevue/04/topic.html

FM Global. (2007). *Pocket guide to prefire planning* (4th ed.) [Brochure]. Quincy, MA: Author.

Factory Mutual System. (1978). *Prefire Planning* [Brochure]. Norwood, MA: Author.

Finucane, M. J., & Price, B. (2002). Prefire Planning at Multibuilding Complexes [Online exclusive]. *Fire Engineering*. Retrieved June 30, 2009, from http://www.fireengineering.com/display_article/143718/25/none/none/LNEWS/PREFIRE-PLANNING-AT-MULTIBUILDING-COMPLEXES

Frank, D. (1996). *Terrific training materials high impact graphic designs for workbooks, handouts, instructor guides, & job aids* (1st ed.). Minneapolis, MN: Lakewood Publications.

Godshall, S., & Seasholtz, B. (2009, April). Site Drawings Aid in Fire Attack. *Fire Engineering*, *162*(4), 14-20.

Hudiburg, E., & McCoy, C. E. (Eds.). (1970). *Fire Department Facilities, Planning, and Procedures*. Stillwater, OK: International Fire Service Training Association.

Kroon, B. (2009, February). *Emergency Response to High Rise Fire Alarm Rooms: The First Five Minutes*. (Available from the National Fire Academy, Emmitsburg, MD)

Lakamp, T. C. (2007, June). *Examining Fire Department Response and Occupant Actions with High-rise Structures in Cincinnati, Ohio*. (Available from the National Fire Academy, Emmitsburg, MD)

Lockwood, R. (2004, April). Roadmap to Response. *Fire Rescue*, *22*(4), 80-87.

Major, B. (2008, December). *Improving Pre-Incident Planning for Fayetteville Fire Department*. (Available from the National Fire Academy, Emmitsburg, MD)

Massey, C. S. (2004, August). Pre-Planning: The Key to Success. *Firehouse*, 96-102.

McGrail, D. M. (2007). *Firefighting operations in high-rise and standpipe-equipped buildings*. Tulsa, OK: PennWell Corporation.

Murphy, J. J. (2009, January). Are You Preplanning Your Buildings? *Fire Engineering*, *162*(1), 85-92.

National Fire Academy. (2009). *Executive fire officer program applied research guidelines* [Brochure]. Emmitsburg, MD: Author.

National Fire Protection Association. (2003). *Recommended Practice for Pre-Incident Planning* (NFPA). Quincy, MA: NFPA.

National Fire Protection Association. (2009). *Standard for Fire Safety and Emergency Symbols* (NFPA). Quincy, MA: NFPA.

Norman, J. (2005). *Fire Officer's Handbook of Tactics* (3rd ed.). Tulsa, OK: PennWell Corporation.

Quiter, J. R. (2008). High-rise buildings: what should be done about them? [Online exclusive]. *Fire Protection Engineering*. Retrieved October 1, 2009, from http://www.fpemag.com/articles/article.asp?i=228

Rossett, A., & Gautier-Downes, J. (1991). *A handbook of job aids*. San Diego, CA: Pfeifer & Company.

Routley, J. G., & Anthony, D. F. (1988). *First Interstate Bank Fire Los Angles, California.* Retrieved from lafire.com: http://www.lafire.com/famous_fires/880504_1stInterstateFire/FEMA-TecReport/FEMA-report.htm

Shupe, J. (2006, December). Big-City Strategy and Tactics for Small-Town Fire Departments. *Fire Engineering*, *159*(12), 57-68.

Surveyer, J. (n.d.). *Canvas 8 the master illustrator program.* Retrieved October 1, 2009, from http://thephotofinishes.com/pf2dcanv8.html

Taylor, J. (2009). High-Rise Prefire Planning [Online exclusive]. *Fire Engineering*. Retrieved June 21, 2009, from http://www.fireengineering.com/display_article/354154/25/ONART/none/BRNIS/High-Rise-Prefire-Planning?dcmp=rss

Tempe Fire Department (2005). *Pre-Fire Planning*. Retrieved June 21, 2009, from

Terpak, M. A. (2002). *Fireground Size-Up*. Tulsa, OK: PennWell Corporation.

Appendix A

Fire Departments Receiving High-Rise Pre-Fire Survey

Burbank, CA*

Cincinnati, OH

Clark County, NV*

Denver, CO

El Segundo, CA*

FDNY*

Fresno, CA

Grand Rapids, MI*

Houston, TX*

Honolulu, HI*

Long Beach, CA*

Madison, WI*

Oakland, CA*

Pasadena, CA*

Philadelphia, PA*

Portland, OR*

Reno, NV

Salt Lake City, UT*

San Francisco, CA*

Seattle, WA*

Tacoma, WA

Torrance, CA*

Vancouver, BC*

Virginia Beach, VA*

Washington DC*

* denotes received completed survey

Appendix B

High-Rise Pre-Fire Survey

High-Rise Pre-fire Survey

Requested by: Bruce Kroon, Captain

Bellevue Fire Department

This survey is part of an Applied Research Project (ARP) for the Executive Fire Officer Program (EFOP) at the National Fire Academy (NFA). Your participation in this survey will help to make high-rise pre-fires in the Bellevue Fire Department, and hopefully elsewhere, a more useful tool for fire personnel.

For all questions, please circle the best answer. Some questions may require that you circle more than one answer. That's OK. If a question does not provide an appropriate answer for your department, please write in what you believe would best answer the question. If answering this survey via e-mail please mark your answer either in **bold** or underline.

1. How many high-rises does your city have?
   a. 20-50
   b. 51 – 100
   c. 101 or more

2. Does your department currently employ pre-fires for high-rise buildings?
   (If answer is "No", please skip to question 9)
   Yes
   No

3. If "Yes" to question #2, where are these pre-fires located?
   (check all that apply)
   a. Hard copy (paper) kept on responding apparatus
   b. Hard copy kept at alarm room of high-rise building
   c. Electronic copy (computer) kept on responding apparatus
   d. Other (please specify) _____

4. Does your department provide high-rise pre-fires to surrounding fire departments who respond into your jurisdiction on automatic or mutual aid?
   Yes
   No

5. Who is responsible for creating your high-rise pre-fires?
   a. Fire Prevention (Inspector/Investigator)
   b. Suppression (Firefighters/Line personnel)
   c. Other City Department (Building, Permits)
   d. Private contractor
   e. Other (please specify) _____

6. How is the information presented in your pre-fires? (What do they look like?)
   a. One page (8.5 x 11) single sided
   b. One page (8.5 x 11) double sided
   c. Electronic (computer based) only
   d. Other (please specify) _____

7. What type of information is included on your pre-fires?
   (check all that apply)
   e. Plot map of building included (overhead view)
   f. Cut-away map of building included (side view)
   g. Text only
   h. Graphics only
   i. Text and Graphics

8. How often are your high-rise pre-fires updated?
   a. Semi-annually
   b. Annually
   c. Other (please specify) _____
   d. Don't know

9. When responding to a high-rise alarm, what is your perceived usefulness of a high-rise prefire?
   a. Not at all useful
   b. Somewhat useful
   c. Very useful
   d. No opinion

10. Does your department follow NFPA 1620 (Recommended Practice for Pre-Incident Planning) or NFPA 170 (Standard for Fire Safety and Emergency Symbols)?
   a. Yes –NFPA 1620
   b. No – NFPA 1620
   c. Don't know if NFPA 1620 used
   d. Yes – NFPA 170
   e. No – NFPA 170
   f. Don't know if NFPA 170 used

11. Mark, in rank order, the pre-fire information you feel is the most useful to first responders.
(1 = most useful, 8 = least useful)

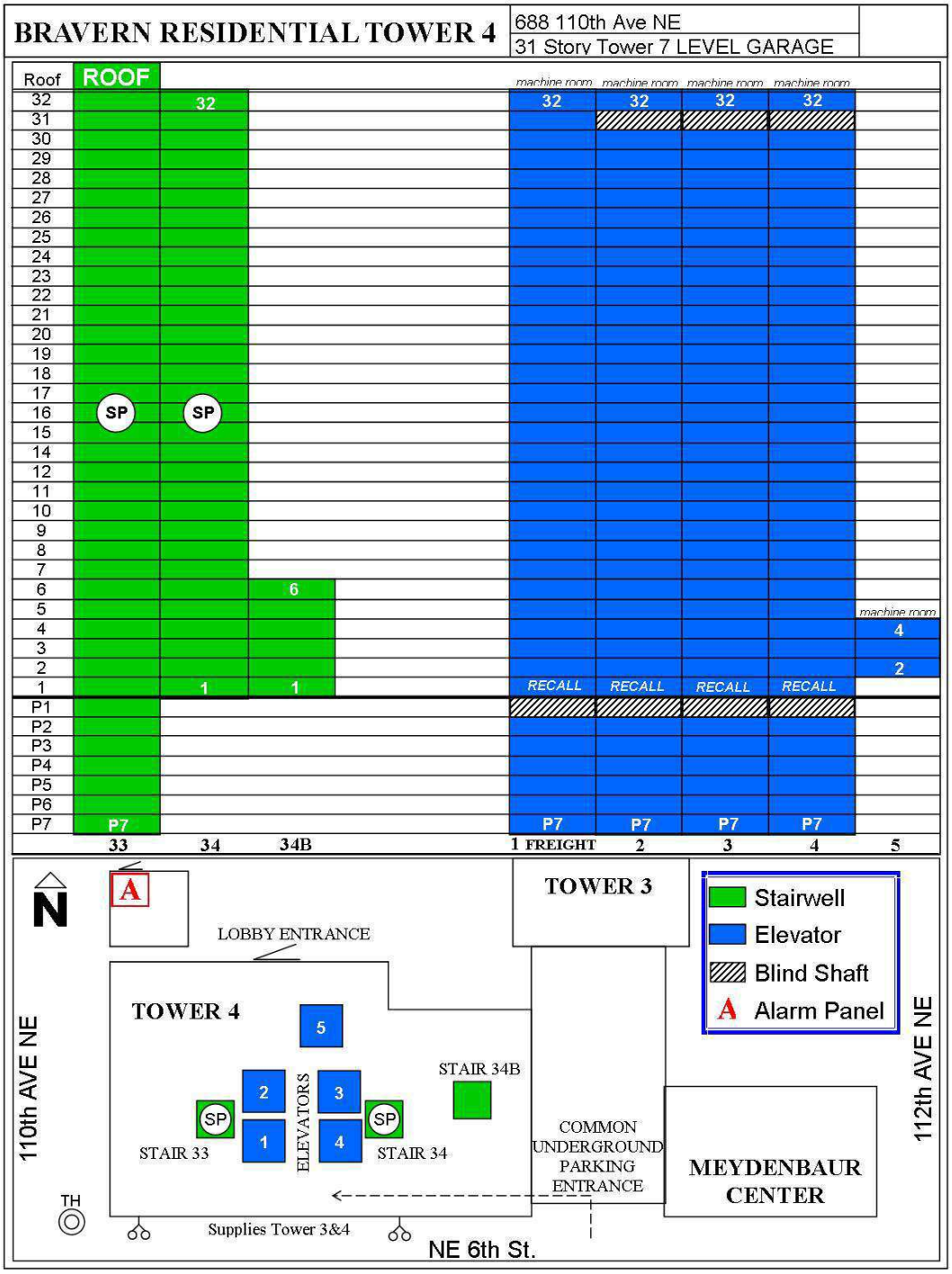
____ alarm room/fire control room
____ stairs
____ elevators
____ standpipes
____ sprinklers
____ fire pumps
____ building communications systems
____ other (please specify) _____

Please provide your name, department and contact information.
Name _____
Department _____
Contact phone or e-mail _____
It would be very helpful if you could send me an example of a current high-rise pre-fire for your city or jurisdiction in PDF format. If you prefer, you can mail a hard copy to: Bellevue Fire Department, 450 110th Ave NE, Bellevue, WA 98004, attn Captain Bruce Kroon, Station 7.
Thank you for your help in this survey! It is greatly appreciated.
Bruce Kroon

Appendix C

Bravern Tower 4 – Pre-Fire

(front side of pre-fire)



(back side of pre-fire)

BRAVERN RESIDENTIAL TOWER 4 - INFORMATION CARD

BUILDING INFORMATION:

Address: 688 110th Ave NE Bellevue, WA 98004
Bldg Name: Tower 4 - One Bravern Court
Total Stories: 33
Commercial Floors: L1 – L3.5
Residential/Hotel Floors: L4 – L32
Public Assembly Spaces: L1 – L4 (not inc. parking)

PARKING GABAGE:

Number of floors: 7
Level Designations: (Top to Bottom)
P1, P2, P3, P4, P5, P6, P7

STAIRWAYS:

Designation:	Floors Served:	Pressurized:	Standpipe:
33	P7 – L33	Yes	Yes
34	L1 – L32	Yes	Yes

Roof access from stairway(s):
Hatch No Door Stair 33 – 4-33S33

Stairway type:
Return (Y/N): YES Scissor (Y/N): NO

Access or Private stairs on floor(s) Levels 30 to 31

ELEVATORS:

Bank Designation:	Car #	Floors Served:	Machine Room:
West	1	P7-P5,P2-P1,L2,L4-32	L33
West	2	P7-P5,P2-P1,L2,L4-30, L32	L33
East	3	P7-P5,P2-P1,L2,L4-30, L32	L33
East	4	P7-P5,P2-P1,L2,L4-30, L32	L33
MRL	5	L2-L4	L5**

** Car #5 has machine in top of hoistway (no designated room), elevator controller is on L5.

FREIGHT ELEVATOR LOCATION: #1

RECALL FLOOR: Level 2
Alternate recall floor: Level 4

FIRE PROTECTION SYSTEMS:

FDC Location(s): 110th at Arrival Court, 110th and NE 6th, NE 6th at Garage entry
Non-sprinklered floors: None
Looped System (Y/N): No
PRV Floors: Every floor up to L23
PRV Outlet Pressure: Varies between 155 & 180 PSI
FD Pump System at: 315 psi, 319 psi, 323 psi
Fire Pump Location(s): P4 level P456 (SE corner)
Sectional Valve Location: Stair 34
Fuel Storage Tank (Y/N) and Floor: No
Water Reservoir System (Y/N) and location: Yes; Adjacent to pump room, P4 level, SE corner
How many gallons in system: 48,000 gallons
Special Suppression Systems: Level 4 East Commons Kitchen Type 1 Hood (Ansul)

COMMUNICATION SYSTEMS:

PA System (Y/N): Yes
Evacuation Plan – How many floors evacuate on alarm: 3 (Floor, Floor Above, Floor Below)
Firefighter Phones (Y/N): Yes
Leaky Coax (Y/N): Yes
Fire Alarm Room Location and Access:
FCC3 – 110th Autocourt, NW Corner of Tower 4

LOBBY CONTROL LOCATION:

Primary: P1 elevator lobby near Stair 34 enter off of NE 6th Parking Garage entrance

Secondary: Entrance to Tower 4 off of Autocourt at Lobby level

BASE LOCATIONS:

Primary: 110th between NE4th and NE6th

Secondary: 108th between NE4th and NE 8th

Appendix D

Bravern High-Rise Pre-Fire Questionnaire

Bravern Residential Tower 4 - High-Rise Pre-Fire Questionnaire

Please answer the following questions based on your experience and use of the pre-fire given to you today for the Bravern Tower 4 high-rise drill. Circle the choice that best fits your answer.

1. What department do you represent?
    a. Bellevue
    b. Other, please specify_____

2. Are you familiar with Bravern Tower 4?
    a. Yes
    b. No

3. Rate your confidence level if you were to respond to Tower 4 tonight, for an actual emergency, and had to navigate around Bravern Tower 4 with the use of the pre-fire given to you today.
    a. No confidence at all
    b. Some degree of confidence
    c. Reasonably confident
    d. Confident
    e. Very confident

4. Did you like the use of color in the pre-fire?

    a. Yes
    b. No

5. Did the use of colors in the pre-fire make it easier to identify critical building components such as stairs and elevators?

    a. Yes
    b. No

6. If you could change your department's high-rise pre-fire to any design you wished, would you:

    a. Keep the design and layout my department currently uses
    b. Switch to the design and layout of the pre-fire used today

7. What do you like most about the pre-fire you used today?

    _____

8. What do you least like about the pre-fire you used today?

    _____

Thank you for your help on this survey!

Bruce Kroon, Captain
Station 7, B Platoon
Bellevue Fire Department

Appendix E

High-Rise Survey Results

Question 1:
How many high-rises does your city have?

a. 20-50
b. 51 – 100
c. 101 or more

Department	Answer
Seattle	c
Houston	c
Honolulu	c
WA DC	c
Madison	a
Clark Co. NV	c
Philadelphia	c
Grand Rapids	a
El Segundo	a
Oakland	c
Pasadena	a
Long Beach	c
San Francisco	c
Burbank	a
FDNY	c
Torrance	a
Salt Lake City	b
Virginia Beach	b
Portland	c
Vancouver, BC	c
Austin	b

2. Does your department currently employ pre-fires for high-rise buildings?
(If answer is "No", please skip to question 9)
Yes

No

Department	Answer (1 = Yes, 0 = No)
Seattle	1
Houston	1
Honolulu	1
WA DC	1
Madison	0
Clark Co. NV	1
Philadelphia	1
Grand Rapids	1
El Segundo	1
Oakland	1
Pasadena	1
Long Beach	1
San Francisco	1
Burbank	1
FDNY	1
Torrance	1
Salt Lake City	1
Virginia Beach	1
Portland	1
Vancouver, BC	1
Austin	0

3. If "Yes" to question #2, where are these pre-fires located?
(check all that apply)
   a. Hard copy (paper) kept on responding apparatus
   b. Hard copy kept at alarm room of high-rise building
   c. Electronic copy (computer) kept on responding apparatus
   d. Other (please specify) _____

Department	Answer (1 = yes, 0 = no, blank = no answer)			
	a.	b.	c.	d.
Seattle	1	1	1	1
Houston	1	1	1	0
Honolulu	0	0	1	1
WA DC	0	0	0	0
Madison				
Clark Co. NV	0	0	1	0
Philadelphia	1	0	0	1
Grand Rapids	0	1	0	0
El Segundo	0	0	0	1
Oakland	1	0	0	0
Pasadena	1	1	0	0
Long Beach	1	1	0	0
San Francisco	1	1	0	0
Burbank	0	0	1	0
FDNY	0	0	0	1
Torrance	1	0	1	0
Salt Lake City	0	0	0	1
Virginia Beach	1	0	0	0
Portland	1	0	1	1
Vancouver, BC	1	0	0	1
Austin				

4. Does your department provide high-rise pre-fires to surrounding fire departments who respond into your jurisdiction on automatic or mutual aid?

Yes
No

Department	Answer	(1 = Yes, 0 = No, blank = no answer)
Seattle	0	
Houston	1	
Honolulu	0	
WA DC	0	
Madison		
Clark Co. NV	1	
Philadelphia	0	
Grand Rapids	0	
El Segundo	0	
Oakland	0	
Pasadena	0	
Long Beach	0	
San Francisco	0	
Burbank	1	
FDNY	0	
Torrance	0	
Salt Lake City	0	
Virginia Beach	0	
Portland	0	
Vancouver, BC	0	
Austin		

5. Who is responsible for creating your high-rise pre-fires?
   a. Fire Prevention (Inspector/Investigator)
   b. Suppression (Firefighters/Line personnel)
   c. Other City Department (Building, Permits)
   d. Private contractor
   e. Other (please specify) _____

Department	Answer	(blank = no answer)
Seattle	b	
Houston	b	
Honolulu	b	
WA DC	b	
Madison		
Clark Co. NV	b	
Philadelphia	b	
Grand Rapids	b	
El Segundo	b	
Oakland	b	
Pasadena	b	
Long Beach	b	
San Francisco	d	
Burbank	b	
FDNY	b	
Torrance	b	
Salt Lake City	b	
Virginia Beach	b	
Portland	b	
Vancouver, BC	d	
Austin		

6. How is the information presented in your pre-fires? (What do they look like?)
   a. One page (8.5 x 11) single sided
   b. One page (8.5 x 11) double sided
   c. Electronic (computer based) only
   d. Other (please specify) _____

Department	Answer	(blank = no answer)
Seattle	d	
Houston	d	
Honolulu	c	
WA DC	a	
Madison		
Clark Co. NV	c	
Philadelphia	b	
Grand Rapids	b	
El Segundo	d	
Oakland	a	
Pasadena	a	
Long Beach	b	
San Francisco	d	
Burbank	c	
FDNY		
Torrance	a	
Salt Lake City	c	
Virginia Beach	d	
Portland	d	
Vancouver, BC	a	
Austin		

7. What type of information is included on your pre-fires?
(check all that apply)
   a. Plot map of building included (overhead view)
   b. Cut-away map of building included (side view)
   c. Text only
   d. Graphics only
   e. Text and Graphics

Department	Answer	(1 = yes, 0 = no, blank = no answer)			
	a.	b.	c.	d.	e.
Seattle	1	1	0	0	1
Houston	0	0	0	0	1
Honolulu	1	0	0	0	1
WA DC	1	1	0	0	1
Madison					
Clark Co. NV	1	0	0	0	1
Philadelphia	1	0	0	0	1
Grand Rapids	1	0	0	0	1
El Segundo	1	0	1	0	0
Oakland	0	0	0	0	0
Pasadena	1	0	0	1	0
Long Beach	1	0	0	0	1
San Francisco	1	1	1	0	0
Burbank	0	0	1	0	0
FDNY					
Torrance	1	0	0	0	1
Salt Lake City	0	0	1	0	0
Virginia Beach	1	0	0	0	1
Portland	0	0	0	0	1
Vancouver, BC	1	1	0	0	1
Austin					

8. How often are your high-rise pre-fires updated?
   a. Semi-annually
   b. Annually
   c. Other (please specify) _____
   d. Don't know

Department	Answer	(blank = no answer)
Seattle	c	
Houston	d	
Honolulu	d	
WA DC	d	
Madison		
Clark Co. NV	d	
Philadelphia	c	
Grand Rapids	c	
El Segundo	b	
Oakland	c	
Pasadena	b	
Long Beach	b	
San Francisco	c	
Burbank	c	
FDNY		
Torrance	c	
Salt Lake City	b	
Virginia Beach	b	
Portland	c	
Vancouver, BC	c	
Austin		

9. When responding to a high-rise alarm, what is your perceived usefulness of a high-rise prefire?

a. Not at all useful

b. Somewhat useful

c. Very useful

d. No opinion

Department	Answer	(blank = no answer)
Seattle	c	
Houston		
Honolulu	b	
WA DC	c	
Madison	c	
Clark Co. NV	c	
Philadelphia	b	
Grand Rapids	b	
El Segundo	b	
Oakland	c	
Pasadena	c	
Long Beach	c	
San Francisco	c	
Burbank	c	
FDNY	c	
Torrance	c	
Salt Lake City	c	
Virginia Beach	c	
Portland	b	
Vancouver, BC	c	
Austin	c	

10. Does your department follow NFPA 1620 (Recommended Practice for Pre-Incident Planning) or NFPA 170 (Standard for Fire Safety and Emergency Symbols)?

A. 1. Yes –NFPA 1620

2. No – NFPA 1620

3. Don't know if NFPA 1620 used

B. 1. Yes – NFPA 170

2. No – NFPA 170

3. Don't know if NFPA 170 used

Department	Answer (blank = no answer)	
	A.	B.
Seattle	3	3
Houston	3	3
Honolulu	3	3
WA DC	1	2
Madison	2	2
Clark Co. NV	3	3
Philadelphia	3	3
Grand Rapids	3	3
El Segundo	3	3
Oakland	3	3
Pasadena	3	3
Long Beach	1	3
San Francisco	3	3
Burbank	3	3
FDNY	1	1
Torrance	1	1
Salt Lake City	3	3
Virginia Beach	1	3
Portland	3	3
Vancouver, BC	3	3
Austin	3	3

11. Mark, in rank order, the pre-fire information you feel is the most useful to first responders.
(1 = most useful, 8 = least useful)

____ alarm room/fire control room
____ stairs
____ elevators
____ standpipes
____ sprinklers
____ fire pumps
____ building communications systems
____ other (please specify) _____

Department Answer (blank = no answer)

	Alarm room	**Stairs**	**Elevators**	**Standpipes**	**Sprinklers**	**Fire Pumps**	**Building Communications**
Seattle	3			1	2		
Houston	1	4	3	5	6	7	2
Honolulu	5	4	3	1	2	7	6
WA DC	4	2	3	1	6	5	7
Madison	6	5	3	2	1	4	7
Clark Co. NV	1	5	4	2	3	7	6
Philadelphia	6	3	4	2	1	5	7
Grand Rapids	8	5	6	2	1	3	4
El Segundo	1	2	6	3	8	7	4
Oakland	1	4	5	3	2	7	6
Pasadena	1	2	7	3	4	5	6
Long Beach	1	3	4	2	5	7	6
San Francisco	4	1	3	2	5	6	7
Burbank	1	3	2	5	6	7	4
FDNY	7	4	5	2	1	3	6
Torrance	2	1	4	3	5	7	6
Salt Lake City	4	5	6	3	1	2	7
Virginia Beach	4	3	5	2	1	6	7
Portland	3	5	7	1	2	6	8
Vancouver, BC							
Austin	1	4	6	2	3	5	7

Appendix F

Pre-Fire Questionnaire Results

Respondent	Question #1	#2	#3	#4	#5	#6
1	1	1	d	1	1	0
2	1	0	c	1	1	
3	1	0	b	1	1	0
4	0	0	d	1	1	1
5	0	0	c	1	1	0
6	0	0	c	1	1	
7	0	0	c	1	1	0
8	0	0	c	1	1	0
9	0	1	d	1	1	
10	0	0	d	1	1	
11	0	1	c	1	1	
12	0	0	c	1	1	0
13	0	0	c	1	1	0
14	1	0	c	1	1	1
15	1	0	b	1	1	
16	1	0	c	1	1	
17	1	0	c	1	1	
18	1	0	b	1	1	
19	1	0	b	1	1	
20	1	0	b	1	1	1
21	1	0	c	1	1	0
22	1	0	c	1	1	0
23	1	1	d	1	1	0
24	1	0	c	1	1	0
25	1	0	c	1	1	0
26	1	0	d	1	1	0
27	1	1	c	1	1	1
28	1	0	c	1	1	1
29	1	1	c	1	1	
30	1	0	b	1	1	0

Respondent	Question #7	Question #8
1	split view, elevator detail	
2	visual aids	
3		
4	easy to read	
5	color and layout	mark stair/elevator with N, S, E, W
6		
7	easy to read	
8	simple, color	
9	easy to read, color	make numbers and labels stand out more
10	color	Meydenbauer Center font too big
11		
12		
13	color	
14	easy to understand	
15	back page info	
16	picture of stairs and elevators	put plot map on top of cut-away view
17	bottom half and back page	show more surrounding streets
18	colors	needs better legend
19	info good but more useful for engineer	bar graphs not necessary
20	easy to understand	
21	one page	
22	simple, color	too much emphasis on stairs and elevator
23	info easy to locate	"L" confusing should be "F" for floor
24	easy to read and identify areas	
25	easy to find stairs	map is small and simplified
26	not cluttered, great graphics	
27	color	show more surrounding streets
28		
29	stairwell marked well	small plot map.
30	colors and where stair and elevator go	better info on how to get to alarm room