ANALYZING THE FREQUENCY OF COMMERCIAL AND MULTI-FAMILY OCCUPANCY INSPECTIONS IN THE CITY OF BELLINGHAM

LEADING COMMUNITY RISK REDUCTION

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ABSTRACT

The Bellingham Fire Department had rejuvenated its commercial occupancy inspection program. The problem was the Bellingham Fire Department had no justification or rationale for the previously defined fire company life safety inspection intervals for the various inspected commercial and multi-family occupancy types. The purpose of this research project was to establish a new fire company life safety inspection interval for commercial and multi-family occupancies in the City of Bellingham.

The research questions addressed in this paper were; (a) what requirements and standards exist related to inspection frequency for commercial and multi-family residential occupancies? (b) what fire risk hazards and vulnerabilities exist in the City of Bellingham to justify changing existing inspection intervals? (c) what are the types and quantity of the various commercial and multi-family residential existing in the City of Bellingham? and, (d) what are the inspection intervals used by various Puget Sound area fire departments to ensure life safety code compliance?

Historical and action research methods were used to research this project. An extensive literature review, communications with federal and local officials, and a questionnaire of Puget Sound area fire departments were used to gather the needed information.

The results of this research identified that the department will be required to adopt the 2003 International Fire Code by July, 2004, and that the occupancy classification designations for many of the existing commercial occupancies will have to be changed to reflect the IFC occupancy classifications. The most significant of these changes affect the group A and B occupancy classifications. A risk analysis of the city identified that over 45% of the city's

occupancies are either maximum or high risk, and that the majority (64%) of the city's structure fires occur in single family and multi-family residential structures. An inventory of the city's commercial occupancies revealed that over 51% of the occupancies are group B and M, yet only account for 9% of the structure fire responses over the past five years. Twenty out of twenty four Washington State fire departments surveyed conduct fire inspections, with 70% of these departments using fire operations crews to conduct these inspections. The majority (75%) still conduct annual fire inspections for all occupancy types, yet 40% of the departments are not able to complete the inspections as scheduled.

The recommendations included evaluating and reassigning new occupancy classification types for each occupancy based on the 2003 IFC, continue inspecting multi-family residential occupancies on an annual basis, but shifting the focus to education rather than inspection, and reducing the frequency of inspections to other commercial occupancy types based on fire loss history and the sheer number of B and M group occupancies. Western Washington University should also be contacted to coordinate a focused inspection review effort to reduce their catastrophic fire loss.

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INTRODUCTION

The City of Bellingham Fire Department recently recognized the need to rejuvenate its commercial occupancy inspection program. In the spring of 2003, the Department implemented an aggressive commercial occupancy inspection program. This goals of this program are; (a) inspect all commercial occupancies, and (b) gather critical pre-incident building construction and hazard information for the Department's computerized records management system within a year. Accomplishing these aggressive goals is a challenge, and while committed to reestablishing a "baseline" inspection database, the department must find a balance between inspection workload distribution and scheduling enough time to perform other administrative assignments, training, and emergency response. Staggering inspection intervals is an obvious potential solution to reduce the current inspection workload.

The problem is the Bellingham Fire Department has no justification or rationale for the previously defined fire company life safety inspection intervals for the various inspected commercial and multi-family occupancy types. The purpose of this research project is to establish a new fire company life safety inspection interval for commercial and multi-family occupancies in the City of Bellingham.

The research questions addressed in this paper are: (a) what requirements and standards exist related to inspection frequency for commercial and multi-family residential occupancies? (b) what fire risk hazards and vulnerabilities exist in the City of Bellingham to justify changing existing inspection intervals? (c) what are the types and quantity of the various commercial and multi-family residential existing in the City of Bellingham? and, (d) what are the inspection

intervals used by various Puget Sound area fire departments to ensure life safety code compliance?

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BACKGROUND AND SIGNIFICANCE

Bellingham is located in Whatcom County in the far northwestern area of Washington State. It is nestled between the Cascade mountain range and the San Juan Islands, on the shores of Bellingham Bay. The 2000 census lists the city's population at 67,171 persons.

During its nearly 100 year history, the City of Bellingham has experienced countless numbers of structure fires, many of them during the 20 years that this author has worked for the Bellingham Fire Department. Perhaps the most devastating of these fires occurred on June 10, 1999, when a 16 inch underground petroleum pipeline ruptured, spilling approximately 230,000 gallons of gasoline into a pristine salmon stream and creek. The gasoline eventually ignited, devastating one and one half miles of undeveloped park land and killing three young residents. The damage from this disaster was measured in the millions of dollars, and compromised the city's water supply system for three months.

During the past twenty years, the Bellingham Fire Department has struggled to maintain an effective fire prevention division. In 1983, the fire department had an inspection bureau consisting of a fire marshal and two fire inspectors. The fire marshal at the time, Robert Neale, was an aggressive advocate for fire prevention, fire code enforcement, and fire investigation.

In the mid 1980's Mr. Neale understood that the two inspectors could not keep up with the ever increasing load of inspections. Under his tutelage the bureau implemented an aggressive commercial occupancy inspection program nicknamed "FOCUS"-Fire Company Occupancy Survey (FCOS). The basic concept of this program required that fire operations crews perform periodic commercial occupancy inspections on a semi-annual to multi-year basis. The goals of the program were to: (a) periodically examine every part of the community where fire problems may occur, (b) inspect on an assigned schedule specific occupancies identified as having life safety or fire protection challenges, (c) refer individuals with special fire related problems to the Life Safety Division for consultation, (d) provide information and education to modify public attitudes about fire safety, (e) identify specific target hazards in the community requiring a pre incident plan, (f) enhance the public image of the Fire Department, (g) establish a framework for fire companies to organize their daily work routine with an emphasis on tactical planning, training, safety and fire prevention, and (h) Enhance anti-arson efforts by increasing public awareness of the Fire Department. (Bellingham Fire Department, 1998)

All fire operations shift personnel were trained in basic inspection techniques, and Fire Marshal Neale created an innovative and comprehensive reference guide to assist company officers in conducting uniform and thorough inspections. The FCOS program was successfully implemented, and during the early years succeeded in closely monitoring commercial occupancies. Instrumental in the success of the FCOS program was the incorporation of a then radical concept known as "self-inspection" for small businesses with few fire/life safety hazards or concerns. Self-inspections relied on the honesty and altruism of local business owners, who completed their own inspection forms and mailed them into the fire department office.

In 1995, Mr. Neale resigned from the Bellingham Fire Department to assume a fire chief position in another municipality. After his exit, the FCOS program floundered without its champion, and the number of completed inspections slowly dwindled until there were virtually no company inspections being completed by operations personnel. During this same time period the fire inspectors were inundated by unprecedented growth in new building construction. This construction boom meant these inspectors spent the majority of their time in new construction plan reviews or construction inspections/confidence testing, and little time in existing occupancy inspections.

In 2001, the Fire Department invited representatives from the Washington State Department of Labor and Industries to conduct a safety survey of all Department facilities, procedures, and policies. They identified a significant deficiency regarding a lack of comprehensive and readily available pre-incident plans for the city's commercial occupancies. The Department had previously noted this deficiency and assigned a battalion chief to organize and oversee a rejuvenated pre-incident plan effort.

On February 20, 2003 West Warwick, Rhode Island suffered a tragedy as 100 nightclub patrons perished in a horrific fire at The Station nightclub, becoming the fourth worst nightclub disaster in North American history. (Kurkjian, 2003) The day after this event, the Bellingham Fire Department administration met to discuss the implications of this tragedy, and quickly decided to use this tragedy as an opportunity to motivate both businesses and firefighters to embrace occupancy inspections and gather critical pre-incident plan information.

As an initial step, engine companies and fire inspectors visited all Bellingham nightclubs and shared information about the West Warwick fire, provided important nightclub safety information, and inspected each premises for obvious life safety code violations, such as illegally blocked/locked exits, inadequate exit lighting, overcrowding, and flammable wall/ceiling

coverings. As more details of this event began to emerge, including allegations that recent fire inspections of The Station had missed significant fire code violations, the Department decided to take an aggressive approach to prevent a similar tragedy in Bellingham.

The Department's Life Safety Division conducted an inventory of existing commercial occupancies, which quickly confirmed that very few inspections had been conducted since 2000, and that the two year old computerized occupancy building construction information was woefully incomplete. The Division reorganized the known occupancies into inventory lists for each engine company by shift. Each engine company was assigned 80-100 occupancies to inspect and gather basic building construction information on a quarterly basis. At the time this paper was written, over one half of these inspections were assigned, and approximately 80 percent of these inspections were completed, resulting in significant gains in gathering comprehensive building construction and pre-incident plan information, along with identifying and correcting a host of different fire code violations.

As a large amount of completed inspections and pre-plan information began to arrive at the Fire Department office, it became apparent that a staggered inspection schedule needed to be developed to maximize the efficiency and efforts of the engine companies.

This research project directly applies to the National Fire Academy's Leading Community Risk Reduction Course (2003) Chapter Two components that address the need to assess community risks and identify applicable risk reduction objectives to reduce these identified risks. "Community risk assessment improves fire service quality since fire service decisions focus on community risk priorities that are properly analyzed rather than emotionally charged" (p. 2-58).

LITERATURE REVIEW

The purpose of this literature review is to briefly explore the historical and current perspective of fire prevention efforts. It will also identify challenges and successes in fire prevention efforts specific to fire inspections, with the goal in identifying potential ideas and solutions germane to administering a fire prevention program with limited resources.

Historical perspective

The history of fire prevention efforts in the United States is well documented, and for the sake of brevity this author will refrain from going into great detail. However, a key historical concept of national fire prevention efforts deserves mention. Landmark fire and life safety code adoption and changes were a reaction to significant fire events that resulted in a large loss of life, dollar loss, or a combination of both. An example of this reactive approach can be found by evaluating the public assembly/theatre life safety codes adopted after the Iroquois Theatre fire in Chicago in 1903. (Compton and Granito, 2002)

The latest comprehensive review of the status of the fire problem in the United States is called America Burning, recommissioned. This report, created by the National Commission on Fire Prevention and Control (NCFPC) in late 1999, revisited America's fire problem since the first America Burning report written in 1973. The original 1973 report identified a severe fire problem in America that has continued unabated for the past 30 years. (NCFPC, 2000) After soliciting input from a wide range of experts and interested parties, the America Burning Commission reached two major conclusions: (a) America has not applied and adequately funded effective loss reduction strategies, and (b) the mission of the nation's fire service has expanded well beyond the boundaries of simple fire protection. (NCFPC, 2000) The Commission

recognizes that local fire agencies are the first responders to almost all community hazards, yet clearly noted that it takes broad-based community support to improve their effectiveness:

> A reasonably disaster-resistant America will not be achieved until there is greater acknowledgement of the importance of the fire service and a willingness at all levels of government to adequately fund the needs and responsibilities of the fire service(p.1).

A cursory review of the 2001United States fire loss statistics show that the nation continues to suffer property loss, income loss, injury, and deaths at a significant rate. In fact, the United States and Canada are still among the worst of all industrialized nations at controlling fire losses. (Crawford, 2002) The National Fire Protection Association (NFPA) fire loss statistics for 2001 show that a fire was reported every 15 seconds, firefighters responded to 521,500 structure fires, and 6196 civilians were killed (although 2451 of these fatalities resulted from the 9/11 terrorist attacks). (NFPA, 2002). In 2002, 97 firefighters died on duty and 41,395 were injured on the fireground. (NFPA, 2002)

In looking at the local perspective of where these fires occur, the overwhelming majority occur in the home and garage, which also corresponds with the highest location of fire deaths in a community. (Hall and Cote, 2003) In 2001, the NFPA (2001) reported that 83 percent of the fire deaths occurred in the home. Of these, the fire death rates are highest for pre-school children and older citizens. Preschool children have a death rate more than twice the fire death rate for the rest of the population as a whole. (Hall and Cote, 2003).

However, when you look at the long-term view of injury and deaths resulting from fires, there is a consistent downward trend since the mid-1990's where fatalities dropped by almost one third, and over 70 percent since 1927. (Hall and Cote, 2003) In fact, in 2001 the home fire death rate dropped nine percent from 2000, the second lowest home fire death total since the

NFPA began collecting fire statistics with a new survey methodology in 1977. (Hall and Cote, 2003)

Current prevention climate

On a national level, fire prevention remains a relatively minor consideration compared to the other aspects of fire protection, like fire suppression. Crawford (2002) notes that a possible reason for this misguided emphasis lies in our society's cultural reliance on technology as a way to control nature by stating: "This belief in technology, combined with a consumer culture that uses materials and discards them, creates an apathy in our populations that relegates prevention to a lower priority." (p. 3) Barr and Eversole (2003) also noted that the fire service needs to shift its focus to a more proactive approach to fire protection.

> There is still a lot of work to be done to lower the number of annual fire fatalities. We remain suppression-oriented-a reactive mode-but must do all we can to move forward toward a more pro-active mode and prevent fires from occurring (p. 1042).

Unbelievably, there are some within the fire service who feel threatened by this approach, feeling that their careers and identity are in jeopardy by shifting focus from suppression to prevention. (Coleman, 1999)

Hall and Cote (2003) note that as a society we live in denial and apathy about fire risk. "Many people tend to believe that fire 'only happens to the other guy', and that view ironically is strongest in populations with above-average fire risk" (p. 2-24). Both Asia and European cultures have a healthier and more realistic respect for fire, resulting in much more emphasis being placed on prevention efforts. (Crawford, 2002)

The challenge of inspections

Many of the articles this author reviewed revealed about the changing role of the fire service in a climate of dwindling public funding, increasing public expectations, expansion of services into non-traditional roles, and an increased regulatory environment. All of these influence a department's ability to focus on prevention efforts, and raise significant challenges to implementing effective prevention programs. David Ott (2001) in a National Fire Academy applied research paper that analyzed the Imperial Beach, California Fire Department inspection program, noted these challenges, stating:

> In an effort to justify its worth to its customers, fire departments have increasingly accepted more responsibilities for a diverse range of services, often without a corresponding increase in staffing levels to offset the increased work load…..These increased responsibilities and services being provided by the fire service have increased training requirements for fire service personnel…It can be anticipated that increasingly in the future, more time will need to be allocated to meet training requirements and mandates that are driven in part by technology changes and higher customer service expectations and needs (p. 5).

As previously identified, most fires and fire deaths occur in the home and or garage. However, the 1997 edition of the Uniform Fire Code specifically excludes one and two family homes from inspection requirements. Not surprisingly for the reasons previously noted, in a recent survey of the nation's fire service, an estimated 20.9 million people-seven percent of the population live in communities where no one conducts fire code inspections at all. (FEMA 2002)

Now that we have identified the challenges in the broad fire prevention perspective, let us turn our attention to the specific challenges related to fire inspections. In a time of tight budgets and increased public expectations for emergency services and the government services in

general, it is imperative that we examine the efficiency and effectiveness of current fire prevention and inspection methodologies. This author found surprisingly little research specific to the effectiveness of current fire inspection programs, especially as it relates to defining a justifiable inspection frequency program. This deficiency was also noted by Crawford (2002), who noted that the frequency of inspections is based mostly on the resources available for the task. Furthermore he noted that this approach, while understandable, does not adequately address the problem, stating:

> Generally speaking, inspections that occur more frequently would yield a safe community. If nothing else, a local jurisdiction would be able to document the number of hazards noted and abated through the inspection process. However, no definitive studies have outlines what inspection frequency is best. One study, performed by the National Fire Protection Association did identify a relationship between inspection frequency and the number of fires. It did not conclude a specific time frame that should be applied for all jurisdiction and property types (p. 56).

The study referred to above was conducted by the National Fire Protection Association and the Urban Institute in 1977-1978. The purpose of the study was to determine if some fire code inspection practices worked better than others in reducing fire loss and casualties. (Hall, 1979) It evaluated properties, excluding single and two family dwellings, in eleven metropolitan cities. The study concluded that in the eleven cities surveyed, those cities with annual fire inspection programs had a lower occurrence of fires than those communities without an annual inspection program. It also noted that those inspection programs that used firefighters to conduct inspections instead of relying on exclusive use of fire inspectors had a lower fire rate as well. (Hall, 1979)

Ott (2001) noted the importance of periodically evaluating an inspection program to define its effectiveness and efficiency, stating: "Quite often, either due to budget constraints or simply a lack of awareness of the importance of such inspection programs, these programs are not given the attention or resources they need to be effective" (p. 10). Diamantes (2003) alluded to the pressing need to evaluate need and tailor fire code inspection services to each unique community and available resources when he stated:

> Inspecting every premises and occupancy on a regular basis is fine if you are employed by a small enough jurisdiction, or one that has the staffing to carry out that many *quality* inspections. But how often is enough? Who needs to be inspected first? (p. 19)

Coleman (1999) takes a different approach in calling for an empirical evaluation of fire prevention efforts as he challenged the fire service to evaluate its current inefficient and sometimes ineffective fire inspection practices. He called on the fire service to look at the actual fire statistics for a given community, stating that the fire loss statistics will be limited to a relatively limited number of fires. He noted:

> Many fire prevention bureaus devote a considerable amount of their time to looking at everything without regard to consequence. Subsequently, they never get around to looking at the things that are really important before they become critical….In short, fire prevention bureaus ought to look at their inspection frequency and focus their efforts (p. 29).

Diamante (2003) indirectly agrees with this approach by stating that inspection frequencies and priorities must be determined by the local jurisdiction's needs and available resources.

Crawford (2002) stressed the importance of applying uniformity in code enforcement, and the need to develop a justifiable inspection program that results in systematic and regular fire safety inspections. He suggests first looking at the statistical fire problem in the community coupled with a list of potential problem occupancies where the risk of death or community loss is great.

The effectiveness of company inspections

As noted earlier, the Bellingham Fire Department's FCOS program relies on engine company crews to perform the majority of the commercial occupancy fire inspections. Due to recent efforts to resurrect this program, each engine company is required to perform a certain number of inspections each quarter. Donner (1997) cautioned against this approach, stating that departments that rely on engine company inspections found that these engine companies picked their inspections based on ease of the inspection occupancy rather than the importance. He noted: "When a company chooses to inspect the local convenience store rather than the nursing home, this is usually in response to an inspection quota based on a specific number of inspections. A demanding workload influences the choice" (p. 100).

In the search for research related to effective fire inspection frequency, this author was frustrated to only find three specific written works addressing inspection intervals. In 1992, District Chief Vicki Phillips (1992) of the Palm Beach, Florida Fire Rescue Department evaluated her department's inspection schedule by comparing fire loss data from the previous three years against the inspections conducted to determine the effectiveness of the inspection schedule. Her findings concluded: (a) single family homes continue to suffer the greatest fire loss, and (b) the store/office property use category should move from a 24 month cycle to a 12 month cycle. (Phillips, 1992) In looking at the series of articles cited previously, her methodology of evaluating Palm Beach County fire loss against the inspection program was

sound, and worthy of much more exploration and effort than has apparently been expended since the research was conducted.

Boulder, Colorado Fire Department took an innovative approach to managing fire inspections in the early 1990's, as a result of an overwhelming increase in the number of fire inspections needing to be accomplished and the inefficiencies of the inspections that were being conducted. (Donner, 1997) He noted that with their old system of inspection assignments, company officers either; (a) ran out of time, (b) intentionally neglected complex inspections, or (c) performed sloppy inspections to meet a quota.

To address these deficiencies, the Boulder Fire Department convened a team of department personnel to develop a system for prioritizing inspections. The product of this effort is a life safety hazard assessment system that ensures uniformity, and maximizes effort towards those occupancies deemed to be most hazardous. The factors used to calculate the life safety hazards included; (a) property use, (b) occupancy load, (c) ease of escape for occupants, (d) ease of access for fire crews, and (d) built-in fire protection features in the building. (Donner, 1997) The results of this reorganization effort moved over 40% of the total fire company inspections to a two or three year inspection cycle, and of those inspections completed the business owners were happier because the engine companies had time to spend with them explaining the inspection results. (Donner, 1997) In reviewing the Boulder program, this author noted that while it does a good job at identifying the physical features of a structure and occupancy group, it does not appear to take into account their local fire loss history, or address how compliance violations are incorporated into the building assessment.

The third research project addressing the effectiveness and efficiency of inspections was conducted by Jerry Thorson (2000), of the Federal Way, Washington Fire Department. Thorson took a comprehensive look at the inspection performance of his department, and concluded that they did not have the time or resources to complete inspections as previously scheduled. He initiated a variable inspection program allowing select business owners in Group B and M occupancies to complete self-inspections on an every other year basis, augmented by engine company inspections on the offsetting years, significantly decreasing the inspection workload on the engine companies.

The Bellingham Fire Company Occupancy Survey Program

As previously noted, the Bellingham fire department recently rejuvenated its fire inspection program, with a goal of inspecting all known commercial occupancies within a year. The guiding document for the FCOS program identified occupancy groups that were segmented differently than the Uniform Fire Code (UFC) occupancy codes, and established a corresponding inspection frequency. These groups and inspection frequencies were initially created by using a subjective, non-scientific, approach of perceived risk and fire protection issues related to public and firefighter safety. R. Neale (personal communication, September 15, 2003) See Appendix C for a full listing of the FCOS occupancy types and inspection frequency.

In practice, this inspection schedule was never fully implemented. Firefighters found the inspection frequency schedule confusing, and difficult to administer. Within a few years after implementation, most group B occupancies were allowed to perform self inspections because of the increased work load on fire operations crews. R. Neale (personal communication, September 15, 2003) This program also failed, as most business owners failed to return the completed inspections, resulting in the engine companies completing a follow up inspection.

Literature Review Summary

In summary, the fire service has done an excellent job of identifying the fire problem within the United States, yet has met limited to no success in changing the nation's culture or perception of fire risk. In order to be effective, fire departments and communities must quit viewing fire prevention efforts as a necessary evil of the fire service. In tight economic times, fire prevention bureaus are one of the first places government leaders look to reduce to preserve the more popular, but inefficient from a loss prevention standpoint, fire suppression resources. The City of Bellingham is no exception to this approach, and has proposed reductions to its Life Safety Division in response to mayoral mandate.

PROCEDURE

Definition of Terms

Demand zones Geographical zones dividing the City of Bellingham into square mile sections. These sections are then categorized as having a Maximum, High, Moderate, or remote hazard depending on the probability and consequence of an identified hazard found within the zone.

Fire Company Occupancy Survey (FCOS) The Bellingham Fire Department's fire inspection program outline, developed in the mid 1980's, which depends on fire operations personnel to conduct fire inspections and pre-incident planning in commercial occupancies.

Fire RMS A computerized records management system used by the fire department to document training, emergency responses, inspections, pre-incident plans, and daily shift staffing.

International Fire Code (IFC) A life safety code created and published by the International Code Council. The purpose of the code is to ensure fire resistive and safe building construction practices related to fire protection. It also specifies approved fire prevention activities and fire protection systems and practices. In July 2004, the State of Washington will be adopting this code by reference.

National Fire Protection Association (NFPA) A non-profit organization comprised of members committed to reducing loss of life, property, and the environment from fire by supporting and conducting fire safety research and public education.

Occupancy classification An assigned building type as defined by the local Building Official. The assigned type is based on the use of the occupancy, and falls into one of the following Groups:

Group A – Assembly	Group B- Business	Group E – Educational
Group F- Factory	Group H – Hazardous	Group I – Institutional
Group M – Mercantile	Group R – Residential	Group S – Storage
Group U - Utility		

Uniform Building Code (UBC) A building code created and published by the International Conference of Building Officials. The purpose of the code is to ensure safe and uniform building construction practices. This code is adopted, with some amendments, by the State of Washington, and the City of Bellingham.

Revised Code of Washington (RCW) The Revised Code of Washington (RCW) is the entirety of all Washington State laws currently in force.

Uniform Fire Code (UFC) A life safety code created and published by the International Fire Code Institute. The purpose of the code is to ensure fire resistive and safe building construction practices related to fire protection. It also specifies approved fire prevention activities and fire

protection systems and practices. In July 2004, the State of Washington will replace, by reference, the 1997 edition of this code with the 2003 IFC.

Washington Administrative Code (WAC) Washington State administrative rules and regulations that interpret a law or policy of a state agency. The WAC has the force of state law.

Washington Survey and Rating Bureau (WSRB) An independent property insurance rating bureau for Washington State. It assesses fire protection practices throughout the state, and provides assessment information to insurance companies to set appropriate fire insurance rates.

Western Washington University (WWU) A four year state funded institution of higher education located in the City of Bellingham. It is comprised of 73 buildings located on a 215 acre campus. It has a population of 12,000 students and 615 faculty.

The procedures used in this research project included a comprehensive literature review conducted at the National Fire Academy Learning Resource Center in Emmitsburg, Maryland in July 2003, and a review of existing Bellingham Fire Department FCOS documents. Mr. Robert Neale was contacted to establish the FCOS history and rationale behind the current inspection frequency.

To identify the fire risk hazards and vulnerabilities within the City of Bellingham, the fire department's Life Safety Division conducted a hazard risk and vulnerability analysis. This analysis weighed two key factors: (a) probability, and (b) consequence. This effort began just before this applied research project, yet the evolution of this assessment and data collection was significantly influenced and directed by the data needs for this applied research project. The Life Safety Division performed a risk analysis, which included examination of the city's emergency incident experience for the past five years, the types and locations of the various commercial occupancies, the density of these occupancies and associated community value, and the perceived hazard risks throughout the city.

The perceived hazards were grouped into five categories: (a) maximum hazard – high probability and high consequence, (b) high hazard – low probability and high consequence, (c) moderate hazard – high probability and low consequence, (d) remote hazard – low probability and low consequence, and (e) special hazards – Isolated maximum risk structures, interstate highways and railroad lines.

A map grid coordinate system is used by the fire department to identify every address in the city for emergency routing purposes. The city is divided up into 41-one square mile blocks that have a portion of the city limits contained within. These blocks, called "demand zones", were used as the template to assign the city risk areas.

Fire RMS computer records and Planning Department demographic records were scrutinized to determine; (a) the frequency and type of emergency events in each demand zone, and (b) the relative dollar and community value of the structures in each demand zone. A Crystal Reports database query was developed to inventory all commercial occupancies residing on the department's computerized database. The initial report generated a list of 200 occupancies without an assigned occupancy code type. The Life Safety Division reviewed the computer file of each of these occupancies to help determine the occupancy code type. All but two of these files were updated with the correct occupancy type, and the report was run again.

A draft questionnaire tool was developed and sent to the Leading Community Risk Reduction class of July, 2003 for review and input about the functionality of the questionnaire. Comments and suggested changes were incorporated into the questionnaire instrument prior to distribution.

The questionnaire was sent to 25 suburban and urban Washington State fire agencies. Before sending the questionnaire, the fire chief of each department received an introductory email to introduce the project and identify the contact person responsible for completing the questionnaire. This contact opportunity was also used to gather additional information related to current fire inspection/confidence test forms from each of these departments for another project underway in the Life Safety Division. Approximately three weeks after the questionnaire was distributed, a follow up email was sent to those who had not already returned the questionnaire, asking once again for their information.

Once the questionnaires were returned and all of the information analyzed, the Life Safety Division met with this author to review all of the information and reach consensus on a revised inspection frequency schedule for commercial occupancies for 2004.

This research paper was written using the fourth Edition of the American Psychological Association Publication Manual as the guiding document.

ASSUMPTIONS AND LIMITATIONS

An assumption was made that each of the respondents to the questionnaire understood each question and answered truthfully. This author was limited by lack of research or articles specific to the frequency of fire inspections. Further limitations were discovered as several of the fire agencies in the south Puget Sound region relied on their county fire marshal to perform fire code inspections, limiting the amount of fire department applicable information and ideas. Lastly, 2002 upgrade changes to our Fire RMS records management system made it difficult to retrieve detailed dollar loss information before 2002. In fact, we were unable to retrieve most of the dollar fire loss information from year 2000.

RESULTS

Research Question One

This author identified codes and standards on the national, state, and local level that influence and guide local fire prevention efforts.

1997 UFC.

The 1997 UFC is one of two principle documents currently used to address fire and life safety code issues throughout the nation. This document, specifically Section 103.3.1.1, defines the authority of fire departments to inspect commercial occupancies. It states;

> The Fire Prevention Bureau shall inspect, as often as necessary, buildings and premises, including such other special hazards or appliances designated by the chief for the purpose of ascertaining and causing to be corrected any conditions which would reasonably tend to cause fire or contribute to its spread, or any violation of the purpose or provisions of this code and of any law or standard affecting fire safety (p. 1-2).

2003 IFC.

The other principle document guiding fire and life safety code issues is the 2003 IFC. There appears to be no language in this code that affects the current delegation of authority or administration of an inspection program at the local level. However it defines the various occupancy classifications differently than the 1997 UFC, placing more emphasis on the type of occupancy and less emphasis on the different occupant loads as defined in the UFC. For example, the 1997 UFC defines an A-2 occupancy as; " a building or portion of a building having an assembly room with an occupant load of 300 or more without a legitimate stage"… (p. I-349). The 2003 IFC defines an A-2 occupancy as; " Assembly uses intended for food and/or drink consumption including, but not limited to: Banquet halls, night clubs, Restaurants, taverns,

and bars"(p. 17). This reclassification effectively moves a large portion of currently defined Group B occupancies to the A-2 category under the IFC definitions.

There are other significant changes to other group occupancy classifications, as a result of the clear definitions of the various types of occupancy uses for each occupancy classification. For example, the IFC defines 17 different uses for an A-3 assembly occupancy, including bowling alleys, churches, courtrooms, and libraries.

Washington State Law.

A comprehensive review of the RCW and the WAC reveal that the emphasis and regulation of fire inspections is left primarily to the discretion of local government. The Chief of the Washington State Patrol oversees the State Fire Marshal, which is the principle fire protection agency of Washington State. RCW 48.48.040 authorizes the State Fire Marshal or designee access into all premises, except for private dwellings for the purposes of inspection for fire hazards and enforcement of applicable laws and standards.

WAC 212-02-010 (1977) defines the general authority, duties, and goals of the State Fire Marshal's office. While initially created to provide strong oversight, its role has changed over the years as stated in Subsection five:

> Additional statutes authorize the fire marshal to establish standards for the prevention of fire and the protection of life and property against fire and panic, govern the use of premises, and conduct inspections to assure conformance to the standards. Subsequent legislative expressly requiring that these functions be performed by local governmental municipalities has resulted in a change in the role of the fire marshal's office from a regulatory function to a supportive function.

WAC 51.44.003 (1998) adopted the 1997 UFC as the principle document for fire prevention and enforcement issues related to the State Building Code. All cities and counties are currently required to use the 1997 UFC as their guiding document. However, the state recently informed all municipalities of its intent to adopt the 2003 edition of the International Fire Code and Building Code as the standard for fire protection requirements, effective July 1, 2004. Once the state formally adopts the IFC, the City of Bellingham must adopt it as soon as possible to comply with state law.

The authorizing WAC 51.44.0200 (2001) includes amendment exceptions to the IFC that alter the institutional and residential group occupancy type as defined in the IFC.

Local regulation.

The City of Bellingham Municipal Code is the legal instrument regulating fire protection and life safety regulations, codes, and standards within the city. Title 17-Building and Construction sets the acceptable parameters for all building construction. (City of Bellingham, 2001) Title 17.20 specifically addresses the adoption by reference of the 1997 Edition UFC with year 2000 state amendments, as well as specific local amendments per local ordinance. (City of Bellingham, 2001) None of these local ordinances specifically address fire inspections beyond inspections for new construction and/or installation of fixed fire protection systems.

The City has adopted, by administrative policy, a set of development standards that identify local rules that alter the UFC to suit local needs. Examples of these standards include; (a) defining the diameter of cul-de-sacs for fire department access, (b) defining the type of construction and width of fire access routes, and (c) application of fixed fire protection systems in all storage buildings over 12,000 square feet with combustible high piled storage. (City of Bellingham Fire Protection Development Standard, 2001)

Additional influences.

The Washington Survey and Rating Bureau (WSRB) is a private agency used by insurance companies in Washington State to assess the capabilities of a jurisdiction's fire protection capabilities. The WSRB rates fire agencies on a class scale from one to ten. Class one denotes the highest possible fire protection rating, and class ten is the worst. Most insurance companies in the state use these ratings to determine the cost of fire insurance rates for customers located within the response area of the particular fire department.

In order for a fire department to receive full credit for any fire inspection program, a five year inspection record is required. Anything less is pro-rated. (Washington Survey and Rating Bureau, 2002)

Research Question Two

In 2002, the fire department responded to 347 reported fires. Of these, 50 (14%) were fires that occurred in structures. Table 1 shows the top three types of structure involved in these fires.

Table 1

Type of structure	Number of fires	Percentage of total
Single family home	22	44%
Multi-family residence	10	20%
Commercial occupancy	9	18%

A review of the past five years of Bellingham fire loss show that the top three types of structure fires occurred in; (a) Single family residence (55%), (b) Multi-family residence (21%), and (c) Commercial occupancies (9%).

The results of this assessment – specific to fire hazard- determined that there are; (a) five maximum risk demand zones (16%), (b) nine high risk demand zones (29%), (c) 13 moderate risk demand zones (42%), and (d) four remote risk demand zones (13%). Additionally, we identified four special risk hazard areas: (a) Whatcom Creek (a unique urban wilderness type setting with extremely fragile ecological considerations), (b) the Burlington Northern-Santa Fe Railroad, (c) the city's water treatment plan, and (d) Interstate Five, which bisects the city.

The maximum risk zones are predominately clustered in our downtown core area, which has the highest population and building density in the city.

Research Question Three

A total of 2911 commercial occupancies were identified within the city limits. The top three occupancy types found in the city are; (a) 1304 (44%) group B occupancies (office, professional, eating and drinking establishments with an occupancy less than 50 persons), (b) 804 (28%) group R1 occupancies (Hotels and apartment houses, and congregate residences that each accommodate more than 10 persons), and (c) 200 (7%) group M occupancies (Building or structure use for display/sale of merchandise, and involving stocks of goods, wares, and merchandise). See Appendix A for a complete building inventory listing.

Research Question Four

Twenty-one out of 25 questionnaires were returned, a return rate of 84%. Twenty departments indicated they conduct commercial occupancy fire inspections, and two departments stated they do not perform inspections. Of those two departments, both stated they rely on their county's fire marshal office for this service, and only one of the two completed the first part of the questionnaire. Table 2 shows a breakdown of the first substantive questionnaire responses from the participating departments. Questions one through four were basic contact information questions.

Table 2

What criteria, methodology, and/or approach did your agency use to establish the inspection frequency(s)? Check ALL that apply.

Number of responses	Response choice
13	State law and/or local municipal code
10	Presence of fire protection systems that must be confidence tested
9	Hazard/Risk assessment for each type of occupancy and/or response area
8	Other (explain below)
6	Common practice of other local departments
4	Fire loss history of your community

Table 2 shows that 65% departments indicated they used state law or local municipal code as criteria to establishing inspection frequency, and only 45% used some sort of hazard risk assessment.

Of the 20 departments that perform inspections, eight stated they are not completing their inspections within their defined inspection interval period, a failure rate of 40%. All eight departments stated that a reason for failing to meet their inspection goals was lack of staff/resources.

Fourteen of the 20 departments (70%) use fire operations personnel to perform inspections. Table 3 shows the breakdown of occupancies inspected by engine company personnel and those inspected by fire prevention personnel.

Table 3

Question 9: If you marked yes on Question 8, please completed the following chart to indicate what types of occupancies these crews inspect.

Occupancy type	Inspected by engine crews	Inspected by prevention personnel
B	14	7
M	13	5
R-1/3	12	5
F-2	11	6
S-1	10	7
A-1/3	8	8
F-1	8	6
E-1/3	7	9

I-1/3	7	9
U1	6	4

The last question asked a department to indicate how often they schedule inspections for the various occupancy categories in their jurisdiction. The majority of the departments perform annual inspections of most occupancy categories. Table 4 shows the breakdown of the frequency of inspections by occupancy type.

Table 4

Question 10: Please indicate the frequency of inspection for each type of commercial occupancy.

Occupancy type	Annual	2 years	3 years	4 years	Other
S-1/5	16	1	1		
E-1/3	16	1	1		
A-1/3	15	1	1		
F-1	15	1	1		
I-1/3	15	1	1		
M	13	2	2		
R-1/3	13	2	1		
F-2	13	2	1		
B	12	3	2		
H-1/3	11		1		
U1	8	1	1		

Only 5 of the 20 departments (25%) depart from the annual inspection schedule for the different occupancy categories, with 1 department conducting all of its commercial occupancy inspections on a three year cycle.

DISCUSSION

Research Question One

Adoption of the 2003 IFC will have a significant impact on both the Life Safety Division of the Fire Department and the Building Services Division of the Planning Department. Specific to the Fire Department, all of the Fire Protection Development Standards will have to be reviewed and modified as necessary to incorporate the 2003 IFC.

In reviewing the 2003 IFC, and proposed WAC amendments to the IFC, it appears there will be significant changes to the occupancy groups as currently defined in the UFC. The IFC occupancy classifications are much easier to understand, with occupancy use examples listed for each group. The most significant changes include clarifying language that defines Assembly group occupancies by the type of use rather than by occupant load, and moves all eating and drinking establishments from the Business group B into the Assembly group A.

Implementing this revised occupancy classification matrix requires evaluation and assignment of a new occupancy classification for each commercial occupancy by July 2004, and will need to be coordinated with the Building Division of the Planning Department.

This research identified a potential trouble spot for the fire department in implementing a revised inspection schedule. As previously noted, the Washington Survey and Ratings Bureau increases the number of deficiency points for an inspection program if inspections are not conducted on an annual basis. Thorson (2000), noted;

> While the Survey and Rating Bureau doesn't have the authority or the ability to require an inspection schedule, a fire department must weigh the impact of an inspection frequency that is less than annual on its insurance rating. Choosing a program of inspections every other year for some occupancies could cost a department ten deficiency points (p. 19).

Another potential complication that could result from implementation of a modified inspection frequency schedule is allegation of selective enforcement. The very standards used to identify and grade the fire protection capabilities of a community could be used against a fire department. In developing a modified inspection frequency schedule in Boulder, Colorado, Harvey (1995) noted the importance of developing defensible criteria, stating: "Whatever evaluation system we chose had to be objective so that cries of 'selective enforcement' would have no legitimate basis" (p. 57).

This author feels that the potential liability posed by allegations of selective enforcement are outweighed by the real liability exposure of not completing inspections of target hazard buildings at all. Ott (2001), in his applied research project, noted potential liability as he examined the efficiency of inspection efforts, and the need to focus inspection efforts on identified target hazards. Both Donner (1997) and Ott noted that a key-motivating factor to evaluating the effectiveness of their inspection programs was the lack of resources to conduct their inspection programs as currently (at the time of their writings) configured.

It is clear that Washington State law gives municipalities significant leeway in structuring their fire prevention activities. It does not appear that there are any restrictions that would apply to the frequency of inspections of commercial occupancies.

Research Question Two

Kolluru et al. (1996) explains risk as "a function of the nature of the hazard, accessibility or avenue of contact (exposure potential), characteristics of the exposed populations, the likelihood of occurrence, and the magnitude of exposures and consequences, as well as public values"(p. 1.10). In the broadest sense, risk assessment and reduction efforts center around four key questions: (a) what can go wrong? (b) what is the likelihood it could happen here? (c) how bad would it be if it happened? and (d) what can we do about it? Our fire risk analysis of our community tried to address these questions, and produced the following results. Our highest fire risk/hazards lie mostly in our dense downtown core area, and our south and north end commercial areas. All three of these areas have high economic, historic, or industrial value. Interestingly enough, each of these maximum risk areas also generated a high number of fire and emergency medical responses.

The review of Bellingham's fire loss history confirms that our fire experience is very similar to that of the rest of the nation. Most of our fires occur in single and multi-family dwellings. Prior to beginning this applied research paper, this author contemplated reducing the inspection frequency for multi-family residential structures. However, this research clearly shows that this approach would not only be counterintuitive, it would also be irresponsible.

A significant challenge to effectively inspecting multi-family residential structures is the relative lack of access we have in these buildings. By law, we are only allowed to inspect the common interior and exterior areas, and usually have very little personal contact with building tenants. This dilemma is common throughout the nation, as our efforts to engineer and regulate life safety issues directly conflict with the culture that places utmost value on personal privacy above all else. (Crawford, 2002) With the exception of outdated fire extinguishers, and the occasional rotten wooden stairway, we do not routinely discover significant fire code violations

in these occupancies. S. Lamoureaux, (personal communication, September 8, 2003). However, our fire loss statistics indicate we have a significant behavioral problem with individual tenants, leading to the obvious conclusion that the best way to reduce fire loss in this occupancy group is through focused public education of these tenants.

Shifting focus from inspection to education in multi-family residential structures would be somewhat of a paradigm shift for our department. However, the "writing is on the wall" regarding this need. Barr and Eversole (2003) predicted the future of the nation's fire prevention efforts, stating;

> Fire prevention efforts will continue to play an important role in fire department activities as we move forward in the 21st century, primarily because of the tremendous fiscal constraints being placed on the fire service. With fewer firefighters and fewer fire stations, a shift to mandated installations of fixed suppression systems and increased public education, both key fire prevention organizational activities is likely (p. 1038).

This view is shared by other fire prevention experts, who noted that public education is taking a much more prominent role in fire prevention and also expanding into other life safety/injury prevention activities, which requires much more concentrated effort to be successful (Crawford, 2002).

Regardless of what form of public education program is developed to address our defined fire problem in multi-family residential structures, it is readily apparent that this program should integrate an annual visit by our engine company crews and/or fire prevention staff to continue to identify fire code issues in the common areas, and also deliver the needed public education information to the tenants in the desired format.

In one of the few applied research projects that addressed inspection frequency, Phillips (1992) compared fire loss data to the frequency of inspections, and found an indirect correlation between the frequency of inspections and the fire loss in each fixed use property use category. In one particular instance, she evaluated her community's fire loss history after previously changing inspection cycles for stores/offices to a 24 month cycle, and based on this history recommended changing the cycle back to 12 months. Diamantes (2003) in his textbook on inspection and code enforcement, noted that deviation from set inspection schedules, or changes to those schedules, must be justified. In his opinion, identification and evaluation of fire loss and/or a global review of code violations for a particular group of occupancy provides the necessary justification for altering the inspection program. This approach would appear to be clearly defensible if challenged by allegations of selective enforcement, and appears to have merit in our community as well.

A local example of this approach was found in evaluating our fire loss history at our state university. The fire loss research revealed Western Washington University (WWU) experienced three significant building fires since 1997. The first fire occurred in an eighth floor dormitory room, the second fire occurred in a computer server room of a classroom building, and the most recent fire gutted the kitchen of a dormitory dining hall. All three fires caused millions of dollars in damage, and significantly disrupted school operations. The last significant fire at WWU prior to 1997 was an apartment fire in a high rise college apartment building in 1978. Fortunately, no one was injured or killed in any of these fires.

The Fire Department does not inspect campus buildings, which includes 15 college dormitory facilities. Instead, the college relies on their own safety staff to conduct inspections and enforce fire codes. Our inspectors only approve new construction campus building plans for fire code compliance, and conduct fire protection system construction inspections prior to issuing

the occupancy permit. Engine company crews tour the campus areas and buildings only on an occasional basis.

WWU's recent fire loss history begs the question; is there a correlation between the WWU fires and a lack of fire inspection oversight by the Bellingham Fire Department? On the surface it appears so. This subject could be the topic for an entirely separate applied research paper. However, even without empirical research and findings, the anecdotal correlation could be enough justification to motivate the university to integrate our respective fire prevention activities, and warrants entering into discussions with WWU safety officials to reduce their risk.

Research Question Three

The purpose of identifying the number of buildings in the various groups of commercial occupancies existing in the city was to quantify the existing inspection workload and shed the light of reality on any changes to our fire inspection programs. Whatever changes we implement must be achievable. Currently, the fire department's FCOS program identifies occupancy types that are different than the group occupancy types defined in the 1997 UFC or the 2003 IFC. For example, the FCOS manual identifies Public Assembly occupancy types by either over or under 4,000 square feet. Public Assemblies under 4,000 square feet are inspected by engine crews, and those over 4,000 square feet are inspected by Fire Inspectors. The 1997 UFC defines Public Assembly as five different sub-types, based on occupancy load, the presence of a stage, and/or if it is used for educational purposes. Other FCOS occupancy types are defined by the number and type of fire protections systems in place along with the number of hazardous operations being conducted. See Appendix C for a list of all FCOS occupancy types and inspection schedule.

The problem with continuing to use this approach is two-fold. First, the ability to decipher the various nuances of occupancy use and define the appropriate FCOS occupancy type is difficult at best, which historically resulted in little to no difference between the inspection frequency of the various occupancy types. Second, a UFC group occupancy type is already assigned to each commercial occupancy address listed in Fire RMS, which would make it very difficult to go back through each address to assign a new, "specialized" occupancy type inconsistent with UFC occupancy types. The department will already be faced with the stiff challenge of reclassifying all occupancies to correspond with implementation of the IFC occupancy classifications.

As noted in the results, the largest number of commercial occupancies are in the group B occupancy type. For the purposes of this research, the group M occupancies were consolidated with the group B occupancies because the group M occupancy is a relatively new classification, introduced after most of our occupancies that would have classified as group M had already been identified as group B. A cursory review of our occupancy inventory indicates that redefining the existing commercial occupancies to correspond with the new IFC occupancy classifications will reduce the number of B/M occupancies by only a small amount.

Given the large number of group B/M occupancies, and the relatively low fire loss history compared against the group R1 occupancy type, it appears that the current approach of inspecting group B/M occupancies on an annual basis is inefficient, especially in the context of our limited resources. In evaluating his department's effectiveness of fire inspection activities, Ott (2001) concluded; "When faced with these types of dilemmas (declining revenues and resources), fire service managers must be innovative and research alternatives and develop strategies that will ensure the effectiveness of a program within the constraints of available resources" (p. 31).

The Bellingham Fire Department's efforts to gather pre-incident information from all of the commercial occupancies should be substantially complete within a year. Once completed, based on our fire loss history correlated with the high number of group B and M occupancies found in the city, there does not appear to be a compelling reason to continue annual inspections based solely on these occupancy types. Regarding the option of changing the inspection frequency for other group occupancy types, given their relatively small number of these type of occupancies the frequency changes should have minimal impact on the inspection workload.

The department faces an additional logistical challenge with implementing a new inspection schedule based on the IFC occupancy classifications. Prior to implementing a new inspection schedule, all existing commercial occupancies will have to be reassigned the appropriate IFC occupancy classification.

Research Question Four

It is apparent that several of the fire departments that responded to the questionnaire are struggling with the same workload issues our department faces. In evaluating the need to manage fire inspections, Donner (1997) noted that a key motivating factor to evaluating their method of inspections was the difficulty in finding the time and resources to complete all of the inspections for the Boulder, Colorado Fire Department.

Most of the departments who returned the questionnaire are using engine companies to perform inspections. However, 40% of the departments note they are unable to meet their inspection goals. All of these departments state that lack of resources is the main reason for not meeting their inspection goals, and two of these departments note the increased growth in their communities. This result demonstrates that Bellingham's experience is certainly not unique, and that other departments are struggling with the increasing growth as well. The fact that 40% of

the participating departments are not accomplishing annual inspections as scheduled is indicative of this growth, and unrealistic expectations of their inspection programs.

As previously noted, the Federal Way Fire Department changed their frequency of inspections in 2000 and also implemented a self-inspection program for certain group B and M occupancies to address their community's current and projected growth. (Thorson, 2000)

While the Bellingham Fire Department was not successful in its self-inspection program, the concept of adjusting the frequency of inspections must be implemented. Ronny Coleman (1999), a contemporary visionary in the United States Fire Service, bolsters this argument when he asked the tough questions:

> …You have to ask yourself the following questions: What occupancies absolutely have to be inspected on a specific cycle? What occupancies can be reviewed periodically? What occupancies may be given the empowerment to inspect themselves? And lastly, are there certain occupancies that you are never going to inspect? (p. 37)

Identifying the appropriate inspection interval for the various occupancies is the final necessary step. Unfortunately, there is no available information that clearly defines the appropriateness of a particular schedule. The surveyed departments shed little light on this aspect of inspections, with the majority continuing to rely on annual inspections for most occupancies. With this finding, we must decide inspection frequency changes by assessing the total number of occupancies in each occupancy type, and the life safety/fire hazard of each type.

Based on the current inventory of occupancies as defined in the 1997 UFC and the fire loss history for the department, a revised inspection schedule was created and reviewed by Life Safety Division personnel. A sample engine company inspection schedule was created to assist in evaluating changes to the engine company inspection workload.

RECOMMENDATIONS

This research clearly demonstrated the need to revise the Bellingham Fire Department's FCOS program to make it more efficient and effective in lowering the community fire risk. The adoption of the 2003 IFC by Washington State in July, 2004 will result in significant changes in cataloging of commercial occupancies in the City of Bellingham. As a result of this research, the Bellingham Fire Department Life Safety Division began working with the city's Information Services Technology Department to develop a Crystal Report that will streamline the process of converting occupancy categories from the 1997 UFC to the 2003 IFC classifications.

It is clear that our engine company crews must continue to conduct inspections of various commercial occupancies. But, it is also clear that the frequency of these inspections should be altered to maximize their prevention efforts towards those occupancies with significantly greater risk of fire based not only on occupant use, but also on our fire loss experience. The proposed inspection schedule found in Appendix F should be implemented once the majority of the initial annual inspections have been completed.

It is also imperative that these crews continue to visit multi-family occupancies, but shift their focus from enforcement to education. The Life Safety Division should obtain or develop educational materials that could be left by the engine crews in the common areas or managers offices of multi-family dwelling complexes.

The Life Safety Division should also contact Western Washington University and enter into a dialogue to identify and address their fire problem, and perhaps include the department in their fire inspection program. This would also allow us the opportunity to fully explore these complex university buildings and enhance our university pre-incident plan database.

Further research and exploration of the effectiveness of changes to existing fire inspection programs is sorely needed to fill the vast void in the field of fire prevention effectiveness. Hopefully, this research paper will fill a small part of this void and lead to further research and discussion.

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APPENDIX A

City of Bellingham

Occupancy Group Inventory

Occupancy Group	Number of occupancies
Unknown	2
A1	9
A2	35
A3	77
A4	2
B	1304
E1	30
E2	10
E3	47
F1	34
F2	56
H1	2
H2	5
H3	10
H4	71
H7	3
I1.1	6
I1.2	5

Occupancy Group	Number of occupancies
I2	8
I3	2
M	200
R1	846
R3	44
S1	21
S2	28
S3	11
S4	2

APPENDIX B

List of contacted Washington fire departments

Auburn Fire Department

Bothell Fire Department

Bremerton Fire Department

Central Kitsap Fire and Rescue

Central Pierce Fire and Rescue

Everett Fire Department

Federal Way Fire Department

Kent Fire Department

Kitsap County Fire District 7

Kirkland Fire Department

Lacey Fire Department

Mercer Island Fire Department

North Kitsap Fire and Rescue

Olympia Fire Department

Pierce County Fire Marshall

Pierce County Fire District 3

Redmond Fire Department

Seattle Fire Department

Snohomish County Fire District 9

Spokane Fire Department

Spokane Valley Fire Department

University Place Fire Department

Tacoma Fire Department

Woodinville Fire Department

Yakima Fire Department

APPENDIX C

Bellingham Fire Department

Current Fire Company Occupancy Survey Occupancy Type Criteria

Engine Company Inspections

Occupancy Type	Inspection Frequency
Public Assembly up to 4,000 square feet	Annual
Schools	Annual
Residential (three attached units or more)	
One and two stories without fire protection systems	Bi annual
One and two stories with fire protections systems/ all three-story residential	Annual
Four story and above and transient accommodations	Annual
Stores and offices	Annual
Except:	
Professional offices up to 20,000 square feet	3 year cycle
Retail sales up to 4,000 square feet	3 year cycle
Service stations	Annual
Basic industrial and manufacturing up to 20,000 square feet, two or less fire protection systems and three or fewer hazardous operations	Annual
Storage/Warehousing	Annual

Vacant structures (not subject to abatement)	Annual

Fire Inspector Inspections

Public Assembly greater than 4,000 square feet	Annual
Institutions	Annual
Basic industrial and manufacturing greater than 20,000 square feet, three or more fire protection systems and four or more hazardous operations	Annual
Spray finishing operations/special high hazards	Annual

APPENDIX D

Questionnaire

Dear Fire Chief/Fire Marshal

I am currently enrolled in the National Fire Academy Executive Fire Officer Program. As you may be aware, this program requires completion of four applied research projects to graduate from this program. Enclosed is a short survey for my current applied research project.

The City of Bellingham continues to grow, resulting in increased demands on our fire crews to complete the required inspections. The purpose of my research is to review our current life safety inspection interval criteria, compare it against regional and national standards and codes, evaluate our own fire/life loss history, and develop a justifiable and rationale inspection schedule for our various types of commercial occupancies.

I would greatly appreciate your department's participation in my research by completing the enclosed survey and mailing it back to me in the enclosed self addressed stamped envelope. Make sure to indicate if you would like a copy of my completed paper and I will email a copy.

Thank you in advance for your help.

Bill Boyd, Fire Chief

BELLINGHAM FIRE DEPARTMENT

Please answer the following questions as accurately as possible. When done, *please save the document on your computer by renaming it with a name that includes your agency/city, and forward the saved file back to me via email by* ***September 30th***. If for some reason you are unable to complete this electronic form, please let me know via phone or email and I will send you a hard copy and self addressed stamped envelope to return. *Thank You!*

1. City/Agency Name:
2. Information of person completing: Name: Title:
3. Contact information: Phone: Email:
4. Does your agency perform routine fire/life safety inspections of commercial occupancies?

   □Yes □No

   (If not, please indicate why not, and skip the rest of the questions and please return the survey)

5. What criteria, methodology, and/or approach did your agency use to establish the inspection frequency(s)? Check ALL that apply

   □State law and/or local municipal code

   □Fire loss history of your community

   □Hazard/Risk assessment for each type of occupancy and/or response area

   □Common practice of other local departments

   □Presence of fire protection systems that must be confidence tested

   □Other (please list below)

Other comments

6. Is your department completing all of the commercial occupancy inspections per the assigned inspection interval each year? □Yes □No

7. If you said No on Question #6, please give your opinion why your agency is unable to complete the assigned inspections

8. Does your agency use emergency operations personnel/engine companies to conduct occupancy inspections? □Yes □No

9. If you marked yes on Question 8, please complete th following chart to indicate what types of occupancies these crews inspect. **Type of Occupancy**	Inspected by emergency response crews	Inspected by fire prevention bureau personnel
(R-1/3) Multi-family residential	☐	☐
(B) Business/offices/ Restaurants	☐	☐
(A-1) Public Assembly <1000	☐	☐
(A-3) Public Assembly >300	☐	☐
(E-1/3) Educational	☐	☐
(F-1) Manufacturing-moderate hazard	☐	☐
(F-2) Manufacturing-low hazard	☐	☐
(H-1/3) Hazardous materials processes	☐	☐
(I-1/3) Health care facilities	☐	☐
(M) Mercantile/stores	☐	☐
(S-1/5) combustible storage/garages/hangers	☐	☐
(U-1) private garages, carports, agricultural buildings	☐	☐
Additional Comments:		

10. Please indicate the frequency of inspection for each type of commercial occupancy **Type of Occupancy**	Annual	Every 2 years	Every 3 years	Every 4 years	Other (explain in Comments)
(R-1/3) Multi-family residential	☐	☐	☐	☐	☐
(B) Business/offices/ Restaurants	☐	☐	☐	☐	☐
(A-1) Public Assembly <1000	☐	☐	☐	☐	☐
(A-3) Public Assembly >300	☐	☐	☐	☐	☐
(E-1/3) Educational	☐	☐	☐	☐	☐
(F-1) Manufacturing-moderate hazard	☐	☐	☐	☐	☐
(F-2) Manufacturing-low hazard	☐	☐	☐	☐	☐
(H-1/3) Hazardous materials processes	☐	☐	☐	☐	☐
(I-1/3) Health care facilities	☐	☐	☐	☐	☐
(M) Mercantile/stores	☐	☐	☐	☐	☐
(S-1/5) combustible storage/garages/hangers	☐	☐	☐	☐	☐
(U-1) private garages, carports, agricultural buildings	☐	☐	☐	☐	☐
Additional Comments:					

APPENDIX E

Questionnaire Written Comments

Question 4 Does your agency perform routine fire/life safety inspections of commercial occupancies? If not, please indicate why not, and skip the rest of the questions and please return the survey.

-We are not authorized to conduct fire inspections, and rely on the county fire marshal to perform these inspections.

-The Pierce County Fire Marshal is responsible for conducting fire inspections in our jurisdiction.

Question 5 What criteria, methodology, and/or approach did your agency use to establish the inspection frequency(s)? Other (please list below)

- The fire districts goal is to improve our insurance rating from a 4 to a 3. One of the ways to get to these points is to show a five-year history of annual inspections. We also figured that this change would also save our citizens an average of $50 annually on insurance.
- We will be looking at the possibility of changing the way we conduct inspections in Everett based on the results of a NFA ARP being written by our Fire Marshal.
- We also balance the need for, and benefits of, inspection against the costs involved with conducting a coherent fire inspection program. Commercial occupancies typically account for less than 8% of our total annual fire call volume.
- We conduct annual fire inspections to assist with pre-emergency planning, to provide "customer" service, and to "market" the Fire Department. Our fire inspection has the

advantage of getting our fire inspectors through each building approximately every three years.

- Maintain ISO scoring for fire prevention-the less often occupancies are inspected, the less favorable the ISO score.
- Since 1988, the City has charged for fire inspections and used the revenue source to pay for 3 FTE's in the Life Safety Division. Total income for 2003 will be $204,000.
- We wanted to keep our Washington Survey and Rating Bureau score down. We wante to reduce fires. We based our idea of using firefighters to inspect on a 1979 NFPA article by John R. Hall. I consulted him in 1982, and he said there had not been any further major studies. But he still felt the findings were valid.
- Annual inspections are required per the Uniform Fire Code and are good business in that the firefighters get into buildings to see what kind of businesses are in the City. It also allows the Fire Department to spot and alleviate potential dangerous conditions present in the business.
- I started engine company inspections in 1991 to maintain the city's #3 rating with the state survey and rating bureau. Later, in 1997, the city hired another inspector and the fire marshal's office took over all inspections. We were able to get 100% of all occupancies. Following the passage of I-695, the city dropped one inspector.
- Our inspection frequency was developed several years ago after we formed a committee of business owners, etc. and solicited their input. Our current frequency is based on the number of previous fire code deficiencies and whether or not they have a working automatic fire sprinkler system.

- We conduct routine inspections on commercial buildings having required fire department permits and cause buildings having required life safety systems to have those systems tested and maintained in accordance with NFPA standards.
- WSRB's 1996 Commentary Update for Fire Safety Control provides a frequency list we try to follow.
- The most overriding criteria is FTE. Budget sets the FTE we have available to inspect. Operations establishes the amount they can handle. Prevention groups the remainder into hazard categories, when known, and starts at the top of the list.
- The current program requires annual inspections of all occupancies. We will be evaluating our inspection frequencies before re-implementation of the program, and I anticipate that the frequencies will increase in some high hazard occupancies based upon the potential for life and property loss. We may also look at self-inspection in some low hazard occupancies to free up time for the increased frequencies in other occupancies.

Question 7. If you said No on Question 6, please give your opinion why your agency is unable to complete the assigned inspections.

- Volume of occupancies and lack of fire prevention personnel.
- A number of reasons: Inadequate staffing in the Fire Prevention Bureau-staffing has not kept up with the pace of growth and construction; Engine Company Inspection program is just now being resumed after a 5 year absence due in part to lack of support at the Deputy Chief level until a recent change in that position.
- Staffing levels
- The number of commercial occupancies has increased beyond the number of available inspectors.

- They cut the Fire Marshals office.
- We have not been able to do enough inspections to accomplish this in one year.
- Our inability to complete the inspections in the past is a result of a lack of commitment to the program, insufficient training, and a lack of accountability and follow up.
- Our engine company inspection program is not working well. We are a one-station department located in the middle of 9 square miles, with a population of 32,000. We have 450+ businesses. The call volume and mandatory training combined with EMS transports make our inspection program fruitless. Spending the day doing inspections is always interrupted by calls. Providing follow up on re-inspections is nearly impossible.

Question 9. If you marked yes on Question 8, please complete the following to indicate what types of occupancies these crews inspect. (Comments)

- We have been unable to get the detail of information out of our SunPro database as requested. We have not until recently entered the Building Code designations. Here is an overall summary: We have about 1350 occupancies in the City of Lacey. As a result of our inspection frequency(which means the work load changes each year) we have about 950 inspections to accomplish. Of that, 600 are given to engine companies and approximately 350 are retained by the Fire Marshal Office. The FMO inspections are the tougher code occupancies and those with a history of non-compliance.
- We have a unique program in Federal Way. Our operations division companies conduct fire and life safety inspections in all occupancies. Our Deputy Fire Marshals conduct the UFC permit inspections about 1-2 months after the annual inspection is completed. We also have a self-inspection program for the B and M occupancies where we only inspect every other year.

- We have crews do all of the commercial occupancies in their area, not just certain types of occupancies. Buildings tend to get left out if you break it up too much. We have one fire inspector do about 700 of the 4000 inspections. The crews do not have time to do them all. He rotates through their areas and does a different portion each year. We want our crews to wear three hats: 1. Public education, 2. Prefire planning, and 3. Code enforcement.
- All inspections are done by the Life Safety Division. 3 FTE firefighter inspectors promoted to this position.
- Occupancies can be inspected by the crews as well as bureau inspectors based on the locations of the occupancies.
- We also inspect home businesses where customers visit the home, i.e. home daycare, residential care facilities.
- Some occupancy types are inspected by either suppression personnel or bureau personnel, depending upon other variables.
- Where inspections by both the emergency response crews and the fire prevention bureau personnel are indicated, generally the bureau personnel inspect before permit issuance, and the companies inspect for on-going compliance with those permit conditions. Bureau personnel also conduct inspections of fire protection systems during new construction and remodel projects. We would not as a general rule inspect U-1 occupancies unless there was a fire department permit issued for the occupancy.
- The areas/occupancies marked for inspection by prevention personnel is also a struggle to complete annually. All of the assemblies and educational occupancies are inspected by our Pub Ed specialist who also has a full load with fire and life safety programs and other classes. With only myself and the Pub Ed specialist it is not possible to get into all of the occupancies

within a year's time and continue to provide timely education programs, new construction and system plan reviews and attend meetings.

Question 10. Please indicate the frequency of inspection for each type of commercial occupancy. (Comments)

- H Occupancies are to be inspected quarterly.
- Any occupancy that has a fire and life safety system built in is inspected 2 times a year. Anything that is high life/high fire gets done twice a year; hospitals, schools, high-rise, jails. Every thing else gets done annually.
- H-1/3 twice a year.
- Our B and M occupancies are part of the self-inspection program, we inspect every other year, and the occupant conducts a self-inspection on the off year. We have a very low incidence of fires in these occupancies and this made sense to us with the other workload issues. Our hazardous occupancies we conduct two inspections per year (at 6 month intervals).
- We are trying to inspect businesses with reportable quantities of hazmats two times a year.
- We are considering doing the less hazardous occupancies less often, but have not acted on this yet. The results of your survey may help sell the program of less frequent inspections if other departments are doing it.
- We evaluate the taxpayer benefit (reduction in fires, insurance cost reductions, etc.) versus the time and resource requirement (personnel, training, equipment, time, etc.) annually during management retreat with our elected board of commissioners. The three-year cycle for inspections was determined to be the best balance of benefit versus cost in 1998. That decision has been reviewed by senior staff and the board of commissioners annually to determine it that is still the most appropriate level of service. We were able to provide

inspections on a two-year cycle for four years (despite the minimum three-year cycle established by leadership) but other customer service requirements demanded more time from the Prevention Division. Consequently, we dropped back to the three-year inspection cycle dictated by the board of commissioners. They were advised of that shift in effort and approved it at the last management retreat. We will continue to collect data, report data, and evaluate benefit versus cost on an annual basis and provide the most appropriate level of service we can.

- The above listed are inspected on a required fire department permit basis.
- All R-1 occupancies are inspected twice each year. Once in the spring for their annual fire inspection and once in the fall for their annual matrix inspection. The matrix inspection includes a variety of items that are retroactive requirements for all R-1 occupancies. A special retro ordinance was established several years back after the Kona Village Fire. It includes fire safety training requirements, fire alarm, sprinkler and smoke alarm installation requirements.
- Some offices and some mercantile occupancies are inspected every-other year, depending upon compliance history.
- If there is no occupancy, we do not inspect. The intervals noted above are general, and next fixed, and may, to some extent not coordinate with all the occupancies within the category. For instance, retail that deals with hazardous materials may be inspected more often that the rest of the category, and a small general office may drop to 4 or more years.

APPENDIX F

Bellingham Fire Department

Revised Inspection Frequency Schedule

IFC Occupancy category (Group)	Frequency
A-1	Annual
A-2	Annual
A-3	Every two years
A-4	Every two years
A-5	Every five years
B	Every three years
E	Annual
F-1	Annual
F-2	Every two years
H-1	Annual (No current occupancies of this type)
H-2/5	Annual
I-1/4	Annual
M	Every three years
R-1/3	Annual
Licensed care	Annual
S-1	Every two years
S-2	Every five years
U	Inspected only on request