WILDLAND URBAN INTERFACE FIRES

Executive Analysis of Fire Service Operations in Emergency Management

Wildland Urban Interface Fires; Reducing The Commitment of

Honolulu Fire Department Resources

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Appendices Not Included. Please visit the Learning Resource Center on the Web at http://www.lrc.dhs.gov/ to learn how to obtain this report in its entirety through Interlibrary Loan.

CERTIFICATION STATEMENT

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

Signed:_____

ABSTRACT

Every year Wildland Urban Interface (WUI) fires threaten lives and property within Honolulu, Hawaii. To reduce the impact of such fires, HFD must understand the standards in place and how such standards support HFD at WUI operations. The questions asked were: What are the National Guidelines for emergency response to mitigate WUI incidents; What are the current procedures or guidelines utilized by the HFD to mitigate WUI incidents; What procedures, personnel, and resources are other departments utilizing to prepare for WUI incidents; and What procedures, personnel, and resources are required by the Honolulu Fire Department to reduce the risk to residents, visitors, and emergency responders to a WUI incident? Evaluative research was conducted to evaluate standards, guidelines, and data on past incidents. A questionnaire was sent to departments seeking their procedures. Research identified that HFD's WUI training was less than the other counties within the State of Hawaii. HFD could improve its efficiency by increasing WUI training and providing adequate resources necessary for rapid mitigation of WUI fires.

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INTRODUCTION

This research project addresses the problem of Wildland Urban Interface (WUI) fires that occur within the City and County of Honolulu. The Honolulu Fire Department (HFD) is responsible to extinguish all fires within the City and County of Honolulu. The City and County of Honolulu includes the entire island of Oahu in the State of Hawaii.

Fires occurring in Oahu's Wildland Urban Interface areas dramatically impact the Honolulu Fire Department. Each year numerous resources are committed to fires that threaten lives and damage property, taxing the personnel and equipment. The resources available on the island are limited and realistically additional trucks or heavy equipment cannot be brought in from other counties or States. When major fires occur, the risk to residents and visitors throughout Oahu increases, due to the depletion of resources available to respond to other types of emergencies.

This research will assess HFD's WUI fires to accurately understand the procedures, personnel, and resources necessary to extinguish them.

Research questions asked by this author are:

(a) What are the National Guidelines for emergency response to mitigate WUI incidents?

(b) What are the current procedures or guidelines utilized by the HFD to mitigate WUI incidents?

(c) What procedures, personnel, and resources are other departments utilizing to prepare for WUI incidents?

(d) What procedures, personnel, and resources are required by the Honolulu Fire Department to reduce the risk to residents, visitors, and emergency responders to a WUI incident?

Evaluative research will be conducted to analyze HFD's procedures, personnel, and resources. Data will be collected from HFD's recent WUI incidents to evaluate the effectiveness of current procedures and guidelines utilized. New research will be conducted through a questionnaire to obtain data from other responder organizations pertaining to their procedures, personnel, and resources in mitigating WUI fires.

BACKGROUND AND SIGNIFICANCE

The Honolulu Fire Department is responsible for providing fire protection within the City and County of Honolulu (hereafter called Honolulu), encompassing the entire island of Oahu, an area of 604 square miles and has a population of 1.2 million people (HFD, 204-1). Honolulu is made up of old and new communities intermixing high-rise residential buildings, hotels, single family homes, and commercial buildings, contrasted with large wildland regions made up of mountains and valleys. Honolulu's urban development is found on the south shore of the island, where the vast majority of high-rise buildings, transportation industries, and commercial enterprises necessary to support the State of Hawaii's economy are located.[1]

Oahu has two mountain ranges that run from the east to the west and divide the island into three geographically diverse areas. The result of this division is that

[1] The State of Hawaii is comprised of seven islands. Oahu is one of these islands and the most developed.

the east side of the island receives a substantial amount of rainfall that supports the thick tropical vegetation found there.

The central plains are large and expansive, used primarily in the past as agriculture land for pineapple and sugarcane; these plantations have all but disappeared making room for new residential subdivisions intermixed with smaller independent farming ventures. Some of the agricultural lots are now large untended fields with overgrown vegetation. Rainfall on the central plains is less than the east side but still considerably more than what falls on the west coast.

On the west side of the island, the geography is much different. This side of the island is mountainous, arid, and hot. The two mountain ranges have removed most of the moisture creating an environment where dry brown brush covers the mountainsides and valleys.

Every year this arid mountainous coastline is impacted by numerous wildland fires that endanger the lives and threaten property of those living within the communities nearby. Being an island with mountainous areas, flat level land for development is limited. This has created a vast amount of wildland interface area that HFD is required to protect. In 2005 HFD responded to 525 WUI fires, of which 352 occurred on the west side of the island. These WUI fires require the commitment of HFD's fire suppression personnel and apparatuses. Some of these incidents require the dispatch of more than 25% of HFD's engine companies and involve operations that exceed 10 hours in length. The mountainous terrain tax the personnel committed to mitigate the fires, placing them in danger of injury and possible death. To make matters

worse, residents within these communities have historically refused to evacuate their homes in advance of the approaching fire front.

Another issue facing HFD is their limited resources due to their forced independence. The HFD is similar to other departments in Hawaii in that they are located on islands and are unable to have their neighboring counties within the State to simply drive additional resources such as engines and water tenders to their county when support is needed during large scale firefighting operations. This inability promotes a degree of isolation and forces HFD and its neighboring departments to handle the incident with those firefighting resources available on each island. Although HFD has entered into mutual agreements with the Federal and State firefighting departments for assistance, these resources are also limited and sometimes unavailable.

To perform its mission, HFD's land based fire suppression resources consist of 42 Engine companies, 15 Ladder companies, and five water tankers. Its Special Operations resources include two Rescue companies, two Hazardous Materials companies, an Aircraft Station, and a Fireboat. These resources are divided amongst five battalions. The battalions are situated so that Battalion 1 and Battalion 2 cover the metropolitan areas of Honolulu. Battalion 3 is located on the eastern side of the island. Battalion 4 is responsible for the western side of the island and Battalion 5 is responsible for the central part of Oahu.

HFD carries a great responsibility. Although the island appears very small on a map, it is heavily populated and HFD has limited resources. WUI fires possess a definite threat to life and property. As very recently seen, WUI fires put a heavy demand on HFD.

Nationally, HFD is no different from the continental United States. Wildland interface fires are a serious problem. In 2004 there were more than 77,500 wildfires, which consumed 6,790,692 acres. In the course of these fires, more than 1,095 structures were burned and the estimated cost of fire suppression was $890,233,000 (NIFC, 2005).

This research project is part of the United States Fire Administration's (USFA) National Fire Academy Executive Fire Officer Program (EFOP). This research correlates to the NFA's Executive Analysis Of Fire Service Operations In Emergency Management (EAFSEOM) course by assessing HFD's resource capability in mitigating WUI incidents. This research is also intended to contribute towards the 5 year Operational Objectives of the United States Fire Administration to reduce the number of firefighter fatalities by 25%.

LITERATURE REVIEW

To accurately evaluate HFD's emergency response to WUI incidents, it was necessary to conduct a literature review to better understand what national guidelines are in place pertaining to emergency response to WUI incidents. The author will be evaluating the following aspects of emergency response to WUI incidents. The first being an evaluation of the personnel's training that is conducted so that they may operate at a WUI fire. The second is to evaluate the department's preplanning as these types of procedures could increase the effectiveness and safety of the WUI operations. Also reviewed will be HFD's procedures and training to better understand our own efforts employed to mitigate WUI incidents.

Below are several general definitions provided by the National Fire Protection Association (also known as the NFPA) on terms relative to this research (2002):

Defensible Space. An area as defined by the Authority having jurisdiction (AHJ) (typically 30 ft) between an improved property and a potential wildland fire where combustible materials and vegetation have been removed or modified to reduce the potential for fire on improved property spreading to wildland fuels or to provide a safe working area for fire fighters protecting life and improved property from wildland fire.

Wildland Fire. An unplanned and uncontrolled fire spreading through vegetative fuels and at times involving structures.

Wildland Urban Interface. An area where improved property and wildland fuels meet at a well-defined boundary.

Wildland Urban Intermix. An area where improved property and wildland fuels meet with no clearly defined boundary.

Training

To better understand the national guidelines for operating at a WUI fire, the author referred to several different agencies. One of which was the National Wildfire Coordinating Group (NWCG). The NWCG is currently made up of the Department of Agriculture Forest Service, four Department of Interior agencies, the Bureau of Land Management (BLM), the National Park Service (NPS), the Bureau of Indian Affairs (BIA), the Fish and Wildlife Service (FWS). The United States Fire Administration (USFA), State forestry agencies through the National Association of State Forestry (NASF), and the Inter-Tribal Timber Council (NFPA, 2002).

Under the umbrella of the NWCG, State and Federal agencies combined to establish the Wildland and Prescribed Fire Qualification System Guide and is also known as PMS 310-1. The Wildland and Prescribed Fire Qualification System Guide developed under the sponsorship of the NWCG provides guidance to participating agencies and organizations. This guidance is given for the establishment of minimum standards for wildland firefighting and prescribed fire personnel. The PMS 310-1 System achieves this by establishing minimum interagency training, skills, knowledge, experience and physical fitness standards for wildland and prescribed fire positions (NWCG, 1999).

The following is some background information on the PMS 310-1 System. The components of this system are the Position Task Books (PTB), which contain all critical tasks required to perform the job. The PTBs are in a format that allows documentation of each individuals. Another component of the PMS 310-1 System is the training courses that provide the knowledge and skills necessary to perform the duties of that position. Not all of these courses are required but they provide the foundation by which personnel can prepare themselves for the position performance evaluation. The third component of the PMS 310-1 System is the Job Aids. These aids provide a quick reference for performance in that specific position. The final component is the Agency Certification by which the members' ability to perform in the position is documented.

Incident complexity is determined by factors such as size, location, threat to life and property, jurisdictional boundaries, fuel type, and other factors. Depending on the complexity, the incident will be identified as a Type 1 – 5. A Type 5 incident requires relatively few resources and would be of a short duration. While a Type 1 incident would be very complex, and involve numerous agencies and resources (NWCG, 1999).

Overall, NWCG's PMS 310-1 System is responsible for the roles and responsibilities of more than 97 positions. Included in the 97 positions mentioned above are 78 Incident Command System (ICS) positions. Several of which are the positions of Division Group Supervisor (DIVS), two types of Operations Section Chief, Strike Team Leader Crew (STCR), and Strike Team Leader Engine (STEN), as well as the five types of Incident Commander positions. Twelve wildland fire skill positions including the Advanced Firefighter/Squad Boss (FFT1), Firefighter (FFT2) positions, as well as Crew Boss (Single Resource) and Engine Boss (Single Resource) are defined in PMS 310-1 (NWCG, 1999).

The Firefighter (FFT2) position has the following required training: Firefighter Training (S-130) and Introduction to Wildland Fire Behavior (S-190). Knowledge and skills needed are: Introduction to Incident Command System (ICS) 100 Class (NWCG, 1999).

The position of Engine Boss (Single Resource) (ENGB) has the following required training: Crew Boss (S-230), Intermediate Wildland Fire Behavior (S-290), Engine Boss (S-231), Fire Operations in the Urban Interface (S-205). Knowledge and skills needed are: Basic ICS (I-200), Ignition Operations (S-234), Interagency Incident Business Management (S-260) and Basic Air Operations (S-270). These are in addition to the prerequisite experience required to reach this position (NWCG, 1999).

It is important to note that the above qualifications have been agreed to by all participating agencies. They are required to have been met for national mobilization purposes. HFD does not currently mobilize its members nationally. The National Wildfire Coordinating Group states that it recognizes the ability of cooperating agencies

at the local level to jointly define their certification and qualification standards. The NWCG goes on to suggest that agencies dealing with other than wildland and prescribed fire incidents may want to consider using PMS 310-1 guidelines for establishing certification and qualifications within those organizations (1999). Two sample flowcharts to detailing the organization structure and requirements needed to advance within NWCG's system are included, Appendix A-1 details the progression of qualification for Operations and Appendix A-2 diagrams the qualifications needed to advance with the command staff. These flowcharts can also be located in Appendix B of NWCG PMS 310-1Wildland Fire Qualifications Guide (1999). Other flowcharts are provided in that guide covering Air operations, logistics, planning, finance, and extended dispatch.

Another source to find national guidelines for wildland firefighter training is the National Fire Protection Association. The NFPA 1051 is the Standard for Wildland Fire Fighter Professional Qualifications (NFPA, 2002).

In the NFPA, Section A.5.5.3 (A), it mentions that safety and welfare of personnel is the first and foremost consideration in all incident operations and decisions. A wildland firefighter must have a working knowledge of fire suppression safety standards and procedures, including Fire Behavior NWCG Class S-190, Introduction to Fire Behavior, 10 Standard fire orders, 18 "watch out" situations, NFES 2225 – Common Denominators of Fire Behavior on Tragedy and Near-miss Forest Fires, Downhill indirect line construction guidelines, LCES (lookouts), communications, escape routes, safety zones, and PMS-416 Standard for Survival (2002). The 10 Standard Fire Orders (Appendix B-1) and the 18 Watch Out Situation (Appendix B–2) were developed to enhance firefighter safety. If firefighters follow the foregoing classes and guidelines,

much of the risk of firefighting can be reduced. LCES is basic wildland firefighting knowledge and covered in NWCG's S-130 Firefighter Training, Unit 1 course.

The NFPA Wildland Fire Fighter Professional Qualifications System is very similar to the NWCG Wildland Firefighter levels. In comparison of the two systems, certain differences were noted. The position titles for similar duties are different. What NFPA refers to Wildland Fire Fighter 1 is similar in training to what NWCG refers to as Firefighter II (FFT2). An NWCG Firefighter II is required to take S-130, S-190, and I-100 ICS classes. NFPA requirements for the Wildland Firefighter I list the same classes but further includes requisite knowledge of S-110 (Basic Fire Suppression Orientation), PMS-410-1 (Fireline Handbook), PMS-414-1 Fire Fighter's Guide, and PMS-416 (Standard for Survival) (NFPA, 2002). As these members receive additional training and knowledge, and have additional skills, they are able to advance within each system.

The next level in the NWCG system is the position of Advanced Firefighter/Squad Boss (FFT1), which is similar to NFPA Wildland Firefighter II. The requirements for NWCG Advanced Firefighter/Squad Boss position are S-131 (Advanced Fire Fighter Training), S-210 (Supervisory Concepts and Techniques), S-211 (Portable Pumps and Water Use), and S-212 (Wildfire Power Saws) classes. NFPA's Qualifications for Wildland Fire Fighter II include these same classes and in addition, include S-133 (Look Up, Look Down, Look Around) and S216 (Driving for the Fire Service) classes.

Both NWCG's PMS 310-1 and the NFPA's 1051 Annex B reference the NWCG Fireline Handbook as requisite knowledge pertinent for the professional wildland firefighter to understand in order to meet the minimum qualifications of their programs.

This handbook is generally considered the wildland firefighters "bible" as it contains fundamental knowledge imperative for those operating in the fire zone. Presented in this handbook are the list of 18 Watch Out Situations, LCES, Equipment Placement, Water Use Guidelines, and Structural Triage Guidelines (NWCG, 2004).

Pre-incident planning

The primary purpose of a pre-incident plan is to help responding personnel to effectively manage emergencies with available resources (NFPA, 1998). The concept of pre-incident planning is based upon the awareness of a problem, and the commitment to manage, educate, protect, and prevent through a process that collects, analyzes, and disseminates information. This information is then applied to a "what-if-approach" and becomes the basis by which pre-incident plans are developed.

NFPA's Wildland Fire Risk And Hazard Severity Assessment Form (Appendix C) was designed to assist emergency personnel in their hazard assessment of a structure throughout the preplanning process. The components of this assessment are indicated below. The National Fire Protection Association publishes the NFPA 1144, Standard for Protection of Life and Property from Wildfire. This standard was formally known as NFPA 299 and directs the authority having jurisdiction to perform a wildland fire risk and hazard analysis of improved properties located within wildland/urban interface or intermix areas. This analysis shall contain, at a minimum, the identification and documentation of wildland fire risk and hazard areas, establishment of priorities relative to mitigating the dangers from wildland fire, determination of mitigation measures for vegetation, other combustibles, and other construction criteria. Components of a Wildland Fire Risk and Hazard Mitigation Plan shall include access, ingress, egress

and evacuation, fuel modification, water supply, construction, location and design of structures, and ignition potential (NFPA, 2002).

Michael S. Rohde conducted a study of six major wildland fires occurring in California between 1990 and 1996. This study identified best command practices that might be utilized by incident commanders or those responsible in leadership positions at such fires. The study found that pre-fire planning for wildfire risks in the WUI area is critically important. Recommendations for this planning include conceiving strategies and tactics, identifying values at risk, planning deployments and evacuations, calculating resource needs, and projecting the fire behavior and spread (Rohdes, 2004).

The NFPA has also published the Recommended Practice for Pre-Incident Planning, which is titled NFPA 1620. This document is the recommended practice for evaluating the construction, protection, and operational features in developing a pre-incident plan for responding personnel to fires and emergencies. NFPA 1620 also notes that a pre-incident plan is one of the most valuable tools available to assist responding personnel in effectively controlling an emergency and that a pre-incident plan should be the foundation for decision making during an emergency situation (NFPA, 1998). Another value of preplanning is that information obtained can be applied to various types of emergencies and situations once the information has been collected.

General areas covered in a pre-incident plan are physical elements, site considerations, occupant considerations, protection systems, water supplies, special hazards, emergency operations, and testing and review of the pre-incident plan.

Structural Triage

Structural triage is a process that assists in the determination of where to place efforts and resources so that they may accomplish the most good.

The NWCG Fireline Handbook Chapter 6, Urban Interface discusses the Wildland Firefighters' duties in the area of structural triage. It provides structure triage guidelines to assist in evaluating the defensibility of structures in a wildfire situation. These are broken down into three categories:

- Those that are not threatened.
- Those that are threatened and have the potential to be saved.
- Those that are notable to be saved and too dangerous to protect.

Also discussed are considerations such as safety zones, the proximity of the fuels to the structure (also known as defensible space), the intensity and behavior of the fire, the position of the fire relative to the slope of the terrain, flammability of the roofs of homes and siding, and the availability of additional resources having ample time to position themselves in place to protect the structures.

General guidelines are also included in the NWCG Fireline Handbook for estimating the number of resources needed to adequately protect structures. These guidelines recommend that one engine be assigned to protect up to four structures depending on the conditions of the fire. Should the structures be closer together, one engine would be needed to protect every two structures (NWCG, 2004).

In an applied research project for the National Fire Academy (NFA) Executive Fire Officer Program, Dean Lange conducted research as part of his Executive Leadership course. This research was titled, "Pre-planning For Wildland/Urban Interface Fires In Clark County Washington". Lange discusses the difference between structural firefighters and wildland firefighters. While both types of firefighters may be operating in a manner that is considered proper for their environment, they could yield dangerous results when applied to the wrong situation. The example provided included a structural firefighter at the scene of a roof fire, who was trained to enter the structure to check for occupants and extinguish the fire from within. In the same situation, a wildland firefighter has been trained to size up the fuels that lie in the path of the fire, assess the rate of the spread of the fire, observe the characteristics of the terrain, and note potential hazards to the crew. Lange suggests that the answer seems to be that all firefighters would receive the training and equipment to handle all types of fires (2004). In part, Lange's recommendations included that Clark County Fire District No. 11 adopt a checklist as a tool for preparing structural triage for the command staff and company officers. As the officers become more proficient in the use of the structural triage list, they in turn would begin to train other members of their respective companies.

Myfirecommunity.net is an online community center developed for the purpose of sharing wildland fire information. Through this site, the author was able to access an electronic document titled, "Structures in the Wildland," which was revised in February 2001. This document discussed the difficult decisions company officers and strike team leaders have to make when they are forced to decide which homes they will try to save and which homes they will not. Some of the guidelines to structural triage on

this matter include evaluating the structure itself, considering its type of construction, the roof coverings, siding, and overhangs. Another factor that impacts the ability to protect the structure is the defensible space, vegetation and other combustibles remaining within the area which reduce the defensible space, personnel safety, availability of resources, fire behavior, and the surrounding fuels (Myfirecommunity, 2001).

PROCEDURES

To effectively address this research, this author determined that it was necessary to divide the research into three separate categories, all of which would be conducted simultaneously. The first was to evaluate HFD's training, the procedures in place to perform pre-incident planning as well as the impact created by WUI fires that HFD must respond to on an almost daily basis. The second was to research national guidelines, standards, and best practices to provide this author with a means to evaluate HFD's training and preplanning procedures to realize our strengths and weaknesses. The third area of research was to obtain new data pertaining to the procedures or actions by other fire departments in the way they train and preplan, and the allocation of resources that they can commit to a wildland fire.

The first area of research mentioned above entailed research of voluminous records from HFD's incident database. To effectively evaluate how HFD was being impacted in terms of personnel and resources committed to mitigate wildfires, it was necessary to understand HFD wildfire history. Therefore, a review was conducted of the annual number of wildfires in each of the years from 2002 through 2004. The number of wildfires in each of these years are as follows: 2002 – 599 fires, 2003 – 982 fires, and

2004 – 525 fires. In order to utilize the most recent data available, 2004 was analyzed for this research project.

HFD incident reports are documented on the National Fire Incident Reporting System (NFIRS). NFIRS 5.0 and provided historical data, which was used in this research. To obtain the research, the author analyzed each of HFD's incident reports in 42 Fire Response Zone's (FRZ) to identify those incidents in 2004 that listing the incident type as 140, 141, or 142, which pertain to wildfire situations.

HFD had 525 wildland fire reports for 2004. This author reviewed the data from these 525 incidents and transferred the information manually to an electronic format. In order to manage this compiled data, this author developed a spreadsheet that captures 14 categories of information. They include the date of incident, incident report number, battalion of occurrence, street name, fire response zone, census tract number, time of alarm, hours on-scene, number of firefighters, number of aerial or engine apparatuses, number of tanker apparatuses, Air 1 (HFD's helicopter), acres burned, and mutual aid received.

The efforts of this author were intended to obtain a better understanding of personnel and apparatuses needed for HFD to mitigate wildland fires in Honolulu. Accurate information on these needs is of utmost importance to understanding the scope of Honolulu's wildfire problem.

A search was made of each of the 525 incident reports (I/R) by searching for the report number on HFD's National Fire Incident Reporting System. This search would display the requested reports. If the report was for a widland fire, a tab would indicate such. Several other tabs would also appear on each report, some of which

are discussed below. This author confirmed the reports desired by year and address, and took the data from each report. Upon the opening of an incident report on the NFIRS 5.0 format, the following steps were necessary to obtain needed the data.

The report opens on the Basic Tab, which confirmed the date and incident type. Then the Location Tab was then accessed to provide the census tract number. Next, the Resources Tab was accessed to provide the Time of Alarm (T/A), the resources committed to this incident, and the apparatuses cleared time. The Resources Tab lists each apparatus that was utilized. By selecting each resource, *i.e.,* Engine 26, the author was then able to access the Personnel Tab for Engine 26. This lists the members on Engine 26 during that incident. If six fire apparatuses were dispatched to this incident, then six Personnel Tabs were accessed individually in order to accurately obtain the number of personnel at each incident. The cleared time under the Resources Tab is the time the apparatus is released from the incident and is available to return to its quarters or be dispatched to another incident. Next, the Wildland Tab was accessed to retrieve the numbers of acres burned. Finally, the Narratives Tabs were accessed to confirm further possibility of mutual aid resources, and to provide a better understanding of the incident situation and the events occurring. Each company responding completes a narrative and are usually identified by the company number, *i.e.,* E26. While the Basic Tab includes a field for entering mutual aid received or provided, HFD's members usually elaborate on that matter within the narrative.

When the spreadsheet was developed, it did not account for the total personnel hours required for each incident. These hours are the sum of the number of

personnel on-scene multiplied by the number of hours on-scene. This author recorded these findings on a table presented later in this research.

In addition to analyzing the history of HFD's WUI fires, research was made on the procedures of HFD's training and inspection programs. Training documents, when available, were retrieved to obtain data that supports the current wildland fire training provided by HFD's Training Bureau. This research basically involved review of existing HFD manuals and documents to validate the activities and procedures that HFD currently has in place. Occasionally, follow-up was needed to obtain documents specific to certain bureaus or functions.

As indicated above, preplans are of critical importance. Thus, a review of HFD's preplans located on the Department electronic Records Management System (RMS) was made. These records are accessible by all department members. This author obtained data relevant to HFD's pre-incident planning procedures.

The preceding mentioned research on HFD matters was one area evaluated. The second area of research focused on national guidelines and standards pertinent to wildland fire training, pre-incident planning and WUI operations. To accomplish this, an Internet search was conducted to learn about the various agencies that support wildland firefighting throughout the United States. Existing documents, both printed and electronic, were reviewed and are summarized within the literature review of this paper. When possible, others were solicited for information for sources and agencies involved in the effort to address America's wildland fire problem. Also utilized to obtain data relevant to this research was the Learning Resource Center at the National Emergency Training Center (NETC) in Emmitsburg, Maryland.

The third area of research was directed towards the development of new data that was obtained through a questionnaire sent to various firefighting agencies with similar environments. The firefighting resources of the HFD are distributed throughout 42 fire response zones, formally known as “first in” areas. The communities protected by HFD have been categorized into three community types following the definitions adapted from the International City/County Management Association annual report. They are urban, suburban, and rural. Twelve of HFD’s stations service urban Oahu (28.5%), 23 stations (56%) are located within suburban communities, and 7 stations (16.5%) are within rural communities. Following these guidelines, this author attempted to direct questionnaires to metropolitan, suburban, rural, and county fire departments and agencies. While 55.6% of the questionnaires were mailed to departments serving suburban communities, 15.8% were sent to urban communities, and 29% of the questionnaires were mailed to rural departments.

In addition to the City and County of Honolulu, the State of Hawaii is made up of Maui, Hawaii, and Kauai Counties. Due to geographic similarities in geographic makeup, weather patterns, and the problems poised by isolation due to all counties being made up of islands, all of these county fire departments were solicited. Also providing fire protection within the State of Hawaii is the Federal Fire Department, primarily responsible for fire protection on military property within Hawaii. The State of Hawaii, Department of Land and Natural Resources (DLNR), Forestry and Wildlife Division also has a small firefighting response team primarily responsible for State forestry lands. These two agencies also answered the questionnaire. This provided the

author with two insights, one providing a broad brushstroke of a national snapshot and another of the State of Hawaii.

The questionnaire packet included a cover letter addressed personally to the Fire Chief of the Department. This required telephone research to confirm the identity of the current Chief and mailing address. The reason for addressing the questionnaire to the Chief of each Department was to assure the highest return ratio of questionnaires in today's busy work environment. The cover letter also provided an e-mail address where the responders could contact me should they desire to request an electronic copy of the questionnaire or if they had any further inquiries. The questionnaire itself was provided on a separate page that provided room for a response to be handwritten or typed. A self-addressed and stamped envelope was also included to assist with their response.

Each questionnaire was assigned a number by this author and asked the responders to provide their agency name and date of response. The number on each questionnaire corresponds to a number on my master mailing list so this author would know which agency was providing the input should they forget to write the name of their department on the response.

The first question posed to the other fire departments was, "What is the percentage of response companies that can be committed by your Department to Wildland Urban Interface Fires while maintaining an acceptable level of service to your community?" This question was asked to find out if the responding departments had threshold levels where they considered the commitment of further resources to WUI fires would result in unacceptable service levels for their community. While this question

allows each respondent to have a different definition of acceptable, my concern was if they had a threshold level that separates acceptable and unacceptable resource levels.

The second question followed up on Question 1 and asked, “Does your department exceed this percentage and if so, how often?” This question was asked to find out how many departments had continued to commit resources to a WUI fire while believing that the resources remaining to provide emergency services to the community are less that what was considered acceptable.

The third question asked, “Please describe the types of wildland firefighting training that is provided to your members including the length and frequency of the training”. This question was asked to provide insight to the wildland firefighting training being provided by various departments within the United States and the extent of that training.

The fourth question followed up on the third question and asked, “What percent of your personnel assigned to firefighting duties receive this training?” This question was asked to provide this author with an idea of the depth of training provided to personnel within each department.

The fifth question asked, “Does this training lead to a National or State certification.” This question was asked to indicate to the author if the training of personnel fulfilled the requirements needed for, or could be applied to, certification.

The sixth question asked, “Does your Department routinely conduct pre-incident planning for Wildland Urban Interface areas? If so, please briefly describe.” This question was asked to provide the author with an insight to the number of respondent

departments that conduct wildland preplans and what types of methods or information may be captured during those preplans.

The seventh question asked, “Does your Department rate (triage) structures in your Wildland Urban Interface areas according to their defensibility? If so, briefly explain.” This question was asked to provide this author with a snapshot of the responding departments’ involvement in wildland structural triage and possibly some insight and ideas to their department’s procedures.

To assist this author with the compilation of information being provided by the completed questionnaires, four spreadsheets were developed and the responses were logged as they were received. The first spreadsheet included the responses to Question Nos.1 and 2. The second spreadsheet was used to record the responses to Question Nos. 3 and 4. In response to Question No. 3, many departments indicated they conducted multiple wildland fire training classes. As such, additional rows were inserted into the spreadsheet so each class received its own row. This maintained the ability to sort this document as long as the information was entered in the same format. The answers to the fifth question were inputted on the third spreadsheet. This provided room for columns to include a yes or no answer and to identify which standard or certification was used. This format again allowed for the ability to sort the data and facilitate data retrieval. The answers to the sixth and seventh questions were recorded on the fourth spreadsheet.

In order to evaluate the information within the responses to the questionnaire, the spreadsheets were sorted by specific matters. The first spreadsheet was sorted by the column titled, “Commitment” (Appendix D). This column lists the commitment by percentages. The second spreadsheet was sorted by the column, “Type of

WUI Training Provided" (Appendix E). Information in this column is listed by the course number, when provided, *i.e.,* S-130. This spreadsheet required considerable analysis due to the large amount of information received. The third spreadsheet was sorted by the column titled, "Certification" (Appendix F). The answers provided in this spreadsheet were documented in a yes or no format. The fourth spreadsheet was sorted twice, the first time by the column titled, "Preplans" (Appendix G1) and a second time by the column titled. "Triage" (Appendix H). Copies of these spreadsheets are included in the appendix.

The data sorted on these spreadsheets was analyzed and recorded in terms of percentages of the total responses received as the author evaluated the responses to arrive at conclusions based upon the information received.

RESULTS

Research Questions

Question # 1

What are the National Guidelines for emergency response to mitigate WUI incidents?

The national guidelines establish minimum interagency training, skills, knowledge, experience and physical fitness standards for wildland, and prescribed fire positions to agencies that participate in national mobilization. NWCG 310-1 states that personnel mobilized beyond their geographic area must meet the established qualification standards in this guide. Any organization or agency providing resources to fill national interagency requests for incidents or multi-agency prescribed fires of moderate or higher complexity will be expected to meet the minimum national requirements described in NWCG 310-1. HFD is not a participant of the national mobilization due to its island

jurisdiction. Currently, HFD does not mobilize its personnel outside the State of Hawaii, and has only once since 1982 sent personnel to assist Maui County with wildland firefighting on the island of Molokai.

The NWCG suggests that agencies dealing with other than wildland and prescribed fire incidents may want to consider using PMS 310-1 guidelines for establishing certification and qualification within those organizations (NMCG, 1999).

Question # 2

What are the current procedures or guidelines utilized by the HFD to mitigate WUI incidents?

HFD's training procedures include Fire Recruit Awareness Training. This training was instituted with the 81st recruit class. To date 385 members have participated in this 2-hour awareness training. HFD has a total of 1,145 members (HFD, 2004b). In June 2005 HFD's Battalion 4, which is located in an area where most WUI fires occurred in 2004, provided fire operations personnel with a 3-hour Wildland Operations Class. This class was offered once on each of the three platoon on-duty days. HFD's Training and Research Bureau no longer offers this class. No roster was kept of those that did attend the class in June 2005. Battalion Chief Roland Harvest assigned to HFD's 4th Battalion, 1st Platoon coordinated the training. He estimated that approximately 195 HFD personnel attended this training (personal communications, July 20, 2005). None of HFD's wildland fire training currently led to any National or State certifications.

The Honolulu Fire Department is offered opportunities to send personnel to wildland fire training classes provided by the DLNR Forestry Division. Through personal communications with Mr. Pat Constalles, DLNR Forestry Division, on

August 16, 2005, it was estimated approximately 1% of HFD's personnel have participated in this training over the last 10 to 15 years.

The Honolulu Fire Department has an established Pre-incident Planning Program in place. Fire suppression companies are required to complete 12 preplans a year (HFD, 2004a). This requirement pertains to each engine, aerial, and rescue apparatus on each platoon. A station that houses an Engine and an aerial company would be required to complete 24 preplans per calendar year on their platoon. Multiply this by HFD's three-platoon system and that station would be responsible for 72 preplans combined in a calendar year. These preplans are normally conducted on high-risk commercial occupancies. The rural areas where the majority of Honolulu's brush fires occur generally have a reduced number of high-risk facilities, making it possible for company officers to shift their attention to wildland urban interface areas with a history of significant wildland fires. Pre-incident plans are completed on HFD's RMS and tracked by their Tax Map Key (TMK) number. The practice of sorting preplans for wildland areas by TMK number is impractical. Most wildland areas are grouped in large tracks of thousands of acres of forest reserve lands under a single TMK number. Even if company officers tie the preplan to a residential lot nearby, it is still difficult for personnel from other fire response zones to locate these pre-incident plans on HFD's RMS. HFD does not readily have a way to immediately identify an address by using a TMK number. As RMS lists preplans by TMK numbers (which are approximately eight digits), personnel unfamiliar with the area would not ordinarily be able to retrieve the preplan quick enough after they get an alarm. It would take too much crucial time to locate the preplan by using a TMK number. Thus, they would not take advantage of the information provided in the preplan.

The HFD does not have an established program to perform emergency structural triage at this time. Individual company officers may have familiarized themselves with the process but it would be on their own initiative and enacted on their own behalf.

The HFD has 42 stations that house engine companies. Five of these are stations also house tanker apparatuses. HFD's current dispatch procedures are to dispatch both the engine and tanker to fire calls occurring within those FRZs where both apparatuses are located. Fire calls including those for WUI incidents occurring in FRZs where no tanker apparatus is located, only have a single engine dispatched on that first alarm assignment. Should the officer need the resources of additional companies or tankers, they can make that request to the dispatch center.

The HFD has established three levels of Departmental Staffing to identify island wide levels of fire and emergency coverage (HFD, 2004a). These levels are used to assist the department in assessing its staffing and coverage needs necessary to ensure the department's ability to carry out its mission is maintained. Each level of staffing is determined by subtracting the number of first line companies that are out-of-service for any reason for a period longer than 30 minutes. Level 1 is reached when one-fourth or 25% of the total number of companies are out-of-service. Level 2 is reached when 33 % of the companies are out-of-service, and Level 3 of staffing is when 50% of the companies are out-of-service. Whenever any of these three levels of staffing are reached, response options by the department may include canceling non-emergency activities and training, staffing relief apparatuses, prioritizing fire and emergency calls, and recalling personnel (HFD, 2004a).

When HFD reaches Level 2 or 3 staffing due to a large WUI incident or several incidents, the commitment of further HFD resources to the WUI incident may not be possible. HFD's Fire Communication Center (FCC) will notify the Incident Commander of the staffing level and that further requests for resources may not be available. This is due to the limited amount of departmental resources on the island of Oahu, and the need to maintain acceptable levels of service throughout the island. Incident Commanders at WUI incidents are then forced to reassess their strategy or reassign resources already committed.

In 2004 the HFD responded to 525 WUI fires. Sixty-seven percent of these fires occurred in Battalion 4, which covers the west coast of Oahu. Battalion 5 experienced just fewer than 19% of the WUI fires. Together they accounted for 86% of Honolulu's WUI incidents. Individual incident commitments can be viewed on the document titled: 2004 HFD WUI Incident Summary Spreadsheet, found in Appendix I.

HFD Resource Commitment To WUI Incidents In 2004, By Battalion

Battalion Of Occurrence	Number of Incidents	Duration In Hours	Number of Firefighters Utilized	Total Work Hours	Apparatuses Involved in Mitigation	Tankers Utilized	Frequency Of Mutual Aid
Bn. 1	17	17	86	82	20	0	0
Bn. 2	22	33	130	254	30	3	0
Bn. 3	35	39	151	177	38	1	0
Bn. 4	352	442	2177	3888	440	290	7

Bn. 5	99	159	709	1730	131	29	1
Total	525	690	3261	6131	659	323	8

Because of the impact experienced in Battalion 4 with WUI incidents, further analysis was conducted to analyze the duration of the incidents occurring within Battalion 4 alone. This analysis involved a comparison of those FRZs in which a tanker apparatus was assigned and responded on the initial alarm, as compared to those FRZs without a tanker apparatus. The results of this analysis are broken down in the table below. Eighty percent to 98% of WUI incidents were mitigated in under an hour in FRZs with a tanker. In comparison, 68% to 75% of WUI incidents in FRZs without a tanker were mitigated in under an hour.

Battalion 4 Mitigation of WUI (Comparison of FRZ with and without tankers)

FRZ E24	Total Incidents	33	
Tanker Assigned	Incidents > 1 hour	23	69.69 %
None	Incidents < 1 hour	10	30.31 %
FRZ E35	Total Incidents	8	
Tankers Assigned	Incidents > 1 hour	6	75.00 %
None	Incidents < 1 hour	2	25.00 %
FRZ E40	Total Incidents	45	
Tankers Assigned	Incidents > 1 hour	31	68.88 %
None	Incidents < 1 hour	14	31.12 %
FRZ E42	Total Incidents	13	
Tankers Assigned	Incidents > 1 hour	9	69.23 %
None	Incidents < 1 hour	4	30.71 %
FRZ E12	Total Incidents	50	

Tankers Assigned Yes (1)	Incidents > 1 hour Incidents < 1 hour	49 1	98.00 % 2.00 %
FRZ E26 Tankers Assigned Yes (1)	Total Incidents Incidents > 1 hour Incidents < 1 hour	122 98 24	 80.32 % 19.68 %
FRZ E28 Tankers Assigned Yes (1)	Total Incidents Incidents > 1 hour Incidents < 1 hour	81 66 15	 81.48 % 18.52 %

This difference could be attributed to the availability of a sufficient water supply source on the scene of the incident. HFD apparatuses generally carry 500-750 gallons of water. Once this supply is extinguished, their firefighting options are limited until additional water can be obtained by another apparatus or by another means of water supply. Should the first arriving engine company not be dispatched with a tanker and it is decided one is necessary, a tanker will be dispatched. Unfortunately, the first arriving engine may deplete its water supply before the tanker, which is coming from another FRZ, arrives at the scene. Should the initial engine deplete its water supply, the fire may out-run the initial tactics of the firefighters.

This author conducted further analysis on the duration for those incidents that exceeded 1 hour. This analysis indicated that when HFD resources in Battalion 4 were unable to mitigate incidents in less than an hour, they averaged more than 3½ hours to extinguish the WUI fire. This points out the value of mitigating WUI fires within the first hour of operations before they can intensify and spread. If this is not accomplished, HFD will need to commit even more personnel and apparatuses, and for extended periods at an increased impact to HFD.

Question # 3 asked:

What procedures, personnel and resources are other departments utilizing to prepare for WUI incidents?

The responses from the questionnaire have identified that 22% of the agencies who responded to the questionnaire will commit 100% of their resources if needed to a WUI incident. Some of these agencies elaborated that they were able to commit 100% of their resources due, in part, to mutual aid pacts that support the movement and automatic aid of resources throughout their State or district. Four agencies reported that they are capable of committing between 94% and 60% of their resources, 11 agencies (22% of the responses) also reported that their procedures allow for the commitment of 50% of their resources while maintaining acceptable levels of service within their community. Twenty-four percent of the responses reported their agency could commit between 49% and 10% of their resources, while maintaining acceptable levels of performance (Appendix D).

When asked if their agencies ever exceeded these levels, 40% responded that they had done so in the past. Another 34% reported that their procedures would not allow exceeding those levels. Eighteen percent reported that this question did not apply to their department. Most of this 18% indicated their agency would commit 100% of their resources to WUI fires and therefore, obviously, could not commit more than 100%.

The data provided by the questionnaire identifies 152 wildfire training classes provided by the various departments completing the questionnaire. The most frequently provided training was the NWCG S-130 and S-190. This training was reported by 36% of those agencies that took part in the questionnaire. Nine other agencies

responded that their personnel received a Red Card as part of the wildland fire training. This equates to another 18%. The amount of responses received from agencies that provided S-130 and S-190 training, and those departments that provided their members with Red Cards total more than half the agencies responding (54%).

The next most frequently offered training reported in the responses was S-205/S-215 - Fire Operations In The Urban Interface course (30% of the responses). Sixteen percent of the departments provided Basic Wildland Training without elaborating on the particular course given. Twelve percent of the departments responding offered a Intermediate Wildland Fire Behavior S-290 course. Further results of the types of training contained in the responses can be reviewed in the appendix (Appendix J).

In evaluating those departments questioned within the State of Hawaii, Maui County has provided S-130 and S-190 training to 10% of their personnel and Hawaii County has provided these classes to 25% of their personnel, Kauai County is providing the S-130 and S-190 curriculum, which is administered by members of the DLNR Forestry Division to Kauai County's fire recruits as part of their training. To date, they estimate that 66% of their members have participated in this training. The Federal Fire Department in Hawaii has offered the S-130 and S-190 training to approximately 10% of their personnel. DLNR Forestry Division reported their firefighters are all S-130 and S-190 trained.

Seven of the 50 agencies that responded to the questionnaire reported they provided no wildland fire training. Another three agencies reported that they provided only minimal wildland fire training to their personnel. Together, these agencies represent 20% of the agencies responding.

In evaluation of this data, this identifies that a substantial number of agencies responding have identified that they provide some form of WUI training to their personnel, with the S-130/S-190 and the Red Card curriculums being the basis for the largest percentage of the training.

The results of the questionnaire from departments located within Hawaii are also similar to what was found in the overall questionnaire. While lower percentages of the agencies' personnel may have received the S-130 and S-190 training, these curriculums are still being provided to firefighters in each of the other three counties, the DLNR Forestry Division, and Hawaii's Federal Fire Department.

Fifty percent of the agencies responded that their training does lead to a National or State certification and 50% responded that it did not. All 50 agencies responding to the questionnaire answered this question (Appendix F).

Of the 50 agencies that responded to the questionnaire, the response was evenly divided between those that conducted pre-incident planning for WUI areas (48 %) and those that did not (48 %). Two respondents (4 %) did not answer this question (Appendix G).

Sixty-two percent of the agencies reported that they do not conduct structural triage to evaluate their defensibility in WUI situations. Of the 30% that reported conducting structural triage, the largest percentage reported basing their structural triage upon water supply, defensible space, and accessibility. Eight percent of the agencies chose not answer this question (Appendix H).

Question # 4 asked:

What procedures, personnel and resources are required by the Honolulu Fire Department to reduce the risk to residents, visitors, and emergency responders to a WUI incident?

Effective mitigation of WUI incidents requires a sufficient number of personnel, proper equipment, adequate training, and support by effective departmental procedures. To fulfill this requirement, HFD must assess its usual position as a structural firefighting department. The question HFD's leaders must ask is should it train for their most frequent type of incident or should they train for those types of incidents that are of lower probability but higher consequence? HFD may make a higher commitment to combating WUI fires by providing additional training to its members. HFD must place a high importance on providing personnel with training for all incidents they are anticipated to encounter, not only structural fires but also WUI fires.

HFD's FRZ No. 26 experienced 122 WUI fires in 2004. This translates to an average of just over one WUI fire every three days. Add to this those times they provide assistance into FRZ No. 28 and Engine Company No. 26 wherein they might have responded to more WUI fires in neighboring FRZs.

Oakland, California is an example of a department that has addressed the need to be prepared for both structural firefighting and wildland firefighting. The Los Angeles County Fire Department receives more than twice the annual training hours than HFD firefighters receive in WUI incidents and this training is provided to more than twice as many members than HFD employees.

Numerous documents have substantiated the value of pre-incident planning. HFD has a mandatory program to conduct pre-incident planning. Half of the agencies responding to the questionnaire reported that they perform some type of pre-incident planning.

The HFD has five frontline tanker apparatuses. Three of these are assigned to Battalion 4, one is assigned to Battalion 5, and one is assigned to Battalion 3. This respectively equates to 57% of Battalion 4 and 90% of Battalion 5 are not equipped with tanker apparatuses. Collectively, more than 85% of Honolulu's WUI fires occur in these two battalions. As discussed above, data from 2004 indicates this would increase the time to mitigate a WUI fire.

HFD's current dispatch procedures do not to support the initial operations of those companies without a tanker apparatus. This is because no tankers are automatically dispatched as part of the first alarm assignment to FRZs without tanker apparatuses.

DISCUSSION

As America's population continues to increase, more people will choose to live in wildland urban interface areas. The responsibility for departments to be prepared to protect these residents from WUI fires remains, much in the same way that departments are expected to be prepared for other hazards that are predominate within their jurisdictions.

Agencies such as the NFPA and the NWCG have established standards and minimum requirements for professional wildland firefighters, but these do not clearly address the responsibilities of urban departments.

In today's fiscal environment, fire departments throughout the country are finding themselves directed and mandated by governmental agencies such as OSHA and the Department of Homeland Security (DHS) to meet directives and regulations. Often these mandates come without the funds necessary to support the actions required. This financial strain limits fire departments on the number of new programs and training that can be enacted. While the NFPA and the NWCG offers recommendations that improve wildland firefighting operations, its adherence is optional. Some agencies adopt the entire standard, while others choose to only follow certain parts when possible.

Like so many other departments, HFD has found its ability to enact new programs limited. Training for wildlland firefighting would be forced to compete with other newly established programs such as the National Incident Management System (NIMS) awareness that is now required by DHS.

Through this research, this author has determined that WUI incidents create a significant impact on the HFD. The demand arising from the 525 WUI fires in 2004 required the commitment of 993 pieces of fire apparatuses to those incidents. HFD was definitely heavily impacted and the tax on resources affected service levels. The 6,131 suppression hours required to control and extinguish these fires cannot be ignored. In 2004 HFD was involved with multiple WUI fires that occurred simultaneously on 20 occasions. Due to the scope of the vast information on this matter, this author was unable to determine how often WUI incidents occurred while other major events such as building fires or rescues were taking place.

One of the limitations of this research is that it only evaluated WUI incidents. HFD responds to many more incidents than just WUI incidents. Further

analysis is necessary to accurately understand the full impact resulting from WUI fires. An example of this could be the wear and tear on equipment, injuries and fatigue to personnel, and a more comprehensive understanding of HFD service levels to other types of incidents while resources are committed to WUI fires.

To further amplify the WUI impact, 2004 appeared to be a mild wildfire season. Wildland fires have a tendency to burn in cycles. These cycles are impacted by the fuel load and weather condition. By comparison, the 2005 wildfire season as of July 15th has exceeded the entire year of 2004. HFD has responded to an estimated 576 WUI fires already (Boylan, 2005). Many of these have been large incidents and several have continued for more than three days. One incident in Nanakuli Valley located in Battalion 4 consumed more than 2,300 acres, more than all of which burned in the year of researched in this study (2005). This stresses the importance of understanding the impacts created by WUI fires as well as measures that could be taken to reduce such fires. Overall the WUI situation is very dynamic and in order for HFD to be proactive, it needs to be better prepared to combat WUI incidents.

Training is one of the means that HFD can reduce this impact. Currently, the WUI training provided by HFD is less than the amount of training provided by most of the agencies that responded to the questionnaire. More than 75% of the responding agencies conducted more hourly annual WUI training than HFD. Without training that provides the basic fundamentals such as LCES, 10 Standing Fire Orders, 18 Watch-Out Situations, and the 4 Common Denominators Of Fire Behavior On Tragedy Fires, HFD's efforts may compromise their effectiveness and safety of personnel. Unfortunately, this

could also be contradictory to the United States Fire Administration's 5 year Operational Objectives to reduce the number of firefighter fatalities by 25%.

The other three counties within the State of Hawaii have begun to train their personnel to the higher WUI standards recommended by the NFPA and the NWCG. Although a smaller percentage of their personnel are being trained, it is implementing this important training. Considering the number of incidents occurring in Battalions 4 and 5 on Oahu, these areas would be an effective place to implement a wildland fire-training program based on the S-130/S-190 curriculum. HFD's current training is insufficient for the hazards that Battalions 4 and 5 face.

The pre-incident planning effort conducted by HFD appears to be adequate when compared to the responses provided in the questionnaire but HFD's problem of accessing the preplan information by TMK number needs to be resolved.

HFD needs to assure that WUI preplans will be conducted in those FRZs at risk to WUI fires after preplans are prepared for occupancies with high degrees of hazard are completed. With HFD's wireless data project currently underway, HFD WUI preplans will become available on mobile data terminals located in each first line apparatus. This dissemination of information paves the way for a structural triage program, which HFD does not have at this time, so that all arriving companies at a WUI fire understand the structures defensibility and can therefore make the best fire-ground decisions. Stuart Glaser stressed the importance of these decisions in his research titled, "Wildland Interface Triage System for Line Officers and Incident Commanders". Glaser discusses the needs for officers, incident commanders, and firefighters to be able to

assess a situation and make rapid, critical decisions within minutes of arriving on the scene (2004).

This research has identified that in incidents where a tanker was dispatched with an engine company resulted in a more rapid mitigation of WUI fires. Currently, less than 25% of the stations in Battalions 4 and 5 have tankers assigned to them. WUI fires occurring in FRZs without tankers do not have a tanker dispatched as part of their initial alarm assignment. The results of this research indicate this procedure hampers HFD's ability to effectively extinguish WUI fires expeditiously. In Battalion 4, those FRZs with tankers are able to mitigate their WUI fires in less than an hour on an average of 16.4% of the times more frequently than the FRZs without tankers. Furthermore, research has indicated that if these fires are not controlled within the first hour, they usually require almost 3½ hours to extinguish. This translates to more resources and for longer periods of time, increasing the impact upon HFD.

RECOMMENDATIONS

Wildfire cycles fluctuate. Some years the WUI risk is very high, others it may be lower. These cycles are very difficult to predict. What is easier to foresee is as Honolulu's population continues to increase, HFD will find more people choosing to live within areas that interface and intermix with wildland fuels. To effectively manage and reduce today's WUI impact, HFD needs to amend it procedures, increasing its training and resource allocation to WUI incidents.

To accomplish this, this author recommends HFD increase the wildfire training to its personnel. HFD should provide NWCG's S-130/S-190 curriculum based training to all chief officers, captains, and personnel assigned to Battalions 4 and 5. Since

a large amount of HFD's firefighter recruits are initially assigned to these battalions, due in part to the fire activity, it may be worthwhile to consider implementation of this training as part of their recruit training. Subsequent training classes can be provided to those members assigned to HFD's other three battalions. All HFD personnel should be required to complete NFPA's online course, "Wildland/Urban Interface Fire Operations for Structural Firefighter Self Study".

Additionally, I recommend that HFD continue its pre-incident planning process and require companies located in WUI areas to assess their WUI fire risk and develop preplans to support and enhance operations in those areas. These preplans should also implement the use of the NFPA's Wildland Fire Risk And Hazard Severity Assessment Form (NFPA 1144). These preplans and assessments should be disseminated electronically via HFD's wireless data network upon its completion.

I also recommend that HFD purchase additional tanker apparatuses to be assigned in the areas of Battalions 4 and 5. HFD should examine ways to obtain the funds necessary for the procurement of these apparatuses by searching for Forestry and other types of federal grant programs. HFD should also now begin to secure approval for Apparatus Operators positions for these anticipated tankers. In Honolulu, the system to obtain approval and funding for new positions takes usually more than 3 years.

HFD should amend its dispatch procedures so that the nearest tanker is automatically dispatched to every WUI fire in Battalions 4 and 5.

Finally, I recommend HFD conduct a comprehensive review of our significant WUI incidents over the most recent 5 years. From this review, HFD's dispatch can send multiple companies to the locations where significant WUI fires have taken

place. This would require an amendment to dispatch procedures. Currently, HFD dispatches multiple companies to building fires throughout Oahu.

In the years past, HFD has found itself in dire situations where resource levels prohibited the commitment of much needed additional resources to WUI incidents. HFD has also seen occasions wherein homes are threatened or destroyed by WUI incidents. This author has also witnessed HFD personnel placing themselves in extreme danger unnecessarily, to which may be attributed to inadequate training or poor decision-making. Fortunately, the property damage has been minimal and the injuries few, but if HFD continues its pursuit to be the best department possible, it must not overlook its protection of wildland urban interface areas.

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