Study and Analysis of Fire Protection Systems in Fraternity and Sorority Houses at the University of Virginia

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By

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On my honor as a University of Virginia student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Papers in Science, Technology, and Society Courses.

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EXECUTIVE SUMMARY

Fire prevention, protection, suppression, and control systems span multiple engineering disciplines. Collectively, engineers refer to this diverse field as fire engineering. Fire engineers depend on reliable data to develop and implement effective fire safety systems. Sufficient data, however, are lacking in the area of fraternity and sorority housing.

The following report establishes the current fire safety conditions in Greek houses at the University of Virginia, analyzes the available fire engineering solutions, and makes recommendations for effective fire safety improvements. Data in the report came from technical research, expert interviews, and an assessment of the University of Virginia Greek system. The online Greek Housing Fire Safety Assessment divided fire safety into the following seven areas: Exit & Egress, Fire Extinguishers, Sprinkler Systems, Policy & Procedure, Attitude & Approach, Management, and Financial Capability & Alumni Support. The assessment found that Greek houses at the University of Virginia are lacking in all seven areas. There are, however, affordable and effective solutions available to houses suffering from deteriorating conditions.

Overall, this project facilitates greater safety for Greek housing in the United States. This objective is accomplished by recommending measures that are applicable to all fraternities and sororities. Among other things, the assessment found a need for more fire inspections and greater house management. The complete conclusions of this report are relevant to the lives of fire engineers, educational administrators, students and the general public.

1 INTRODUCTION

1.1 Purpose Statement

This thesis establishes the current fire safety conditions in fraternity and sorority houses at the University of Virginia, analyzes available fire engineering solutions, and offers recommendations for effective fire safety improvements. The data originate from research, interviews, and surveys of the University of Virginia and its Greek system. The recommendations, however, serve to improve student safety in fraternities and sororities across the nation.

1.2 Problem Statement

1.2.1 Background Information

Engineers use features such as fire retardant materials, detection and suppression technology, egress solutions, and alerting systems to improve safety in residential areas. A fire engineer specializes in integrating these complex systems to minimize the threat of fire. Many engineers, however, fail to understand the reasons that fraternity and sorority houses are so much more at-risk than other groups. The United States has one of the highest fire fatality rates in the industrialized world, with more than 80% of fire fatalities occurring in residences. The National Fire Protection Association (NFPA) reports that approximately 180 fires occur each year in Greek housing, resulting in over $3.2 million in direct property damage (NFPA, *Dormitories* 1). Yet industry professionals have collected minimal amounts of data on fire safety in fraternity and sorority houses, making it difficult to design and implement effective fire safety solutions. As a result, fraternities and sororities are often hesitant to spend funds on fire safety measures that may fail to address their specific needs.

This thesis provides fraternities and sororities with sufficient information to implement effective and affordable fire safety systems.

1.2.2 The Problem with Fraternities and Sororities

Due to a number of recent fires in student housing, many educators and fire professionals are calling for more stringent fire regulations (NFPA, *Dormitories* 15). This, coupled with the growth and development of an industry specializing in fire safety, is evidence of growing societal concern about fire. It is further apparent that fraternities and sororities face different problems than other forms of student housing face. Many fraternities and sororities are located in historical buildings that require additional design considerations before renovation (NFPA, *Heritage* 3). These requirements often make implementing fire safety systems difficult and expensive. Likewise, many of these houses were never intended for the high capacity social events typical of houses today (Laushway and Wilson). At these events, an atmosphere of apathy, carelessness, and general acceptance of risk contributes to a greater level of danger. Fraternity and sorority houses also fall under differing authorities in terms of regulation and oversight. At the University of Virginia, most Greek houses are listed as private residences and fall under the authority of either Albemarle County or the City of Charlottesville. Finally, Greek houses face financial limitations that significantly restrict their ability to install various fire safety measures. Due to these difficulties, the Greek community has widely failed to implement many of the standard fire safety improvements. As a result, the following conditions exist:

- There are minimal data on the level of fire safety in Greek housing
- There are no specific regulations or guidelines for Greek housing
- There are no fire safety solutions designed for Greek housing

This study addresses each of these three concerns. In accumulating data about the University of Virginia's Greek houses, the report enables professionals to make more informed decisions about the design and implementation of fire measures. Future regulations and fire safety solutions can be based on information specific to fraternity and sorority houses. While this study focuses on Greek houses at the University of Virginia, it serves as a representation of the problems facing Greek housing across the nation.

1.3 Rationale and Scope

1.3.1 Current Fire Engineering

Fire prevention, protection, suppression, and control systems span many fields of engineering: mechanical, electrical, material, and computer. Collectively, engineers refer to this field as fire engineering (IFE). This field involves a mixture of engineering principles and a fundamental understanding of fire and individuals' reactions to it. One of the greatest successes in fire engineering has been the widespread installation of sprinkler systems. Fire regulations relevant to these systems include NFPA-13 Commercial Fire Sprinkler Design Standards, NFPA-13R Residential Fire Sprinkler Design Standards, and NFPA-13D Dwelling Fire Sprinkler Design Standards (Dewar 15). While the number of regulations has increased dramatically in the past decade, they remain broad standards that do not address specific situations like Greek housing. Many fraternity and sorority houses still lack the

financial or technical ability to implement the high-tech, all-inclusive, fire protection and suppression systems recommended in these guidelines.

1.3.2 Relationship of this Thesis to Current Research

Residential fire safety is a growing industry that incorporates the latest science and technology available. As such, fire engineers are always looking for better ways to design, implement, and regulate fire safety measures. Progress, however, has also escalated the cost of fire protection systems. Engineers need better information to assist them in developing affordable alternatives to these modern systems. This thesis supplements work already done in the field of residential fire safety. The information included in this report focuses on student housing, particularly fraternity and sorority houses. Together with previous work, the results of this thesis should help engineers develop and implement more effective fire safety measures.

1.4 Social Motivation

1.4.1 Social and Ethical Considerations

Society has shown increasing concern about the level of fire safety in student housing and its impact on the public. Each year, fire adversely affects more and more educational communities (USFA, *Fraternity* 5). It is the intention of this study to respond to this unfortunate trend. On a broad scale, these results facilitate practical and more affordable solutions that will increase public safety. This thesis also serves to encourage further technological progress in academia and industry. Our society has already acknowledged the importance of fire safety in engineering and government regulations. More progress in the

field of fire engineering, however, is necessary to fully protect the public from the threat of fire. Furthermore, that progress must begin with an increase of information and end with the implementation of real, significant change.

1.4.2 Direct and Indirect Beneficiaries

Progress in the field of fire engineering is sure to affect several different stakeholders. The intended beneficiaries of this study include students and those directly associated with Greek housing. Again, the purpose of this study is to improve the level of safety for these individuals. Indirectly, however, the results could affect fire engineers, government regulators, industry professionals, and even the surrounding public. As a result, this report reflects the interests of all stakeholders in its recommendations and conclusions.

Individuals may express concern over some of these recommendations. Admittedly, developing affordable alternatives to expensive fire protection systems could decrease industry profits. This decrease in business, however, should be offset by the increase in potential customers. As the cost of implementation decreases, more fraternities and sororities should be able to afford fire protection systems. As a result, fire engineering professionals should expect an increase in business with these recommendations.

In contrast, end-users fear over-regulation and greater operational costs (Rich 4). Greek organizations often depend on operational independence and minimal expenses for their survival. Increased regulation or financial burden could doom the very organizations this project intends to help. The final recommendations, therefore, offer solutions that minimize both cost and regulation.

1.5 Thesis Overview

The remainder of this thesis explores the history of fire safety, presents all relevant data and analysis, draws conclusions, and offers recommendations for change. Chapter 2 discusses the methods in achieving the objectives of this thesis. Chapter 3 provides a detailed presentation of all relevant research and literature. Chapter 4 presents the current level of fire safety in Greek houses at the University of Virginia. Chapter 5 is a detailed analysis of possible fire safety solutions and the considerations necessary before implementation. In conclusion, Chapter 6 summarizes the results, offers interpretation, and finally makes recommendations for change.

2 METHODS

This chapter explains the investigative process of the thesis project. An extensive amount of research was done to determine which areas needed the most study. These areas were extensively probed through interviews of fire professionals, school administrators, construction experts, and Greek residents. Each fraternity and sorority was also asked to complete an online assessment of its housing conditions. In the final section of this chapter, the relevance and accuracy of the subsequent data is discussed.

2.1 Technical and Background Research

The National Fire Protection Association and the U.S. Fire Administration are the most comprehensive and accurate sources of information on fire. These sources offered a good starting point for the research process. Originally, the project sought information about fire engineering and Greek housing in general. Eventually, fire solutions related to residential and commercial structures were reviewed in detail. This research led to an exploration of the specific needs of Greek housing. Collectively, this research defined specific areas in Greek housing that needed further assessment. A full discussion of the relevant research information can be found in Chapter 3. This research also allowed for more in-depth interviews about fire safety in Greek houses.

2.2 Expert Interviews

Interviews of fire professionals, school administrators, and Greek residents allowed for more specific recommendations. School administrators want their students to be in a safe environment, free of all risk. Francis Laushway, Dean of the Office of Fraternity and

Sorority Life, was able to offer extensive information on fraternity and sorority housing. He was also able to arrange future interviews with fire professionals. In addition to these contacts, Dean Laushway discussed his concern about fire sprinklers, house management, and the physical limitations of the various houses. He suggested that the physical condition of the houses and the degree of house management needed extensive evaluation.

James Wilson of the University of Virginia Foundation's Historic Renovation Corporation (HRC) oversees the management of many fraternity and sorority houses at the University of Virginia. He is an expert on both the renovations and management of Greek houses. HRC was initially established in 1983 as a limited partnership with Greek alumni investors. The limited partnerships allowed for 17 houses to receive greatly needed renovations. Today, HRC actively manages 11 fraternities and 1 sorority (HRC). Since Mr. Wilson manages numerous Greek properties, he was able to explain a lot of the additional problems facing fraternities and sororities. These difficulties include historic considerations, financial limitations, ownership issues, legal designations, and other specific problems. Mr. Wilson, like Dean Laushway, focused on the need for professional management of Greek houses.

Gerald Drumheller of the University of Virginia Office of Environmental and Health Safety, Fire Marshall Stephen Walton of the City of Charlottesville, and former Fire Marshall Benjamin Powell were able to elaborate on the more technical issues concerning fire safety in Greek housing. All of them stressed the need for regular fire inspections. These inspections often catch and correct the conditions these professionals found most distressing about Greek houses. Mr. Drumheller also stressed the challenge of dealing with college students and their casual disregard for safety.

2.3 Greek Housing Fire Safety Assessment

The background research and interviews suggested there were seven areas of primary concern in regards to Greek housing. An online survey, "The Greek Housing Fire Safety Assessment" (GHFSA), was developed to evaluate fraternities and sororities at the University of Virginia in these seven areas. The assessment, shown in Appendix 1, includes questions on Exit & Egress, Fire Extinguishers, Sprinkler Systems, Policy & Procedure, Attitude & Approach, Management, and Financial Capability & Alumni Support. All 32 fraternities and 16 sororities were asked to complete the assessment. Data from the online assessment were collected in Microsoft Excel and manipulated in Microsoft Access. A set of standards, shown in Table 4.1 of Appendix 4, was established for each of the seven areas. Houses that met these standards were given a "safe" rating in that area of fire safety. A "safe" rating meant that houses met expectations for fire safety in that particular area of concern.

2.4 Discussion on the GHFSA Responses

In most cases, the Chapter President or House Manager completed the GHFSA. Although some questions were subjective and open to interpretation, the assessment offered a good estimate of fire safety conditions in fraternities and sororities at the University of Virginia. The GHFSA results offer a means of comparing the different houses and of illustrating fire safety trends in the Greek community. In tables and graphs, the results are broken down into Inter-Fraternity Council (IFC) houses, Inter-Sorority Council (ISC) houses, and all Greek houses.

While this is a study of the fraternities and sororities at the University of Virginia, it is intended to help Greek systems across the United States. Background and technical information came from established sources on fire topics. Likewise, the interviews were of respected fire professionals and knowledgeable administrators. The assessment responses included 100% of fraternities and sororities at the University of Virginia. In most cases, the resident with the most knowledge of overall house conditions completed the survey. Admittedly, however, these individuals cannot respond with the same accuracy as fire professionals. It is expected that some of their responses are either incorrect or optimistic. This limitation means that the general findings are more important than the individual responses of the houses. Likewise, houses that achieve a "safe" rating should continue to strive for improvement. Meeting expectations should never be enough when it comes to student safety.

3 FIRE ENGINEERING AND FIRE SAFETY

3.1 Background Information

Fire engineering is a constantly evolving field of engineering science. Initially, progress came from logical engineering improvements rather than pioneering scientific theory. This chapter reviews the developments in fire engineering, both practical and theoretical. These developments are responsible for current engineering solutions and fire code regulations.

3.1.1 Origins of Fire Safety Systems

In understanding the historical and theoretical background of fire engineering, it is important to understand the concept of containment. At the beginning of the eighteenth century, engineers concerned themselves with the safety and security of entire cities (IFE). The safety of individuals and their property was irrelevant in comparison. Technological progress, however, has allowed fire engineers to concern themselves with increasingly smaller areas of containment. Today, fire engineers focus on the protection of single buildings and even individual rooms. Fire prevention, protection, suppression, and control systems are custom-made for specific needs. The ability to customize fire protection systems has resulted in an increase in overall system effectiveness.

3.1.2 Physical Systems

The first fire protection systems evolved from successful engineering practices. Indeed, the single greatest achievement in fire engineering has been the invention and development of the automatic fire sprinkler system. In the mid-1800s, New England textile

mills used simple perforated pipe systems for fire protection (Bellis). These systems, however, required manual release in the event of a fire. Philip W. Pratt of Abington, MA, patented the first automatic fire sprinkler system in 1872. Soon after, Henry S. Parmalee of New Haven developed the first practical automatic sprinkler head and installed a complete automatic system in 1874 (Rich 1). Both reliable and effective, automatic sprinkler systems are now standard in most public buildings.

Today, modern fire engineering involves the combination of prevention, protection, suppression, and control systems. These systems are both expensive and difficult to implement. Fire engineers need to develop more affordable systems for non-commercial uses. The success of earlier fire sprinkler systems was partially a result of their long-term cost effectiveness and ease of operation. It does not matter how effective a system is against fire, if customers cannot afford to install it.

3.1.3 Codes and Regulations

One reason that fraternity and sorority houses often neglect inspections is because of their status as private residences. This designation exempts them from most codes other than the Virginia Statewide Fire Prevention Code (Walton). Another problem, as seen at the University of Virginia, is houses can reside in different jurisdictions. At the University of Virginia, fraternity and sorority houses exist in three overlapping localities: The University of Virginia, City of Charlottesville, and Albemarle County. While all three of these localities follow versions of the International Fire Code (IFC) with Virginia Amendments, there are subtle differences in enforcement. The National Fire Protection Association also maintains a comprehensive system of codes and standards relevant to fire engineering that these

jurisdictions follow. These codes are rewritten every 3 years, but not necessarily adopted immediately (Walton). As a result, different jurisdictions sometimes follow different versions of IFC and NFPA fire standards.

Similarly, there are four different groups that can mandate fire codes: the government, the relevant educational institution, the national Greek organization, and the local chapter. As previously stated, the government has little control over these "private residences." Likewise, educational institutions lack the legal authority to take effective control. Historically, national organizations and local chapters usually mandate fire regulations according to their insurance policies. Unfortunately, it has taken a number of recent fatal fires to force a review of these policies and regulations (NFPA, *Dormitories* 15).

3.2 Fire Safety in Residential Structures

3.2.1 Residential Fires

The majority of theoretical research into fire engineering began in the twentieth century. Until that time, engineers had relied on common sense and practical engineering to minimize the threat of fire. Today, the U.S. Fire Administration (USFA) and the National Fire Protection Association (NFPA) are the two primary authorities on fire engineering. These organizations conduct studies and collect data on the effects of fire.

Most of these studies show that while fire protection systems do save lives, human error reduces their effectiveness. In 1999, the NFPA conducted a national survey on the public's understanding of fire safety. The study found that:

- Only 60% of Americans have an escape plan and only 42% have practiced it
- 26% of Americans have never even thought of an escape plan

- Only 8% initiated safety measures when their fire alarms sounded
- 30% of residential fire deaths occurred despite functioning smoke alarms (NFPA, *Website*)

These studies illustrate the limits of fire protection systems. Owners must operate safety systems correctly in order for them to function effectively. The correct attitude and approach are essential in any fire safety strategy. Unfortunately, most residences lack fire safety systems entirely. In 2003, there were 388,500 reported home fires in the United States, resulting in 3,145 deaths, 13,650 injuries and $5.9 billion in direct property damage (NFPA, *Website*). The majority of these fires occur in residences that lack fire safety systems. Greek houses need to implement the same fire protection systems that keep commercial mass-occupancy residences (like apartments) safe.

3.2.2 Fraternity and Sorority Housing

Educational institutions, Greek organizations, and local governments are trying to minimize the various fire hazards in student housing. The U.S. Fire Administration has even started collecting data on fraternity and sorority houses. A 2002 USFA study found that:

- Fires in fraternity and sorority houses are five times more costly (on average) than those that occur in dormitories.
- Arson, open flame (candles), and cooking are the leading causes of fraternity and sorority house fires.
- Smoke alarms operate nearly twice as often in fraternity and sorority house fires than in all residential structures (USFA, *Fraternity* 1).

Fires in Greek houses are more frequent, more expensive, and less likely to be taken seriously than other residences and commercial buildings. At the same time, statistics show vast potential for improvement in Greek housing fire safety. More information is necessary, however, in order for engineers to effectively apply solutions. Before fire engineers can develop effective and affordable systems, they must first understand the differences between Greek housing and other forms of student housing.

3.3 Available Research Data

In response to public demands, government agencies and industry organizations have started collecting and analyzing data on student housing. While these data are helping explain the problems and solutions facing fire engineers, the collection is still far from complete. It is known that student housing, and in particular Greek housing, is an area of concern. The data do not show the areas in which fraternities and sororities need the most improvement. The information in the next chapter, however, begins to address this deficiency in the data. As a result, government agencies should be better prepared to recommend changes to regulations and standards. The fire engineering industry should also be more capable of addressing the specific needs of Greek housing.

4 ESTABLISHING THE CURRENT LEVEL OF FIRE SAFETY

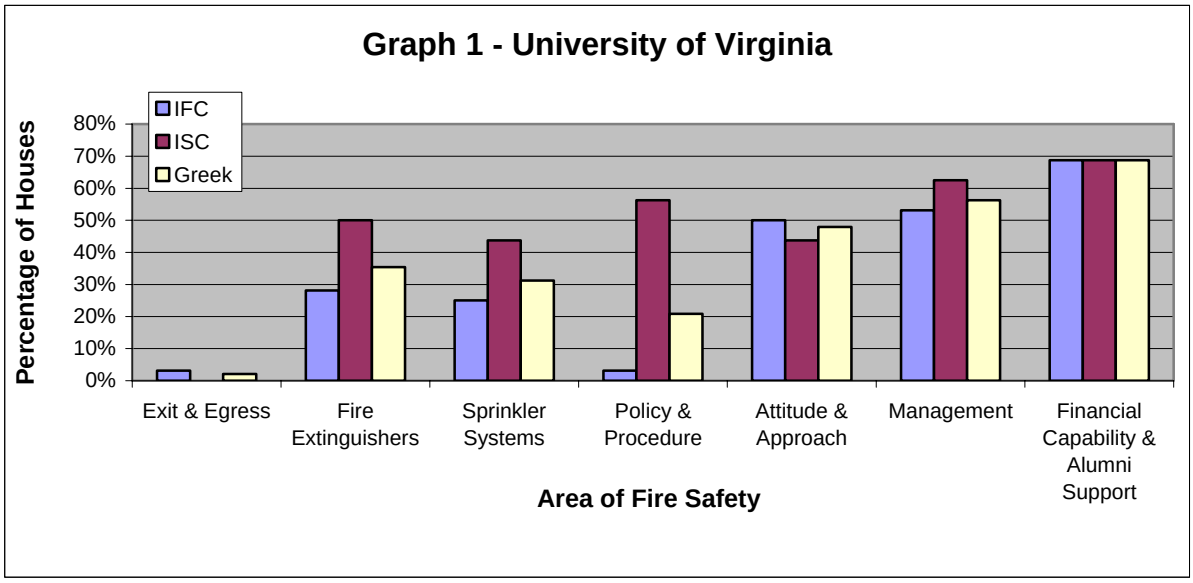
This chapter describes the current fire safety conditions of Greek houses at the University of Virginia. The Greek Housing Fire Safety Assessment addressed seven distinct areas of concern: Exit & Egress, Fire Extinguishers, Sprinkler Systems, Policy & Procedure, Attitude & Approach, Management, and Financial Capability & Alumni Support. Data analysis of the assessment shows certain areas are in particular trouble.

4.1 Greek Housing Fire Safety Assessment

The GHFSA responses were analyzed using Microsoft Excel and Access. Tables 2.1 and 2.2, shown in Appendix 2, give the responses of all 48 Greek houses. PivotTables illustrate the total number of given responses per question. Tables 3.1 and 3.2, shown in Appendix 3, offer a quick summary of the range of responses. In Microsoft Access, the data were sorted to show which houses gave certain responses. Houses were then given a "safe" rating if their answers matched certain criteria. Table 4.1, in Appendix 4, shows the requirements for receiving a "safe" rating in each area. A safe rating does not mean that the house is 100% safe, just that the house met expectations for conditions in that area of concern. Table 5.1, in Appendix 5, shows totals for both the individual houses and the seven fire safety areas. In essence, the table shows the number of "safe" houses in each area and the total number of "safe" areas for each house.

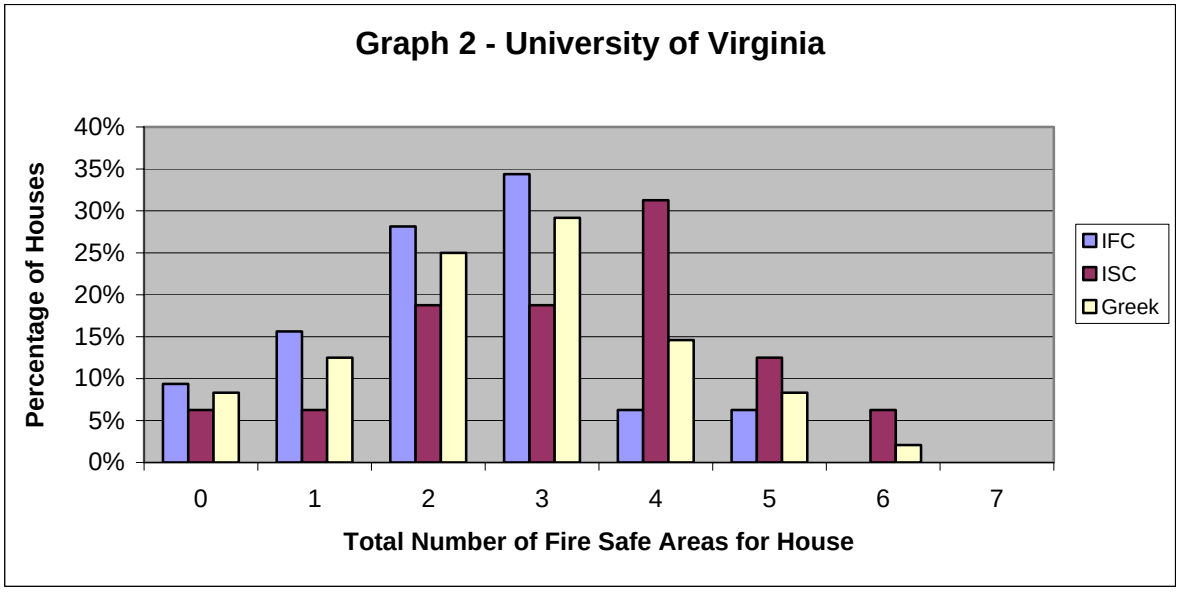
The following are graphical representations of the GHFSA data. Alternative graphs that show total numbers instead of percentages can be found in Appendix 6. Information is given for Inter-Fraternity Council houses, Inter-Sorority Council houses, and all University of Virginia Greek houses. Graph 1 shows the percentage of University of Virginia Greek

houses that earned a “safe” rating according to the seven fire safety areas. The Exit & Egress and Policy & Procedure areas of fire safety are the most deficient of the seven areas.



Graph 1 – University of Virginia. These percentages represent the number of houses that met expectations in the corresponding safety areas.

Graph 2 shows the percentage distribution of houses according to their total number of "safe" ratings. Only 50% of ISC houses and 13% of IFC houses earned 4 or more “safe” ratings on the GHFSA. A total of 4 Greek houses failed to receive any “safe” ratings in the GHFSA, and no Greek houses met expectations for all seven fire safety areas. This graph shows that the majority of fraternities and sororities received less than 3 “safe” ratings each.



Graph 2 – University of Virginia. This graph shows the percentage of houses according to the total number of "safe" ratings they earned from the GHFSA.

4.2 Physical Conditions

4.2.1 Conditions of Houses

The majority of Greek houses at the University of Virginia date from the late 1800s to early 1900s. Unfortunately, these houses are no longer used solely for their intended purpose. Both Dean Laushway of the Office of Fraternity and Sorority Life and Mr. Wilson of the Historic Renovation Corporation discussed the fact that none of the houses was intended for large social gatherings. The coeducation of the university and the raising of the drinking age, however, forced much of the social scene underground and exclusively into the fraternity houses (Laushway). This partially explains why sorority houses are in much better condition than fraternity houses. Sororities tend to have more direct house management and fewer large social gatherings than fraternities.

4.2.2 Exit & Egress

The absolute worst conditions were seen in the area of Exit & Egress. This area refers to the existence of emergency exits, emergency lighting, and a Knox Box that allows the fire department to enter in an emergency. Of all the fraternities and sororities at the University of Virginia, only 1 (2% of the Greek system) house earned a safe rating in this area. The most frequent problems included blocked exits and the lack of a Knox Box. Numerous houses, however, were also lacking sufficient and functioning emergency exit lighting.

4.2.3 Fire Extinguishers

In the area of Fire Extinguishers, 17 (35%) houses earned a safe rating. In order to receive this rating, houses had to have fire extinguishers in all major rooms and corridors that were both inspected and secured in a safe fashion. All three of these conditions are relatively inexpensive and easy to meet. A lack of proper management and concern for safety, however, often resulted in unsatisfactory fire extinguisher conditions. Most critical is the need for fire extinguishers to be inspected and maintained on a regular basis.

4.2.4 Sprinkler Systems

Only 20 (63%) fraternities and 14 (88%) sororities have sprinkler systems covering their physical properties. Of those houses, few properly inspect or maintain them. Consequently, only 15 (31%) houses earned a safe rating in the area of Sprinkler Systems. Some houses are known for “disconnecting” fire sprinkler systems during parties (Drumheller). Their reasons for doing so often come from misconceptions about fire

sprinkler systems in general. In contrast to popular belief, sprinkler heads do not all activate at once, and the damage due to water is minimal in comparison to that of a non-sprinkler fire. Although the majority of residential fires begin in the kitchen, many Greek houses fail to install or take proper care of kitchen hood systems. While 35 (73%) houses have hood systems, only 30 (63%) have ones that actually work. These hood systems can often make the difference between a small kitchen fire and a fatal house fire.

4.2.5 Fire Safety Systems

Fire engineers continue to develop more sophisticated fire protection systems. These developments include extensive monitor and control systems, which connect entire structures into one comprehensive system that is linked to the local fire department. In the event of a fire or sprinkler activation, both residents and the local fire department are alerted instantly. In most fraternities and sororities, smoke detectors are not interconnected and operate independently. If a fire occurs downstairs, those upstairs are often unaware of it until it is too late. Likewise, if a fire or sprinkler activation occurs during a holiday or summer break, there is no one there to alert emergency personnel. The resulting damage to the house can be severe if not catastrophic. The Historic Renovation Corporation connects all 12 of its houses to the local fire department for monitoring. A Knox Box is also installed so that the fire department can gain access in an emergency. This is an example of successful management and the effects it can have on the houses' physical conditions.

4.3 Policy & Procedure

Only 10 (21%) houses earned a safe rating in the area of Policy & Procedure. Despite the low cost of implementation, houses do not use programs, policies, or plans to improve fire safety. A house's policies and procedures are often a good barometer of its concern for safety. In general, houses that follow established policies and procedures are safer for members and residents.

4.3.1 Fire Safety Programs

National organizations can play an important role in the safety and stability of Greek organizations. Most chapters must meet certain criteria set forth by their national organizations for membership, insurance, and alcohol privileges. Unfortunately, few Greek organizations require any specific fire safety measures. Only 22 (46%) houses currently complete a lecture, video, or training on fire safety. These programs are often well organized and delivered, providing valuable information both to residents and house leaders. In requiring such programs, national organizations better prepare their leaders to maintain safe living conditions.

4.3.2 Fire Safety Policies

Although most national organizations do not require them, many chapters have chosen to implement their own form of fire safety policies. The three most popular policies involve bans on burning (26 Houses, 54%), smoking (25 Houses, 52%), and open flame (23 Houses, 48%). These policies are much more important than most individuals realize. Houses that have these policies show higher levels of member awareness. Policies such as

these also decrease the chances of fires ever starting. All together, 34 (71%) houses have some form of policy about fire.

4.3.3 Fire Safety Plans

All fire departments recommend the making and practicing of a fire escape plan. A total of 23 (48%) houses have an emergency plan, often designed by their national organization, outlining who to contact and what to do in a general emergency. Likewise, only 22 (46%) houses have custom designed fire escape plans. In the event of a fire, there is much less time to escape than most people realize. Residents are often unaware of the emergency egress options available to them. A comprehensive fire escape plan would show residents what to do in an emergency. Most distressing is that while 26 (54%) houses have some form of plan, only 19 (40%) have both emergency and fire plans.

4.4 Attitude & Approach and Management

4.4.1 Attitude & Approach

One of the greatest differences between Greek houses and other residences is the residents' general attitude towards safety. In the area of Attitude & Approach, 23 (48%) houses ranked safe. Residents in these Greek houses confirmed that they had pushed for improvements because of their concern for safety. One has to admit, however, that their actions do not always support this declaration. Fraternities often hold parties that push the envelopes of safety. Mr. Drumheller, of the Office of Environmental and Health Safety, believes one of the greatest problems is the decorations for these parties. Bamboo, especially, is highly flammable. In these situations, fire inspections are not enough. A better

approach is for the house leadership to be aware of these dangers and correct them before they ever become an issue.

4.4.2 Management

Management companies or undergraduate residents are usually in charge of fraternity houses. The most popular company is the Virginia Foundation's Historic Renovation Corporation (HRC). In contrast, sororities tend to rely on individual professionals. These "House Moms" are often responsible for both the maintenance of the house and the safety of the undergraduate members. While 27 (56%) houses ranked safe for Management in the GHFSA, all houses could benefit from better management. Conditions in houses that depend on professional management to arrange inspections are often much better than those that rely on residents themselves.

4.5 Financial Status

4.5.1 Current Financial Status of Houses

According to the GHFSA, 28 (58%) houses are currently capable of funding small improvements or major renovations. In truth, almost all houses can afford necessary safety improvements. Only the integration of a fire sprinkler system or the complete renovation of a house would require significant funding. In these cases, houses would have to rely on substantial alumni support.

4.5.2 Alumni Support and Sources of Future Funds

Fortunately, 35 (73%) houses have the alumni support to help fund fire safety improvements to their house. Alumni support is critical in planning and executing significant house renovations. Greek houses must often mortgage their homes, initiate a capital campaign, or raise undergraduate dues to fund house changes. This fact may explain why only 16 (33%) houses stated that they had the current funds, alumni support, and desire to make such improvements.

5 ANALYSIS OF FIRE SAFETY SOLUTIONS

This chapter includes analysis of available fire safety solutions and recommendations for implementation in Greek houses. These recommendations take into consideration the various limitations facing fraternities and sororities. The affordability of fire solutions was particularly important. For this reason, many of the more state of the art and expensive fire engineering solutions are not discussed in detail. Furthermore, the recommendations in this chapter, while focused on the University of Virginia Greek system, are relevant to all fraternities and sororities.

5.1 Special Considerations

5.1.1 Historical Buildings

Many of the fraternity and sorority houses at the University of Virginia date from the late 1800s to early 1900s. The National Fire Protection Association Committee on Libraries, Museums, and Historic Buildings outlines the significance of this fact:

> It can be recognized immediately that buildings or other structures built long ago – before standards which have come about due to scientific advancement – may be void of even elementary provisions for fire protection; for example, many structures were erected prior to the advent of electricity which, without question, has made a great contribution in the detection and control of fire. Then too, most historic buildings were designed to accommodate a very few people and were far from being public buildings (NFPA, *Committee* 3).

Since construction, houses have been renovated to include electricity and other modern conveniences. These renovations, however, push the limits of their original construction. Likewise, fire codes and standards are often vague when it comes to historic buildings. As Fire Marshal Walton explained, historic buildings are often unable to meet current exit and egress requirements due to their earlier construction.

In this case, their status as historic buildings often exempts them from such regulations. A historic classification, however, can also hinder houses from making certain external changes, resulting in difficult and expensive renovations.

5.1.2 Student Behavior in Greek Housing

A general lack of concern for safety was a recurring subject in all the expert interviews. School administrators and fire professionals all agree that residents in Greek houses need to demonstrate more responsible behavior when it comes to the care of their houses. The NFPA believes that, "Good housekeeping is extremely important and should be observed at all times! Allowing clutter or waste materials to accumulate invites fire" (NFPA, *Committee* 4). While sororities have the advantage of better house management and cleaning services, fraternities are known for their poor housekeeping. Recent fire inspections of several houses list poor housekeeping as a significant problem. Again, these conditions are generally linked to general student behavior and insufficient house management.

5.1.3 Effective House Management

Proper house management is extremely important to the safety of Greek houses. The GHFSA shows that a growing number of fraternities are turning to the Historic Renovation Corporation to manage their houses. Management companies, such as HRC, are effective ways to ensure houses receive proper inspection and maintenance. Unfortunately, most fraternities still rely on undergraduate members as house managers. These houses often fail to schedule regular inspections or maintain safety equipment. In contrast to fraternities,

sorority "House Moms" that live in the house are often in a better position than a management service to maintain safe living conditions.

5.2 Available Fire Safety Solutions

5.2.1 Physical Solutions

The most important fire safety measure in high-occupancy residences is an adequate fire sprinkler system. According to HRC, many houses took advantage of supportive tax laws and historic renovation credits to install such systems in the 1980s. Unfortunately, 14 Greek houses at the University of Virginia still lack this safety feature. While many of the tax incentives have changed since the 1980s, there still remain some state benefits for implementing fire safety improvements (Wilson). More importantly, however, Greek organizations can receive significant decreases in their insurance premiums for having fire sprinkler systems. It is within the best interests of educational institutions, national Greek organizations, and individual chapters to add sprinkler systems. The formation of limited liability partnerships, similar to HRC in the 1980s, is an excellent example of these groups getting together to promote safety.

On a smaller scale, however, houses can begin to improve physical living conditions on their own. Houses should consider the following, less expensive, recommendations to make their houses safer:

- Install a Knox Box at the front door
- Keep exits free of debris and other blockages
- Repair and maintain emergency exit lighting

- Install fire extinguishers in all major rooms and corridors
- Secure fire extinguishers in a safe and accessible fashion
- Inspect all physical equipment on a routine basis

These measures, while inexpensive, can make a huge difference in the event of a fire or sprinkler activation. Unfortunately, most houses only realize their importance after an emergency.

5.2.2 Policy and Procedural Solutions

The majority of fraternities and sororities fail to effectively use policies and procedures to protect their houses and residents from fire. Only 10 (21%) houses have preventative programs, policies, and plans for fire emergencies. All houses would benefit from implementing these free and effective solutions. This study recommends the following:

- Greek organizations should require preventative programs in the form of lectures, videos, or training at the start of each school year.
- Chapters should institute policies that guide their members in the safe use of fire.
- Chapters should create and practice a house fire plan each semester.

5.2.3 Attitude & Approach Solutions

In Attitude & Approach, 23 (48%) houses earned a safe rating on the GHFSA. This area focuses on both the house's desires to improve and the steps they have taken to do so. It is interesting to note that while 33 (69%) houses show a strong concern for safety, only 23

(48%) have pushed for improvement in the past 5 years. Apathy is a difficult hurdle for most houses to overcome. In order for Greek houses to effectively transform, their leadership must learn to promote safety in the chapter's daily operations. Greek organizations and educational institutions should offer help to these individuals in the form of training and leadership development. House leadership should be capable of:

- developing a safety plan for all parties and social gatherings
- conducting an annual review of safety measures
- disciplining residents for safety violations
- educating undergraduate members on safety

5.2.4 Management Solutions

House management is an operational area that affects all other areas of house safety. Currently, 29 (60%) houses employ some form of professional to manage their house. Houses that attempt to manage their own properties often neglect regular safety inspections. These houses also take on additional liability in the event of an accident. Essentially, undergraduate managers lack the expertise and legal responsibility to do an effective job. These individuals are not educated in the complexities of house management and typically hold the position for only one year. This lack of education and experience means houses do not receive sufficient management of their safety systems. It is recommended that Greek houses hire a management service that can arrange:

- annual fire inspections
- routine fire sprinkler inspection and testing
- routine fire extinguisher inspection and maintenance
- maintenance of all other physical fire safety equipment

6 CONCLUSION

This chapter summarizes and interprets the results of the thesis project before going on to make recommendations for implementation. The objectives of this thesis were to establish the current level of fire safety in Greek housing at the University of Virginia, analyze the available fire engineering solutions, and offer recommendations for Greek houses in general. The recommendations, while designed for Greek houses at the University of Virginia, are applicable to similar Greek systems across the nation.

6.1 Summary

The Greek Housing Fire Safety Assessment (GHFSA) looks at Exit & Egress, Fire Extinguishers, Sprinkler Systems, Policy & Procedure, Attitude & Approach, Management, and Financial Capability & Alumni Support to determine fire safety conditions in Greek houses. The 2005 GHFSA found that University of Virginia fraternities and sororities need to improve in all seven areas and should begin with comprehensive fire inspections.

The GHFSA determines problem areas, which fire inspections can then explore in further detail. At the University of Virginia, Greek houses are severely lacking in all areas, reflecting the need for comprehensive fire inspections and extensive improvements to fire safety measures. Specifically, the GHFSA found that Greek houses need to address their deteriorating physical conditions through the allocation of house funds for physical improvements. In particular, these funds need to address the extreme deficiencies in Exit & Egress conditions. Likewise, fraternities and sororities need to evaluate the number and condition of fire extinguishers in their houses. Since fire inspections are infrequent, houses often neglect to purchase or maintain these life saving devices. Fortunately, 34 (71%) Greek

houses have comprehensive fire sprinkler systems. The University of Virginia, however, needs to help the 14 Greek houses still lacking these effective life saving devices. The Office of Environmental and Health Safety should assist these houses in coordinating the installation and maintenance of fire sprinkler systems.

In conjunction with these physical improvements, the City of Charlottesville, Albemarle County, University of Virginia, and individual Greek organizations need to work together to establish effective policies and procedures for maintaining safe living conditions. Currently, the City of Charlottesville and Albemarle County have an irregular relationship with fraternity and sorority houses. In addition, Greek houses have an almost nonexistent relationship with the University of Virginia. Finally, national Greek organizations are still lacking in their support of fire safety programs and requirements. House leadership needs assistance from these groups in promoting a positive attitude and approach to fire safety. The lack of proper house management is perhaps the most influential factor affecting overall student safety. Houses need effective management to guarantee that fire inspections take place and living conditions are safe. The good news is that, with help from the surrounding communities and proper planning, houses are financially capable of making the necessary changes for safer living conditions.

6.2 Interpretation

This study revealed which fire safety areas are the most deficient in fraternities and sororities. It likewise revealed that a lack of coordination between chapters, national organizations, school administrators, and fire professionals is keeping houses from reaching their safest potential. At the University of Virginia, the Office of Fraternity and Sorority Life

is in an excellent position to coordinate change. The OFSL already maintains communication with chapters, national Greek organizations, the University of Virginia, and fire professionals. Now, the OFSL should establish a precedence of requiring fire inspections, coordinating them with the fire department, and promoting national Greek organizations to execute the necessary improvements.

While the GHFSA was of University of Virginia Greek houses, the significance of the results goes beyond the University of Virginia. Greek houses across the United States suffer from similarly deficient fire safety conditions. Although Greek systems and government regulations differ depending on the school, most Greek houses are struggling with the same root causes. It is important, therefore, that Greek houses evaluate their own strengths and weaknesses before implementing changes. If possible, a fire marshal should evaluate houses following an in-depth fire inspection. In this GHFSA, that was impossible because most University of Virginia Greek houses have not had recent fire inspections. Therefore, one limitation of the GHFSA is that it is not based on official fire inspection data. Despite these limitations, however, the results show that fraternities and sororities are in need of improvement.

6.3 Recommendations

Greek houses at the University of Virginia should follow the specific recommendations found in Chapter 5. Greek houses across the United States, however, can also benefit from analyzing the trends seen in the GHFSA. In evaluating the responses to the seven areas of concern, certain root causes presented themselves. These root causes, such as

an insufficient number of fire inspections and poor house management, made other safety conditions worse.

Greek houses that lack sufficient house management and regular fire inspections have a greater number of fire safety deficiencies overall. Sufficient house management and regular fire inspections are the heart of any fire safety system. All fraternity and sorority houses, therefore, should strive to promote greater involvement from local government, schools, and alumni. Each of these groups has an interest in the safety of Greek students. In looking at the GHFSA and following its recommendations, educational communities can greatly improve student safety.

The GHFSA or a derivative should also be applied to Greek systems across the United States. Data from a greater number of schools will show deficiencies in individual Greek systems and begin to illuminate trends on a national level. It is likewise recommended that the GHFSA be refined to include more in-depth questioning. At this stage, it was impossible to ask house residents more detailed questions. In the future, however, fire inspectors can answer more specific questions following an inspection. Again, getting all Greek houses to improve house management and request a fire inspection would be a huge success in itself.

BIBLIOGRAPHY

Bellis, Mary. "Fire Fighting – Inventions." Inventors. Oct. 2004. Oct. 2004 <http://inventors.about.com/library/inventors/blfiresprinkler.htm>.

Brown, Gilmer C. "Report on Survey of Fire Hazards on Copeley Hill." Undergraduate thesis. U of Virginia, 1949.

Dewar, Buddy. Fraternity and Sorority House Fire Safety. June 2004. National Fire Sprinkler Association. PowerPoint. Oct. 2004. <http://www.usfa.fema.gov/downloads/ppt/campus/greekhowtoslides.ppt>.

Drumheller, Gerald. Personal interview. 7 Feb. 2005.

Historic Renovation Corporation. March 2005. University of Virginia Foundation. March 2005. <http://www.uvafoundation.com/historicrenovation.html>

Institution of Fire Engineers. 20 Oct. 2004. Institution of Fire Engineers. 28 Oct. 2004 <http://www.ife.org.uk>

Laushway, Francis. Personal interview. 3 Feb. 2005.

National Fire Protection Association. Committee on Libraries, Museums, and Historic Buildings. Protecting our Heritage; a Discourse on Fire Protection and Prevention in Historic Buildings and Landmarks. 2nd ed. Boston: National Fire Protection Association, 1970.

National Fire Protection Association. Dormitory Structure Fires. Oct. 2004. Quincy, MA: National Fire Protection Association, 2004.

National Fire Protection Association. Oct. 2004. National Fire Protection Association Oct. 2004. <http://www.nfpa.org>

Rich, Gary L. "Cost Analysis of Fire Sprinkling Systems." Undergraduate thesis. U of Virginia, 1988.

U.S. Fire Administration. Oct. 2004. U.S. Fire Administration. Oct. 2004. <http://www.usfa.fema.gov>

U.S. Fire Administration. Dormitory Fires. Vol. 1. Washington: U.S. Fire Administration. 2001.

U.S. Fire Administration. Fraternity and Sorority House Fires. Vol. 2. Washington: U.S. Fire Administration. 2002.

U.S. Fire Administration. Residential Structure Fires in 2000. Vol. 3. Washington: U.S. Fire Administration. 2004.

Walton, Stephen. Personal interview. 7 Feb. 2005.

Wilson, James. Personal interview. 4 Feb. 2005.

APPENDIX 1 – GREEK HOUSING FIRE SAFETY ASSESSMENT

Background Information	Thanks for taking the time to answer a few questions. The survey is just 2 short pages. Please fill in the following information so I can keep your information together.
Organization Name:	
Your Name:	
Your Email:	

Introduction	This section of questions focuses on the physical fire safety measures in your Greek house.	
Physical		
Exit & Egress		
1. Does your house have a Knox Box outside the front door? (allows the fire dept. to enter your house during a fire and then contact you)	| ○ Yes | ○ No |	◉ N/A
2. Are exits/corridors blocked or obstructed? (this includes blocking doors during parties or storing boxes in hallways)	| ○ Yes, permanently | ○ Yes, routinely | ○ Occasionally | ○ No, never |	◉ N/A
3. Does your house have sufficient and functioning exit lighting?	| ○ Yes | ○ Sufficient, Non-functioning | ○ Non-sufficient, Functioning | ○ None |	◉ N/A
Fire Extinguishers		
4. Does your house have fire extinguishers in all major rooms/corridors?	| ○ Yes | ○ Some | ○ No |	◉ N/A
5. Do they receive regular inspection and maintenance?	| ○ Yes | ○ Sometimes | ○ No |	◉ N/A
6. Are they secured in a safe and effective fashion? (ie, in a cabinet or on a hanger... rather than sitting on the ground)	| ○ Yes | ○ Some | ○ No |	◉ N/A
Sprinkler Systems		
7. Does your house have a fire sprinkler system?	| ○ Yes | ○ In Some Areas | ○ No |	◉ N/A
8. Does it receive regular inspections?	| ○ Yes | ○ Sometimes | ○ No |	◉ N/A
9. Does your house have a hood-system in the kitchen?	| ○ Yes | ○ Existant, Non-Functioning | ○ No |	◉ N/A

Submit Page One Reset

Background Information	Page 2 of 2
Your Name:	

Introduction	This section focuses on fire safety measures outside of physical improvements.	
Policy and Procedure		
10. Does your house have an official fire/emergency plan? (ie, *what to do in an emergency* or a *fire escape plan*)	| ○ Yes, both | ○ Emergency Plan | ○ Fire Plan | ○ No, neither |	◉ N/A
11. Does your house have a policy about members igniting fires? (ie, fines for fires or smoking indoors)	| ○ Yes | ○ No Smoking | ○ No Open Flame | ○ No Burning | ○ No |	◉ N/A
12. Does your national organization or insurance require the completion of any fire safety programs?	| ○ Yes | ○ Training | ○ Lecture | ○ Video | ○ None |	◉ N/A
Attitude and Approach		
13. Do the members of your organization take safety seriously?	| ○ Yes | ○ Most | ○ Some | ○ No |	◉ N/A
14. Do your house officers attempt to promote safety within the house?	| ○ Yes | ○ Sometimes | ○ During Special Events | ○ No |	◉ N/A
15. In the past 5 years, has there been any push to improve safety?	| ○ Yes | ○ Yes, from Alumni | ○ Yes, from Members | ○ No |	◉ N/A
16. Does your house host open/invite parties with alcohol?	| ○ Yes | ○ No |	◉ N/A
Management		
17. Does your house get regular fire inspections?	| ○ Yes | ○ Sometimes | ○ No |	◉ N/A
18. Does someone manage your house? (either a management company, house mom, or designated member)	| ○ Yes, Business | ○ Yes, Professional | ○ Yes, Member | ○ No |	◉ N/A
19. Name of Management Company or Individual:		○ N/A
Financial Capability and Alumni Support		
20. To your knowledge, does your house have the ability to fund necessary fire safety improvements?	| ○ Yes, Major Renovations | ○ Yes, Small Improvements | ○ No |	◉ N/A
21. If the majority of your house thought it important, could you raise funds from alumni to complete needed improvements?	| ○ Yes, Easy | ○ Yes, Difficult | ○ Maybe | ○ No |	◉ N/A

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APPENDIX 2 – GHFSA RESPONSES

Table 2.1 - GHFSA IFC Responses

Identification	1. Knox Box	2. Exits blocked	3. Exit lighting	4. Fire extinguishers	5. FE inspected	6. FE secured	7. Fire sprinklers	8. Sprinklers inspected	9. Hood system	10. Emergency plans	11. Policies
IFC 1	No	No Never	Non Sufficient Functioning	Yes	Yes	Some	No	NA	Existant Non Functioning	Emergency Plan	No Burning
IFC 2	No	No Never	None	Some	No	Yes	No	NA	No	Yes Both	Yes
IFC 3	No	No Never	None	Some	Sometimes	Yes	No	NA	No	No	No Smoking
IFC 4	No	No Never	Yes	Some	Sometimes	Some	No	NA	No	No	No
IFC 5	No	Occasionally	Yes	Yes	Yes	Some	No	NA	Yes	No	No
IFC 6	No	No Never	Yes	Yes	Sometimes	Some	In Some Areas	Sometimes	Yes	No	No Open Flame
IFC 7	Yes	Occasionally	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
IFC 8	No	No Never	Sufficient Non Functioning	No	No	Yes	Yes	No	No	No	No Burning
IFC 9	No	No Never	Yes	No	NA	NA	Yes	Sometimes	Yes	No	Yes
IFC 10	Yes	Occasionally	Yes	Some	Yes	Yes	Yes	Yes	No	Fire Plan	No
IFC 11	No	No Never	Yes	Some	Sometimes	Some	Yes	Yes	Yes	Yes Both	No
IFC 12	No	Occasionally	Yes	Yes	Yes	Yes	Yes	Sometimes	Yes	No	No
IFC 13	No	No Never	Non Sufficient Functioning	Yes	Yes	Some	In Some Areas	Sometimes	No	Yes Both	No
IFC 14	No	No Never	Yes	Yes	Sometimes	Yes	Yes	Yes	Existant Non Functioning	Emergency Plan	Yes
IFC 15	No	Occasionally	Yes	Yes	Yes	Yes	No	NA	Existant Non Functioning	No	Yes
IFC 16	No	Occasionally	Yes	Some	Sometimes	Some	Yes	Yes	Yes	Fire Plan	No Burning
IFC 17	No	Occasionally	Yes	No	Sometimes	Some	Yes	Yes	Yes	No	No Open Flame
IFC 18	Yes	Occasionally	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
IFC 19	Yes	Occasionally	Yes	Yes	Sometimes	Yes	Yes	Sometimes	Yes	Fire Plan	No Open Flame
IFC 20	No	No Never	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
IFC 21	Yes	Occasionally	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
IFC 22	No	Occasionally	Yes	Some	Yes	Yes	Yes	Sometimes	Existant Non Functioning	Emergency Plan	Yes
IFC 23	Yes	No Never	Yes	Some	Sometimes	Yes	Yes	Sometimes	Yes	No	No Burning
IFC 24	No	Occasionally	Yes	Some	Yes	Yes	In Some Areas	Yes	Yes	Yes Both	No Burning
IFC 25	No	Occasionally	Yes	Yes	Yes	Some	Yes	Yes	Yes	No	Yes
IFC 26	Yes	Occasionally	Non Sufficient Functioning	Some	Yes	Yes	Yes	Sometimes	No	No	No Burning
IFC 27	No	No Never	Yes	Some	Sometimes	Yes	Yes	Yes	Yes	No	No
IFC 28	Yes	Occasionally	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
IFC 29	No	Occasionally	Yes	Yes	Yes	Yes	No	NA	Yes	Yes Both	No
IFC 30	No	Occasionally	Sufficient Non Functioning	Some	No	Yes	Yes	Sometimes	Yes	Emergency Plan	No
IFC 31	No	Occasionally	Yes	Yes	Yes	Yes	In Some Areas	No	Existant Non Functioning	No	No Smoking
IFC 32	No	Occasionally	Sufficient Non Functioning	No	No	No	Yes	No	No	Yes Both	Yes

12. Programs	13. Attitude	14. Officers promote safety	15. Push to improve	16. Host Parties	17. Fire Inspections	18. Manager	19. Management Company	20. Funding Ability	21. Alumni support
None	Most	Sometimes	Yes	Yes	Yes	Yes Member	Andrew Hanson	Yes Small Improvements	Yes Easy
NA	Yes	Yes	No	Yes	No	No	NA	Yes Small Improvements	Maybe
None	Some	Sometimes	No	Yes	Yes	No	NA	No	Maybe
NA	Yes	Yes	Yes	Yes	Yes	Yes Business	NA	Yes Small Improvements	Maybe
None	Most	Yes	Yes	Yes	Yes	Yes Member	Adam Matthews	Yes Major Renovations	Yes Easy
Lecture	Some	Sometimes	Yes	Yes	Sometimes	Yes Business	The Corp	No	Maybe
Lecture	Most	Yes	Yes	Yes	Yes	Yes Business	HRC	Yes Major Renovations	Yes Difficult
None	Most	Yes	No	Yes	No	Yes Member	Andrew Lowry	Yes Small Improvements	Yes Difficult
Lecture	Some	Yes	Yes From Members	Yes	Sometimes	Yes Member	Tyndall Ellis	Yes Small Improvements	Yes Difficult
NA	Most	Yes	Yes	Yes	No	Yes Member	NA	Yes Small Improvements	Yes Difficult
Yes	No	No	Yes	Yes	Yes	Yes Business	Hasbrouck Realty	Yes Major Renovations	Yes Easy
None	Yes	Yes	Yes	Yes	Sometimes	Yes Member	Tripp Rice	No	Yes Difficult
None	Most	Yes	No	No	Yes	Yes Business	NA	Yes Small Improvements	Yes Easy
None	Most	Yes	Yes	Yes	Yes	Yes Member	Jesse Lund	Yes Major Renovations	Yes Difficult
Lecture	Yes	Yes	Yes	Yes	Yes	Yes Member	NA	Yes Small Improvements	Yes Difficult
NA	Most	Yes	Yes	Yes	Yes	Yes Business	Column Club	No	Maybe
NA	Yes	Yes	Yes	Yes	Yes	Yes Business	HRC	Yes Major Renovations	Yes Easy
None	No	Sometimes	Yes	Yes	Yes	Yes Business	Downer Realty	Yes Small Improvements	Yes Easy
NA	Yes	Sometimes	Yes From Members	Yes	Yes	Yes Business	HRC	Yes Small Improvements	Yes Easy
Some	Most	Yes	Yes	Yes	Yes	Yes Member	David Flint, Robert Downer	Yes Small Improvements	Maybe
NA	No	No	No	Yes	Yes	Yes Business	HRC	No	Maybe
Yes	Yes	Yes	Yes	Yes	Yes	Yes Business	HRC	Yes Small Improvements	Yes Difficult
NA	Some	Yes	Yes	Yes	Yes	Yes Business	HRC	No	Maybe
NA	Yes	Yes	Yes	Yes	Yes	Yes Business	HRC	Yes Small Improvements	Yes Difficult
None	Some	Yes	Yes	Yes	Yes	Yes Member	Eta Alumni Inc.	Yes Small Improvements	Yes Difficult
Lecture	Some	Yes	Yes	Yes	Yes	Yes Business	HRC	Yes Small Improvements	Yes Easy
Yes	Yes	Yes	Yes	Yes	Yes	Yes Business	HRC	Yes Small Improvements	Yes Difficult
None	Most	Yes	Yes From Alumni	Yes	Yes	Yes Business	HRC	Yes Major Renovations	Yes Easy
NA	Most	Sometimes	No	Yes	Yes	Yes Member	Chris Winter	Yes Small Improvements	Yes Easy
None	Most	Yes	Yes From Members	Yes	Sometimes	Yes Business	HRC	Yes Small Improvements	Maybe
Yes	Most	Yes	No	Yes	Yes	Yes Member	NA	Yes Small Improvements	Yes Difficult
Lecture	Most	Yes	Yes	Yes	Sometimes	Yes Member	Charlie Kollmansperger	Yes Small Improvements	Yes Difficult

Table 2.2 - GHFSA ISC Responses

Identification	1. Knox Box	2. Exits blocked	3. Exit lighting	4. Fire extinguishers	5. FE inspected	6. FE secured	7. Fire sprinklers	8. Sprinklers inspected	9. Hood system	10. Emergency plans	11. Policies	12. Programs	13. Attitude
ISC 1	No	Occasionally	Non Sufficient Functioning	Some	Yes	Yes	Yes	Yes	Yes	No	Yes	None	Most
ISC 2	No	No Never	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes Both	Yes	Yes	Most
ISC 3	No	No Never	Non Sufficient Functioning	No	No	No	Yes	Sometimes	Yes	No	Yes	None	Yes
ISC 4	No	No Never	Yes	Some	Sometimes	Yes	Yes	Sometimes	No	Yes Both	Yes	Yes	Most
ISC 5	No	Yes Routinely	Yes	Some	No	No	Yes	No	Yes	Yes Both	No Smoking	Yes	Some
ISC 6	No	Occasionally	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes Both	No Smoking	Yes	Yes
ISC 7	No	No Never	Yes	Some	Sometimes	Yes	Yes	Sometimes	Yes	Yes Both	Yes	None	Yes
ISC 8	No	No Never	Yes	Yes	No	Yes	No	No	Yes	Yes Both	Yes	Yes	Yes
ISC 9	No	Occasionally	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes Both	Yes	Yes	Most
ISC 10	No	Occasionally	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes Both	No Smoking	Yes	Yes
ISC 11	No	Occasionally	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes Both	Yes	Lecture	Most
ISC 12	Yes	Occasionally	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	None	Some
ISC 13	No	No Never	Yes	Some	Yes	Yes	In Some Areas	Yes	Yes	Yes Both	Yes	Yes	Yes
ISC 14	No	No Never	Yes	Yes	Sometimes	Yes	Yes	Sometimes	No	Yes Both	Yes	Yes	Most
ISC 15	No	No Never	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes Both	Yes	Yes	Yes
ISC 16	No	Occasionally	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes Both	Yes	Yes	Most

14. Officers promote safety	15. Push to improve	16. Host Parties	17. Fire Inspections	18. Manager	19. Management Company	20. Funding Ability	21. Alumni support
Yes	No	No	Yes	Yes Professional	Jill Abraham	Yes Small Improvements	Maybe
Sometimes	No	No	Yes	Yes Professional	NA	No	Yes Difficult
Yes	No	No	Sometimes	Yes Business	House Corporation Board	Yes Small Improvements	Yes Easy
Yes	No	No	Yes	Yes Business	House Corp, Lennie Clore	Yes Major Renovations	Yes Easy
Sometimes	No	No	No	Yes Business	Piedmont Management, Kari Gibson	Yes Major Renovations	Maybe
Yes	Yes	No	Yes	Yes Professional	NA	Yes Small Improvements	Yes Easy
Yes	No	No	Yes	Yes Business	NA	Yes Small Improvements	Yes Easy
Yes	Yes	No	Sometimes	Yes Member	Tracy Johnson	Yes Small Improvements	Yes Difficult
Yes	Yes	No	Yes	NA	NA	Yes Major Renovations	Yes Easy
Yes	No	No	Yes	Yes Professional	Rachel Micas, Susan Dallas, Katie Parkerson	Yes Major Renovations	Yes Difficult
Yes	No	No	Yes	Yes Professional	Karen Dougland	Yes Small Improvements	Yes Easy
Sometimes	No	No	No	Yes Business	HRC	No	No
Yes	Yes From Alumni	No	Yes	Yes Member	Virginia Botsford and Ila Hughes	Yes Small Improvements	Yes Easy
Yes	Yes	No	Sometimes	Yes Member	Betsy Crouch	Yes Major Renovations	Yes Difficult
Yes	Yes	No	Yes	Yes Professional	Laura Gunlicks	Yes Small Improvements	Yes Easy
Yes	Yes	No	Yes	Yes Professional	Allison Klass	Yes Major Renovations	No

APPENDIX 3 – GHFSA PIVOTTABLES

Table 3.1 - PivotTables IFC (1/2)

Count of House	
1. Knox Box	Total
No	24
Yes	8
Grand Total	32

Count of House	
2. Exits blocked	Total
No Never	13
Occasionally	19
Grand Total	32

Count of House	
3. Exit lighting	Total
Non Sufficient Functioning	3
None	2
Sufficient Non Functioning	3
Yes	24
Grand Total	32

Count of House	
4. Fire extinguishers	Total
No	4
Some	12
Yes	16
Grand Total	32

Count of House	
5. FE inspected	Total
NA	1
No	4
Sometimes	10
Yes	17
Grand Total	32

Count of House	
6. FE secured	Total
NA	1
No	1
Some	9
Yes	21
Grand Total	32

Count of House	
7. Fire sprinklers	Total
In Some Areas	4
No	8
Yes	20
Grand Total	32

Count of House	
8. Sprinklers inspected	Total
NA	7
No	3
Sometimes	9
Yes	13
Grand Total	32

Count of House	
9. Hood system	Total
Existant Non Functioning	5
No	9
Yes	18
Grand Total	32

Count of House	
10. Emergency plans	Total
Emergency Plan	4
Fire Plan	3
No	19
Yes Both	6
Grand Total	32

Count of House	
11. Policies	Total
No	13
No Burning	6
No Open Flame	3
No Smoking	2
Yes	8
Grand Total	32

Count of House	
12. Programs	Total
Lecture	6
NA	10
None	11
Some	1
Yes	4
Grand Total	32

Table 3.1 - PivotTables IFC (2/2)

Count of House	
13. Attitude	Total
Most	14
No	3
Some	6
Yes	9
Grand Total	32

Count of House	
14. Officers promote safety	Total
No	2
Sometimes	6
Yes	24
Grand Total	32

Count of House	
15. Push to improve	Total
No	7
Yes	21
Yes From Alumni	1
Yes From Members	3
Grand Total	32

Count of House	
16. Host Parties	Total
No	1
Yes	31
Grand Total	32

Count of House	
17. Fire Inspections	Total
No	3
Sometimes	5
Yes	24
Grand Total	32

Count of House	
18. Manager	Total
No	2
Yes Business	17
Yes Member	13
Grand Total	32

Count of House	
19. Management Company	Total
Adam Matthews	1
Andrew Hanson	1
Andrew Lowry	1
Charlie Kollmansperger	1
Chris Winter	1
Column Club	1
David Flint, Robert Downer	1
Downer Realty	1
Eta Alumni Inc.	1
Hasbrouck Realty	1
HRC	11
Jesse Lund	1
NA	7
Tripp Rice	1
Tyndall Ellis	1
The Corp	1
Grand Total	32

Count of House	
20. Funding Ability	Total
No	6
Yes Major Renovations	6
Yes Small Improvements	20
Grand Total	32

Count of House	
21. Alumni support	Total
Maybe	9
Yes Difficult	13
Yes Easy	10
Grand Total	32

Table 3.2 - PivotTables ISC (1/2)

Count of House	
1. Knox Box	Total
No	15
Yes	1
Grand Total	16

Count of House	
2. Exits blocked	Total
No Never	8
Occasionally	7
Yes Routinely	1
Grand Total	16

Count of House	
3. Exit lighting	Total
Non Sufficient Functioning	2
Yes	14
Grand Total	16

Count of House	
4. Fire extinguishers	Total
No	1
Some	5
Yes	10
Grand Total	16

Count of House	
5. FE inspected	Total
No	3
Sometimes	3
Yes	10
Grand Total	16

Count of House	
6. FE secured	Total
No	2
Yes	14
Grand Total	16

Count of House	
7. Fire sprinklers	Total
In Some Areas	1
No	1
Yes	14
Grand Total	16

Count of House	
8. Sprinklers inspected	Total
No	2
Sometimes	4
Yes	10
Grand Total	16

Count of House	
9. Hood system	Total
NA	2
No	2
Yes	12
Grand Total	16

Count of House	
10. Emergency plans	Total
No	3
Yes Both	13
Grand Total	16

Count of House	
11. Policies	Total
No	1
No Smoking	3
Yes	12
Grand Total	16

Count of House	
12. Programs	Total
Lecture	1
None	4
Yes	11
Grand Total	16

Count of House	
13. Attitude	Total
Most	7
Some	2
Yes	7
Grand Total	16

Count of House	
14. Officers promote safety	Total
Sometimes	3
Yes	13
Grand Total	16

Count of House	
15. Push to improve	Total
No	9
Yes	6
Yes From Alumni	1
Grand Total	16

Table 3.2 - PivotTables ISC (2/2)

Count of House	
16. Host Parties	Total
No	16
Grand Total	16

Count of House	
17. Fire Inspections	Total
No	2
Sometimes	3
Yes	11
Grand Total	16

Count of House	
18. Manager	Total
NA	1
Yes Business	5
Yes Member	3
Yes Professional	7
Grand Total	16

Count of House	
19. Management Company	Total
Allison Klass	1
Betsy Crouch	1
House Corp, Lennie Clore	1
House Corporation Board	1
HRC	1
Jill Abraham	1
Karen Dougland	1
Laura Gunlicks	1
NA	4
Piedmont Management, Kari Gibson	1
Rachel Micas, Susan Dallas, Katie Parkerson	1
Tracy Johnson	1
Virginia Botsford and Ila Hughes	1
Grand Total	16

Count of House	
20. Funding Ability	Total
No	2
Yes Major Renovations	6
Yes Small Improvements	8
Grand Total	16

Count of House	
21. Alumni support	Total
Maybe	2
No	2
Yes Difficult	4
Yes Easy	8
Grand Total	16

APPENDIX 4 – QUALIFICATIONS FOR SAFE RATINGS

Table 4.1 - Qualifications for Safe Rating

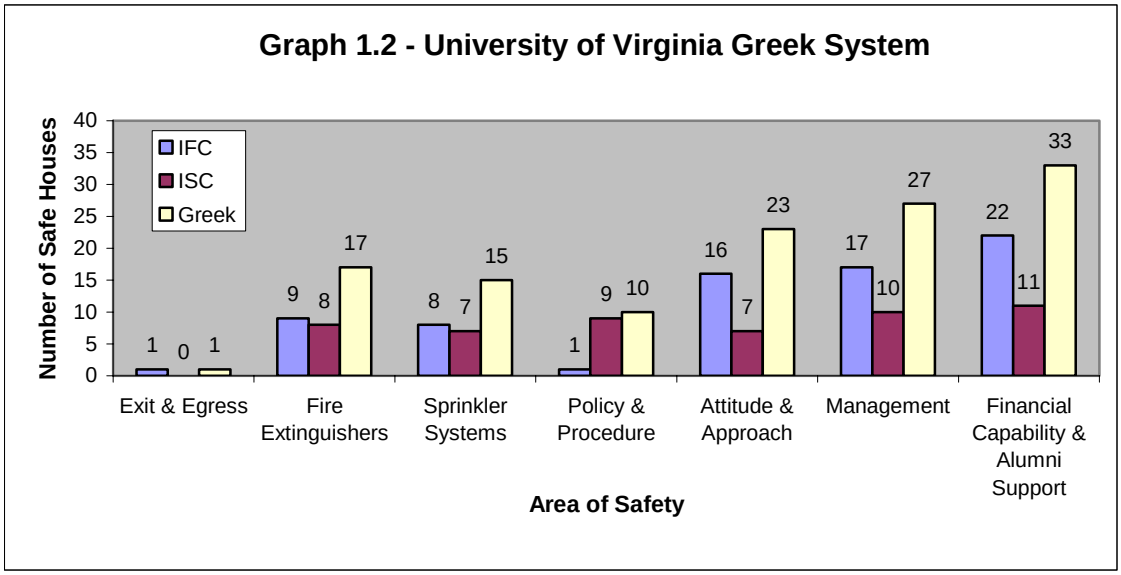
Question No.	Question	Qualifying Answers
Exit & Egress		
1	Does your house have a Knox Box outside the front door?	Yes
2	Are exits/corridors blocked or obstructed?	No Never
3	Does your house have sufficient and functioning exit lighting?	Yes
Fire Extinguishers		
4	Does your house have fire extinguishers in all major rooms/corridors?	Yes
5	Do they receive regular inspection and maintenance?	Yes
6	Are they secured in a safe and effective fashion?	Yes
Sprinkler Systems		
7	Does your house have a fire sprinkler system?	Yes
8	Does it receive regular inspections?	Yes
9	Does your house have a hood-system in the kitchen?	Yes
Policy & Procedure		
10	Does your house have an official fire/emergency plan?	Yes Both
11	Does your house have a policy about members igniting fires?	Yes
12	Does your national organization or insurance require the completion of any fire safety programs?	Yes, Training, Lecture, Video
Attitude & Approach		
13	Do the members of your organization take safety seriously?	Yes, Most
14	Do your house officers attempt to promote safety within the house?	Yes
15	In the past 5 years, has there been any push to improve safety?	Yes, Yes Alumni, Yes Members
Management		
5	Do they (fire extinguishers) receive regular inspection and maintenance?	Yes, Sometimes
8	Does it (sprinkler system) receive regular inspections?	Yes, Sometimes
17	Does your house get regular fire inspections?	Yes
18	Does someone manage your house?	Yes Business, Yes Professional, Yes Member
Financial Capability & Alumni Support		
20	To your knowledge, does your house have the ability to fund necessary fire safety improvements?	Yes Major Renovations, Yes Small Improvements
21	If the majority of your house thought it important, could you raise funds from alumni to complete needed improvements?	Yes Easy, Yes Difficult

APPENDIX 5 – COMPREHENSIVE SAFE RATING TABLE

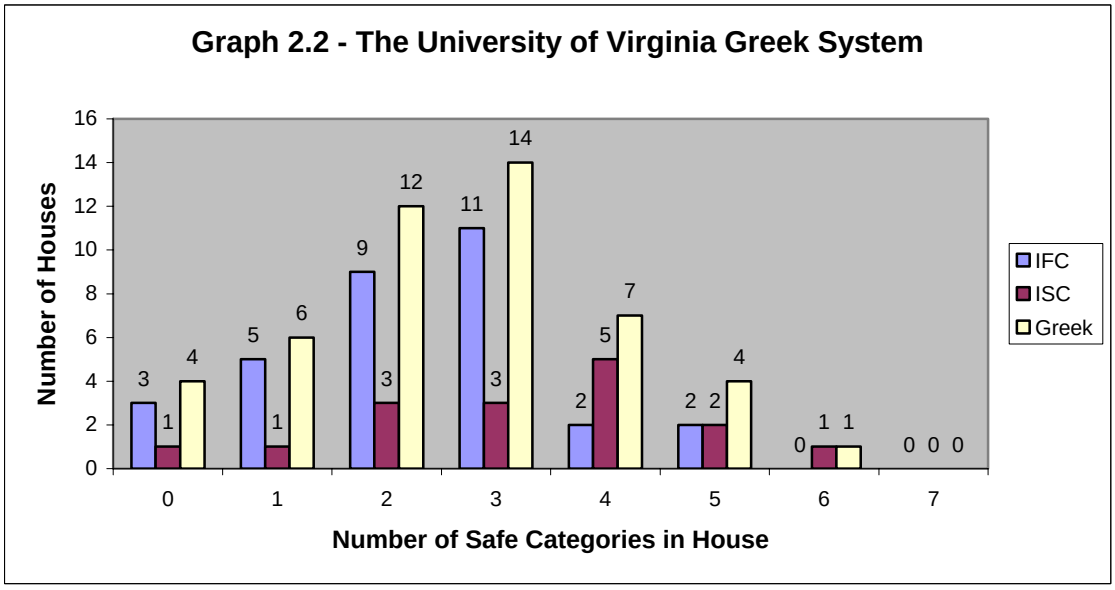
Table 5.1 - GHFSA Analysis

Identification	Exit & Egress	Fire Extinguishers	Sprinkler Systems	Policy and Procedure	Attitude and Approach	Management	Financial Capability and Alumni Support	Total	Total Percentage
IFC 1							1	1	14%
IFC 2								0	0%
IFC 3								0	0%
IFC 4					1			1	14%
IFC 5					1		1	2	29%
IFC 6								0	0%
IFC 7		1	1		1	1	1	5	71%
IFC 8							1	1	14%
IFC 9							1	1	14%
IFC 10					1		1	2	29%
IFC 11			1			1	1	3	43%
IFC 12		1			1			2	29%
IFC 13						1	1	2	29%
IFC 14					1	1	1	3	43%
IFC 15		1			1		1	3	43%
IFC 16			1		1	1		3	43%
IFC 17			1		1	1	1	4	57%
IFC 18		1				1	1	3	43%
IFC 19						1	1	2	29%
IFC 20		1			1	1		3	43%
IFC 21		1	1			1		3	43%
IFC 22					1	1	1	3	43%
IFC 23	1					1		2	29%
IFC 24					1	1	1	3	43%
IFC 25			1			1	1	3	43%
IFC 26						1	1	2	29%
IFC 27			1		1	1	1	4	57%
IFC 28		1	1		1	1	1	5	71%
IFC 29		1					1	2	29%
IFC 30					1			1	14%
IFC 31		1					1	2	29%
IFC 32				1	1		1	3	43%
Total	**1**	**9**	**8**	**1**	**16**	**17**	**22**	**74**	**33%**
Total Percentage	**3%**	**28%**	**25%**	**3%**	**50%**	**53%**	**69%**		
ISC 1			1			1		2	29%
ISC 2		1	1	1		1		4	57%
ISC 3							1	1	14%
ISC 4				1		1	1	3	43%
ISC 5								0	0%
ISC 6		1			1	1	1	4	57%
ISC 7						1	1	2	29%
ISC 8				1	1		1	3	43%
ISC 9		1	1	1	1		1	5	71%
ISC 10		1	1			1	1	4	57%
ISC 11		1		1		1	1	4	57%
ISC 12		1	1					2	29%
ISC 13				1	1	1	1	4	57%
ISC 14				1	1		1	3	43%
ISC 15		1	1	1	1	1	1	6	86%
ISC 16		1	1	1	1	1		5	71%
Total	**0**	**8**	**7**	**9**	**7**	**10**	**11**	**52**	**46%**
Total Percentage	**0%**	**50%**	**44%**	**56%**	**44%**	**63%**	**69%**		
Grand Total	**1**	**17**	**15**	**10**	**23**	**27**	**33**	**126**	**38%**
Grand Total Percentage	**2%**	**35%**	**31%**	**21%**	**48%**	**56%**	**69%**		

APPENDIX 6 – ALTERNATIVE SAFE HOUSE GRAPHS



Graph 1.2 – University of Virginia. This graph shows the number of houses that met expectations in the corresponding safety areas.



Graph 2.2 – University of Virginia. This graph shows the number of houses according to the total number of "safe" ratings they earned from the GHFSA.