

SHELTERING-IN-PLACE DURING WILDFIRE, IS IT A VIABLE OPTION?

**EXECUTIVE ANALYSIS OF FIRE SERVICE OPERATIONS IN EMERGENCY
MANAGEMENT**

By: Ron Lindroth

Poudre Fire Authority &

Livermore Fire Protection District

Ft. Collins, Colorado

An applied research project submitted to the National Fire Academy as part of the
Executive Fire Officer Program.

March 2005

Certification Statement

I, Ron Lindroth, certify that this paper constitutes my own product, that where 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

Wildland/Urban Interface (WUI) fires pose an escalating problem to local fire districts and rural citizens. The purpose of this descriptive research was to determine if Sheltering-In-Place (SIP) could be a viable alternative to current suppression/evacuation strategy. Research found that in most circumstances SIP is a legal option to consider. SIP has been successfully implemented in Australia and parts of the United States, showing a documented reduction in loss of life and homes. To be successful, SIP requires fire service commitment to education and comprehensive civilian preparedness. A survey of district residents revealed both need to occur before local implementation. SIP strategy would ultimately reduce the burden on the fire service, increase public safety, and reduce fire loss in WUI fires.

Table of Contents

Abstract.....	3
Table of Contents.....	4
Introduction.....	5
Background and Significance.....	6
Literature Review.....	8
Procedures.....	14
Results.....	19
Discussion.....	34
Recommendations.....	40
Reference List.....	42
Appendix A: Letters of Introduction.....	47
Appendix B: Wildland Fire Survey Results.....	49
Appendix C: Wildland Fire Survey	58

List of Figures

Figure

1. Triage results of 87 Residential Structures.....	27
2. Percentage of correct responses to fire safety knowledge.....	29
3. Percentage of respondent's agreement with staying home vs. evacuating.....	30
4. Intentions of performing mitigation measures.....	30
5. Respondents evacuation plan and action.....	32
6. Other household member's plans and actual action.....	32

SHELTERING-IN-PLACE DURING WILDFIRE, IS IT A VIABLE OPTION?

Introduction

The problem being researched in *Sheltering-In-Place during Wildfire, is it a Viable Option?* is wildland fires in the Poudre Fire Authority (PFA) and Livermore Fire Protection District (LFPD) are posing an escalating challenge to the fire departments and an increasing risk to district residents. This risk is due to the increased frequency and intensity of wildfires, coupled with the increased development and population of the Wildland/Urban Interface. Concurrently, the staffing and equipping of the fire departments is not keeping pace with the increased risk. Additionally, sole reliance on fire suppression to ensure community safety from wildfire is proving to be an ineffective strategy. The purpose of this applied research project is to determine if Sheltering-In-Place concepts may be effectively applied to residents living in the Wildland/Urban Interface thereby increasing the community safety from wildfire.

This descriptive research project seeks to answer the following research questions:

1. Does a citizen have the legal right to not evacuate their residence during a wildfire?
2. What are the benefits to wildfire Shelter-In-Place strategies and have other jurisdictions utilized this approach successfully?
3. What base of knowledge must a homeowner have, and what mitigation measures must a homeowner have taken, for Shelter-In-Place to be a safe and viable strategy during a wildfire for district residents?

Background and Significance

In the United States, the last two decades have marked an increase in wildland fires that have exacted loss of life in the hundreds, tens of thousands of homes, and an economic loss in the billions of dollars. Much of this loss is attributable to the development of what is termed the Wildland/Urban Interface (WUI). During the last three decades, people have encroached further into the natural fire environment, building both individual homes and complete subdivisions with little consideration given to the dangers of wildfire.

In March of 2004, PFA and the LFPD experienced the largest WUI fire in their history. The multi-jurisdictional Picnic Rock fire burned 8,900 acres. Over the course of three days, it advanced into Bonner Peak Ranch and threatened over ninety homes, destroyed one residence, one commercial grade garage, and two historical buildings. The City of Greeley water supply was adversely affected, and over 100 residents and numerous livestock were evacuated during the fire. Had the weather not favorably changed, hundreds more lives and homes would have been at risk. Extended drought and an abundance of natural fuels have continued to exacerbate the fire problem.

Historically PFA and the LFPD have attempted to address the WUI issue through fire suppression operations and passive fire prevention information programs. Little has been done to directly acquaint and educate the home owner to the realities and responsibilities of living in the WUI. To curtail the threat of wildland fire in the WUI, the current fire department approach will have to change. Fire suppression efforts alone can not effectively mitigate the WUI fire issue, especially when wildfires grow into wind driven or plume dominated conflagrations. An interactive discourse between the home

owner and fire department that encourages co-responsibility towards the resolution of the WUI fire problem must occur. In a previous applied research project *Community Defense from Wildfire, an International Comparison* the author identified successful WUI strategies being employed in Australia that discouraged mass evacuations, but rather empowered the home owner to take responsibility for their own asset protection (Lindroth, 2005). A major component of this strategy included the concept of Sheltering-In-Place (SIP). The SIP concept is one where a competent resident makes an informed and educated decision to use a properly prepared residential structure and site as a safe refuge while the wildfire passes by.

The Australian Fire Services have advocated this concept for the last decade and shown a marked decrease in both loss of life and property (Harrap, 2004 a, c). Communities in California have been successfully developed around SIP principles, and have demonstrated remarkable success (Foote, 2004; RSF-Fire, 2004).

The probable future impact of this study is important to PFA and LFPD in that it further defines the direction the departments should take when developing WUI mitigation programs for the public. It may identify a long term strategy that will successfully reduce the risks associated with living in the WUI.

The author has chosen this research topic because of its relation to the National Fire Academy's Executive Fire Officer Program course *Executive Analysis of Fire Service Operations in Emergency Management*. In Unit 4: Community Risk Assessment / Capability Assessment, the student is to be able to conduct a community risk assessment that identifies and assesses critical hazards and vulnerabilities in a community and identify capability shortfalls in a community. This research project also relates to the

United States Fire Administration operational objective of responding appropriately in a timely manner to emerging issues. By identifying and developing effective solutions to the WUI fire problem, the PFA and LFPD, in partnership with its citizens, will reduce the community's vulnerability to wildfire.

The research project is dedicated to the memory of Graham and Jennifer Lindroth, who lost their lives attempting to escape the 1997 Fern Creek fire in the Dandenong Ranges of Australia.

Literature Review

A literature review was initiated at the National Emergency Training Center's Learning Resource Center. Additional research was conducted through the Internet, professional journals and codes, constitutional law, the Colorado Revised Statutes, and personal interviews. The purpose of this literature review is to discover how others have researched or experienced wildland fire SIP practices. Three basic questions must be addressed. First, does a citizen have the legal right to not evacuate their residence during a wildfire? Second, what are the benefits to wildfire Shelter-In-Place strategies and have other jurisdictions utilized this approach successfully? Third, what base of knowledge must a homeowner have, and what mitigation measures must a homeowner have taken, for Shelter-In-Place to be a safe and viable strategy during a wildfire?

Scant literature exists addressing the legal right of a citizen not to evacuate their residence during a wildfire. This is due in part to the principles of government in our country. The 10th Amendment of the Constitution of the United States (TCUS, 1992) states "The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people" (p. 23). The

Constitution of the State of Colorado, Article II Bill of Rights, Section 28 states “The enumeration in this constitution of certain rights impair or disparage others retained by the people” (CSC, 1877). Annotations of case law support the fact that individual liberty and rights are inherent, that sovereignty resides in individuals and that the public may regulate property under police power and further, the governor of the state of Colorado has been granted specific authority to issue a mandatory evacuation during disaster emergencies as provided for in the Office of Disaster Emergency Services (NexisLexis, 2004). The Emergency Preparedness Guide distributed by the Larimer County Sheriffs Office discusses wildland fire evacuations. There are three levels of evacuation notification the office will provide. Level one is an advisement that there is an emergency, level two is a warning that there is an emergency, and level three is an “Evacuation Order” (EPG, 2004). Though local law enforcement does not have the authority to issue a mandatory evacuation order, they do have the authority to control access to public roads, and may keep the public from returning once evacuated (LexisNexis, 2004). The city of Colorado Springs, Colorado has adopted by ordinance a wildfire mitigation plan that expects the evacuation of all residents from the fire area and provides authorization to public officials to issue a mandatory evacuation order. Any person who refuses the order is subject to arrest (CSEP, 2003).

In Australia, the right of the resident to stay and defend personal property is dependent upon which state they reside. The Australasian Fire Authorities Council (AFAC) believes a national approach should be adopted and advocates members of the community take responsibility for their own safety and property. It further states that where legislation exists that enables forced evacuation, a protocol should be developed

between fire and law enforcement granting the decision to evacuate to fire officials (AFAC, 2001).

The Australian fire service has shown many benefits exist for adopting a SIP approach to wildland fire (Lindroth, 2005). Australian research has shown that most houses are lost as a result of ember attack some time before or after the fire front has passed, not from the passing flame front (Ellis et al, 2004). This belief is supported by Ahern and Chladil (1999) and Ramsay, McArthur and Dowling (1987). Extensive research by the Rocky Mountain Research Station into the loss of structures from ember attack (Cohen, 1999, 2000 b, nd a, b) supports the Australian position. Cohen's work has repeatedly demonstrated the majority of homes are primarily lost from ember attack and not the flame front, and as a result advocates ignition resistant construction of homes built in the WUI (Cohen, 2000 a, c). The practical WUI experience of Butte County Fire Department Battalion Chief Bishop (1998, p. 58) supports Cohen's research. "Delayed ignition in I-zone fires has destroyed many homes that had initially been saved when the fire front moved through." Home losses occur in a broad range of wildland fuel types in both countries and does not appear to be a contributing or differentiating factor.

Studies by Wilson & Ferguson (1984) and Leonard & McArthur (2003) have shown that home survivability increases proportionately as the number of persons staying to protect it increase. Additionally, many civilian deaths have occurred when residents evacuated late and were caught outside or in their vehicles. Often their houses survived the fire and would have provided adequate shelter from the radiant heat had they stayed (Braun, 2002; CFA 2004; NFPA, 1991, 1992).

A review of Country Fire Authority, Australia (CFAA) policy by JRV Risk Engineers found that a strong case could be made to abandon evacuation as a policy given the impracticalities of early evacuation and the tendency for people to evacuate too late (CFAA, 1999). They further stated that with an early evacuation strategy, the risk of loss of life was low but the loss of homes was extreme; with a late evacuation the risk of both losses of life and homes was extreme; and with active defense the risk to of both loss of life and homes was significant. The Tasmania Australia fire service recommended SIP during the severe WUI Hobart fire of 1998. Though over a 1000 homes were threatened, only seven were lost of which six were unattended and there was no loss of life (Gledhill, 1999).

The 2003 Southern California Firestorm where 24 lives and 3,710 homes were lost provides differing perspectives on SIP principles. Often firefighters were faced with ethical dilemmas of operating in too risky of conditions because of the constant threat to civilian lives and private property. There was a lack of clear engagement criteria concerning residents who refused to evacuate indefensible homes verses working to save a more defensible home. When firefighters effectively communicated with residents, they became assets instead of distractions, which reduced the stress on both firefighters and residents alike (Nasiatka, 2003). The report further indicated that evacuation worked more effectively in areas that had plans than areas without plans. Late evacuations and limited traffic routing created challenges for firefighters trying to move into the area. Evacuation centers were overwhelmed by the task of housing, feeding and the communication needs of large numbers of evacuees. While much of the response to the fire siege appeared chaotic with substantial losses, this was not always the case.

In the path of the fire storm stood Stevenson Ranch. Stevenson Ranch is a SIP community with 3,500 homes where effective hazard mitigation measures were implemented after the 1993 conflagrations. Even though the fire burned around the ranch, there was no evacuation of residents, no loss of life, no loss of property and little fire service intervention (Foote, 2004). Franklin (1998) reports similar occurrences of individual property successes during the historic California fires of the 1990s. While SIP developments are being built in other regions, they have yet to experience the on slot of fire to document the results from their efforts (Flynn, 2003; RSF-Fire, 2004). Though quantitative data is limited, the loss of lives and homes from wildfire during the twenty first century is estimated to be 50 times greater in the United States than those of Australian states where SIP strategies are emphasized (Lindroth, 2005).

Substantial literature exists to answer the third research question of what base of knowledge must a homeowner have, and what mitigation measures must a homeowner have taken, for Shelter-In-Place to be a safe and viable strategy during a wildfire?

Krusel and Petris (1992) in a detailed study of the Ash Wednesday brushfire fatalities found that fire victims could be placed into three categories. 1.) Victims who recognized the real threat to their safety with enough time to save their lives, but chose ineffective strategies. 2.) Victims who did not recognize the threat in time to implement effective survival strategy. 3.) Victims who were physically incapable of implementing effective survival strategy.

For SIP principles to be effective, the person remaining must be an adult of sound mental and physical condition. Those that are aged or infirmed, young, or poorly prepared should evacuate the area well ahead of the fire or to adjoining homes that are a

more suitable safe haven. (Boura, 1998; Harrap, 2002a, b; Krusel & Petris, 1992). Active defense of a SIP property carries a significant level of risk. It is only a viable option where residents are well prepared, educated to wildland fire safety principles, and have the capacity to actively defend or protect their home (Braun, 2002). Rhodes and Odgers (2002) describe preparedness as five elements that provide a comprehensive approach to the issue.

- *Awareness* of the risk involves recognizing that wildfires are likely to occur and the homeowner needs to be prepared to deal with the event.
- *Knowledge* and understanding of how wildfires behave, how people and houses best survive a wildfire, and correct expectations of what is likely to happen during a wildfire.
- *Planning* involves developing and practicing a realistic fire plan, and includes the decision on whether SIP or evacuation is the best option.
- *Physical preparations* include a wide range of measures that reduce the fire risk to the property, provide for fire suppression, and ways to ensure personal protection.
- *Psychological readiness* involves residents being mentally and emotionally prepared to respond to the fire and being committed to stick to their plan.

Firewise (2005) programs provide current literature on effective physical preparations that can be taken to reduce the risk of fire. Recommendations for adequate defensible space through vegetation management and fuels reduction are readily available to the public. Building codes and standards for structures in the WUI provide detailed

information on construction techniques that will increase the ignition resistance of the structure (ICC, 2003; NFPA, 2002a), a concept strongly advocated by Cohen (Cohen, Johnson, & Walther; 2001) and Oaks (2001). While information for physical preparations is easily obtainable by most civilians, little literature on the other four areas of preparedness is available to them. Some members of the Firewise working group are moving to broaden its vision of possible solutions (Scarlett et al, 2004). The limited scope of information available to the public is not true in Australia. Australian Fire Brigades, Rural Fire Services and civilian authors provide comprehensive preparedness literature that is available in book, pamphlet and electronic format (Schauble, 2004; Webster, 2000; Whitaker, 2004). Additionally, building codes and land use planning requirements tied to the land title require ignition resistant construction and vegetation modification in an asset protection zone for a structure to be built in the interface (ASC, 2001; NSWRFs, 2001). The Australian fire services take public education very seriously, and endeavor to promote quality research into the field of public knowledge and response to wildfire. With this information, public education programs are further enhanced and refined (Boura, 1998; NSWRFs, 2001, 2002; Odgers & Rhodes, 2002).

In summary, the results of this literature review have identified critical information on what concepts must be addressed when considering a SIP program implementation for residents living in the WUI. It has also provided insight into the history of civilian rights in light of a mandatory evacuation order. Overall, the literature review has provided the author with a new found respect for the complexities involved in SIP program development. The process of citizen education, empowerment, and involvement is the foundation of the SIP program. While it appears to be a daunting task,

the literature clearly supports that this form of personal responsibility may ultimately be the best solution to solving the WUI fire problem, and provided the impetus to gain an understanding of the current knowledge level of district residents.

Procedures

To obtain research information on question number one: Does a citizen have the legal right not to evacuate their residence during a wildfire?, the author contacted Major Bill Nelson (970) 416-1985 of the Larimer County Sheriffs Office on July 27, 2005. Major Nelson could not provide a definitive answer to the question, and directed the author to the Colorado Attorney General Office. On August 3, 2005 the author conducted a telephone interview with Jeannie Smith (303) 866-5310, assistant to the Colorado Attorney General. Ms. Smith provided foundational information concerning question one and directed research towards the Colorado Revised Statutes (CRS)/ Governor/ Emergency/ Forest fire/ Emergency powers. The CRS were then researched on the Internet.

In regard to question two: What are the benefits to wildfire Shelter-In-Place strategies and have other jurisdictions utilized this approach successfully?, an extensive literature review was conducted on campus at the National Fire Academy Learning Resource Center and over the Internet on the worldwide web. Additionally, video footage from the 1991 and 2003 California wildfires, and Cohn's experiments on structure ignitability were reviewed to gain an understanding of fire spread through the WUI. A five day visit to the Australian New South Wales Fire Brigade and Rural Fire Service was made in December of 2004 to gain insight into how the Australian fire services manage the WUI fire problem. Arrangements for the visit and ride-along learning opportunity

were made through Greg Mullins, New South Wales Fire Commissioner and graduate of the National Fire Academy Executive Fire Officer program. Commissioner Mullins then provided assistance to meet Keith Harrap, Assistant Fire Commissioner of the New South Wales Rural Fire Service. An additional two days was spent with the Toowoomba, Queensland Fire Brigade and Queensland Rural Fire service. This was made possible by contacting Queensland Fire Brigade Area Commander Smith who made arrangements for the ride-along.

To answer question number three: What base of knowledge and mitigation measures must a homeowner have for Shelter-In-Place to be a safe and viable strategy during a wildfire for district residents?, a literature review consistent with methods used in question two was done. This review relied heavily on Australian Fire Brigade and Rural Fire Service public education material and three books published on Australian Bushfire Safety, due to limited public literature on this topic available in the United States. To gain insight into the public's perceptions of wildfire danger, their level of understanding of the danger, and to what extent have they prepared for and mitigated the danger; a survey of PFA and LFPD residents living in the WUI near the Picnic Rock fire was conducted (Appendix C).

The survey administered was based on the 2001/2002 New South Wales Bushfires Survey (NSWBS) developed by Alen Rhodes and Dr. Peta Odgers, Australasian Fire Authorities Council, Melbourne Australia, in conjunction with the NSWFB. This survey was selected for two reasons. First, the questionnaire provided a format to successfully garner information on the knowledge, understanding, behavior,

prevention activity and perception of risk of the public to wildfire. Secondly, the results of the Australian survey were available to the author for comparison.

To conduct the survey, permission was obtained from Alan Rhodes a.rhodes@cfa.vic.gov.au to replicate the intent of the NSWBS. The survey was then rewritten in language consistent with American understanding. A survey area of ten square miles surrounding and including the Picnic Rock fire was picked for the study. A total of 87 surveys were distributed reaching 100% of the survey area populous; and included 30 stand alone residential properties and 57 residential properties in the Bonner Peak Ranch Association. The study included both PFA and LFPD jurisdictions where substantial WUI risks with long narrow roads, brush filled gullies, heavy timber, limited immediate fire protection, and a populous with recent experience with a large wildland fire exist. The surveys were accompanied by a cover letter (Appendix A), and were distributed by personal delivery to each of the residences on August 2&3, 2005. When the resident was home, the author provided a brief background as to the purpose of the survey. If the resident was not home, the survey packet was left on the door. A return addressed and stamped envelope was included with the survey. Finally, an email was sent to all Bonner Peak Ranch residents by ranch secretary Gibbs requesting their support in completing the survey. Of the 87 surveys distributed, a total of 43 (50%) were returned.

While delivering the survey, each residence was evaluated for its susceptibility to loss from wildfire using Firewise principles. Using this evaluation, properties were triaged into three broad categories: “stand alone”, “savable with help”, and “at risk”.

The compilation of survey responses and analysis of the results were done using standard methods and are presented as a percentage of how the respondents answered.

Respondent percentages to each specific question may be found in Appendix B.

Limitations and Assumptions

The basis of legal research into question one was limited to the views and interpretations expressed by those in the current legal and judicial systems of the State of Colorado, supported by a cursory review of the Colorado Revised Statutes. While results are deemed accurate, they are not to be construed as an in depth legal study based on historical interpretations of case law.

While cultural differences between Australians and Americans exist; the assumption has been made that people respond to authority, education, and emergencies in similar ways due to the inherent nature of western European culture.

It is further acknowledged that the survey was distributed to less than ten percent of the districts' residents living in the WUI. To survey the complete populous living in the WUI would be beyond the scope of this research project.

Definition of Terms

Asset Protection Zone – The Australian term for Defensible Space.

Defensible Space – The area around the home where natural and man-made fuels have been modified to reduce the intensity of fire.

Ember Attack/Flurry – The phenomena of large quantities of wind blown fire brands immediately preceding the fire front.

Shelter In Place – The concept of sheltering in place is one where knowledgeable and competent individuals make an educated decision to stay at their properly prepared

residence during a wildfire. As the fire passes, the residents would remain inside the structure, then exit the structure after the threat passes to extinguish small fires that may be present on their assets.

Structure Triage Categories - Stand Alone: risk of loss from wildfire is minimal. Needs Assistance: the risk of loss would be decreased by the presence of two or more individuals with basic fire suppression knowledge and equipment. At Risk: risk of loss is high and would require trained firefighters with fire apparatus to have any chance of survival.

Wildland / Urban Interface - In its simplest terms, the interface is defined as the line, area, or zone where natural vegetative fuels (wildland) change to fuels that are man-made structures and other development (urban).

Results

On July 25, 2005, Major Bill Nelson of the Larimer County Sheriff's Office and former director of Larimer County Emergency Services was contacted to provide information on research question one: Does a citizen have the legal right to not evacuate their residence during a wildfire? Major Nelson could not provide a definitive answer to the question, and suggested contacting the Colorado Attorney Generals office. This was done and an appointment to speak with a staff member was made.

The results of question number one were ascertained by conducting a personal telephone interview with Jeannie Smith, assistant to the Colorado Attorney General on August 3, 2005. Ms. Smith stated she has an understanding of state law associated with mandatory evacuation, and in fact had provided legal opinions on the subject during the

Hayman fire, Colorado's largest fire in history. Due to her subject matter expertise, Ms. Smith was interviewed.

Ms. Smith stated that Article 10 of the United States Constitution reserves all rights other than those specifically granted to the federal government, to the states and individual citizen. The Colorado State Constitution further defines the states authority, then reiterates those rights not reserved by the state are individual rights. For government to be able to infringe on the individuals right, whether federal, state or local, it must have been granted the authority to do so. Article 32 of the Colorado Revised Statutes states Governor has been granted the authority to declare a state of emergency, and under this state of emergency, has the authority to issue executive orders and regulations that have the force and effect of law. Subsection (7) of CRS 24-32-2104 lists additional powers conferred upon the governor which includes: (e) Direct and compel the evacuation of all or part of the population from any stricken or threatened area within the state if the governor deems this action necessary for the preservation of life or other mitigation, response, or recovery; (f) Prescribes routes, modes of transportation, and destinations in connection with evacuation. (g) Control ingress to and egress from a disaster area, and the movement of persons within the area, and the occupancy of premises therein.

Ms. Smith clarified that residents must evacuate there residence if ordered to do so when under a disaster state of emergency that has been formally declared by the governor, and do not have the right to stay and defend their property. However she went on to say that this declaration happens vary rarely, and local government does not have the same authority. Nothing written in the Colorado Revised Statutes grant county government, the county sheriff, or fire districts or chiefs the authority to issue a

mandatory evacuation order. Nor has local law in Larimer County been amended to grant such authority. Thus, in the absence of a Governors declaration, residents do in fact have the legal right to shelter in place and not evacuate their property.

There are two more legal aspects that must be noted. The Sheriff's Office and the Fire Chief have the legal authority to control ingress and egress into an emergency scene. Thus, once a resident has voluntarily evacuated, even though they may have had the evacuation order presented to them as mandatory, they will be prevented from re-entering. Additionally, Ms. Smith stated that those residents that did not evacuate must stay on their own property. If found using a public road or interfering with a firefighter in performance of duty, they may be arrested and removed from the area.

To answer to research question two: What are the benefits to wildfire Shelter-In-Place strategies and have other jurisdictions utilized this approach successfully?, the author has had to rely heavily on information gained from the literature review and personal interviews with experienced fire officers, both local and abroad.

Both scientific research and wildfire experience have shown that SIP concepts can be successful when properly implemented. A sufficient understanding of fire behavior, construction methods, personal and physical preparation, and loss data exists to overwhelmingly support the argument that when properly and completely implemented, civilian defense of and sheltering in there homes is a very successful strategy. The research did not find one fire fatality where a life was lost when a complete SIP program was instituted. However research did show that an incomplete or partial preparation, both physically and psychologically, can have severe consequences. The concept of last minute evacuation is extremely risky, and places both the resident and home in

substantial danger. Numerous examples exist where civilian loss of life is directly attributable to late evacuation. The tens of thousands of homes lost in the WUI are evidence that the suppression based model of fire protection is not working.

The New South Wales Fire Brigade Fire Commissioner Greg Mullins relayed an interesting observation. “My perception of what I observed in the U.S. during my study was that the communities were seen as a “problem” that needed to be moved out of the way so that the fire department can do its job. It also seemed to me that many citizens knew little about fire and what they could do to help themselves other than flee” (G. Mullins, personal communication, September 27, 2004). This perception appeared to be true while observing citizen actions on video footage from Oakland and Paint fires of southern California. Observations of raw video footage from the California “Old Fire” of 2003 indicated many homes were lost from ember attack, and subdivisions were virtually empty of civilians, leaving film crews successfully defending some residential assets with garden hoses. Many instances were observed where one or two civilian defenders would have allowed the residence to be saved. From Captain Pietrangelo’s observations, the two modern structures lost in the Picnic Rock fire occurred from ember attack and not the passing flame front (personal communication, January 28, 2005).

Two distinct processes were used to answer question three: What base of knowledge must a homeowner have, and what mitigation measures must a homeowner have taken, for Shelter-In-Place to be a safe and viable strategy during a wildfire for district residents? A literature review was conducted to provide the author with a clear and comprehensive understanding of what complete preparedness encompasses.

The Australasian Fire Authorities Council's approach appeared to the author to be the most comprehensive information available. Complete preparedness requires an awareness of the risk, knowledge of both fire and human behavior, planning for the fire event, physical preparations to reduce the properties susceptibility to fire, and psychological readiness for the fire event.

Risk awareness involves recognizing the fact that a wildfire is likely to occur, and that residents need to be prepared to deal with it. Awareness is foundational to all the other aspects, because without awareness, the resident will be taken totally by surprise and simply reacts to the situation. Living in the mountains has inherent risks associated with weather, wildlife, fire, limited medical assistance and other public infrastructure. With the influx of urban people into rural areas, it can not be assumed everyone has accurate risk awareness. Risk awareness includes people's perception of how likely, and how often a wildfire may occur; and how well they would cope with and recover from the fire.

Knowledge is critical for the resident to shelter in their home, and must be complete and accurate. The recommended information a person must be knowledgeable of includes the following topics:

- Fire Behavior- How fires intensity and rate of spread is influenced by vegetation, weather, drought, and topography.
- How Houses Burn- Houses ignite in three ways: ember attack, direct flame contact, and radiant heat. The house is susceptible to ember attack up to an hour before the fire front arrives, and up to eight hours after. When the fire front

arrives, it will generally last 5 to 15 minutes and subject the house to ember attack, radiant heat, and direct flame contact.

- How To Survive – Personal survival requires the understanding that in wildland fires, it is radiant heat that threatens life, not smoke as in the case of structure fires. A properly prepared home will provide protection from the radiant heat. A vehicle may provide more protection than being outside, but is generally not sufficient to provide adequate protection, and being exposed to intense radiant heat can be lethal in seconds. Skin is extremely susceptible to radiant heat burns, thus thick natural fiber clothing should cover all the body as a barrier to radiant heat. Because of the extreme lethality of being trapped outside or in a vehicle by the fire, last minute evacuation should not be attempted.

Planning involves developing, writing and practicing a plan that considers all members of the family and takes into account the different circumstances of each. Thought must be given to what will be done if family members are away, if children or elderly adults are home alone, pets and livestock, communications with neighbors and family members, and other details particular to the family. Most importantly, the decision to stay to defend the home and SIP or to leave well ahead of the fire must be made. Plans must be made that do not rely on fire department support; they may not be available to do so. An understanding how a residents can access timely fire situational information and updates is important to know beforehand.

Physical preparations are those measures taken to reduce the risk of the house catching on fire, tools to fight the fire, and supplies to keep household members safe. Physical preparations are to be done well before the fire season, and maintained annually.

- **Defensible Space-** By zone modification of vegetation, the intensity of the fire can be substantially reduced before it reaches the structure while still having esthetically pleasing landscape. Fuel modification includes thinning trees, removing ladder fuels, removing concentrations of fuel such as firewood, mowing, and maintaining a green or inorganic perimeter around the structure. Fire resistive plant species may be used as wind, ember and radiant heat barriers; as well as other fire resistant landscaping measures such as rock walls and berms.
- **Structure Ignition Resistance-** WUI building codes describe in great detail how a structure can be built to resist ignition. The removal of ember traps by screening vents and openings, double paned or tempered glass that withstands radiant heat, roofing and siding that is at least one hour fire rated. Items such as excelsior plant baskets or floor mats, upholstered lawn furniture, debris in gutters, lattice work and privacy fencing may also trap embers and spread fire.
- **Firefighting Equipment-** Basic tools such as garden hose and nozzles with a water supply that operates without public utilities, water containers, garden sprayers, shovels, rakes, ladder, wet towels and mops, all to be used to extinguish spot fires and not to attack the fire front. Additionally, appropriate clothing including boots, gloves, wide brimmed hat, goggles, and mask should be ready for each household member. Finally personal items of food, drinking water, medication, flashlight and radio with spare batteries, and a first aid kit should be sufficiently stocked to last five days.

Psychological readiness involves residents being mentally prepared to activate their fire plan and committed to staying with it. With proper preparations, instead of

reacting, residents will be able to respond appropriately to the threat. Consulting with properly trained fire authorities may provide insight for additional refinement of the preparations, and peace of mind knowing the preparations passed a professional review.

While the homeowner is primarily responsible for preparation before the incident and its effective implementation when the emergency arises; it is the responsibility of the government to provide accurate, timely information to all those affected by the fire.

To completely answer the third question, a review of the fire department survey is in order. A total of 87 surveys were delivered, with a return of 43 surveys (50 %). The respondent demographics included 24 males (56%) and 19 females (44%). The age of respondents was primarily in their 50's (30%), then 40's (25%), followed by equal numbers in their 30s, 60's, and 70's. Further, 52% of households had two residents, 16% had three, 12 % were single residents, and 12% had four or more family members. One quarter of the respondents indicated dependent children or adults living in their home. There were no obvious differences or trends observed in the survey responses due to age or gender. Approximately one third of respondents reported fire on or near their property with 12% reporting damage of improvements. One quarter of the respondents experienced heavy smoke and ash but no fire, and one half reported seeing the smoke and fire at a distance.

While delivering the survey, homes were evaluated and triaged into three categories; at risk, savable with SIP preparation, and stand alone. Of the 87 homes evaluated, 12 were at risk, 51 were savable, and 41 were considered safe to stand alone.

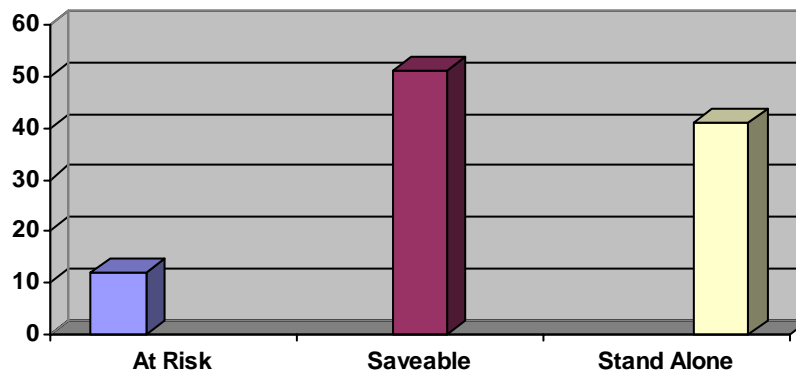


Figure 1: Triage results of 87 Residential Structures

To gain an understanding into the resident's perceived risk of wildfire, seven questions were asked. The WUI fire problem is primarily suppression response oriented though some prevention measures are undertaken. Question four asked the respondents how effective agencies were in this response. Ninety five percent stated that fire departments were effective or better, 82.5% stated the forest service was effective or better, 67.5% stated local government was effective or better, and the homeowner association was viewed as equally effective and ineffective. When asked how effective the same agencies were in preventing fires, all agencies scored 15% less effective than their ability to respond. Question five asked homeowners to rank six options on whose responsibility it was for wildland fire safety. Respondents overwhelmingly stated that individual households were primarily responsible, followed by fire departments. Respondents closely ranked the forest service, local government, and homeowner associations in successive order, and consistently rated insurance companies as least responsible.

Questions 6-9 were asked to ascertain respondents risk awareness of wildfire when compared to other traumatic events. Ratings of how likely and how often a wildfire

may occur; and how well they would cope with and recover from a fire were compared to other threats including severe storms, terrorism, a house fire, vehicle crash, theft/assault, or medical emergency. Ninety five percent of the respondents answered correctly that a wildfire would likely occur in the area during the next two – five years. When asked how often wildfires occur, the frequency was perceived as less than severe storms but more frequent than all other risks. Almost all respondents reported their household would deal with a severe storm, wildfire, or medical emergency well or very well, twice the number who stated they would deal well with a law enforcement event. In coping a week after the event 90% of respondents felt confident coping with a severe storm, though the confidence dropped to 52 % when easily coping with a wildfire. Most respondents felt it would be harder to cope one week after a medical emergency, vehicle crash, house fire, theft/assault or terrorist event than a wildfire.

Questions 1-3 were asked to assess the general fire safety knowledge of the respondent. Question one asked ten true/false/don't know questions that would provide insight to the resident's level and accuracy of knowledge. The expected correct answer has been shaded in figure 2 on the following page.

	True	False	Don't know
All trees should be removed from an area within 1000 feet of the house.	10	85	5
Houses can explode in severe wildfires.	62.5	10	27.5
A wildland fire front will generally spread one mile an hour or less.	20	42.5	37.5
Most people who die in a wildfire die from the effects of the heat generated by the fire.	20	50	30
Most houses are destroyed in the short period of time it takes for the fire front to pass.	32.5	42.5	25
In choosing clothes, keeping cool is the most important consideration when fighting a fire.	12.5	72.5	15
If caught in a wildfire while driving, it is safer to stay in the car than to get out.	35	30	35
It is advisable to hose down your house on a high fire danger day just in case of fire.	10	65	25
During a total fire restriction, it is acceptable to have a charcoal or wood cooking fire.	0	95	5
A wood sided house can provide effective protection from the effects of a fire front.	5	80	15

Figure 2: Percentage of correct responses to wildland fire safety knowledge.

Question two was asked to gain insight into the perceived risk of sheltering in place versus evacuation even at the last minute. Staying home would be considered a safe and correct response if SIP preparations have occurred. Leaving at the last minute would be considered an unsafe and incorrect response, though leaving early would be a safe and acceptable response.

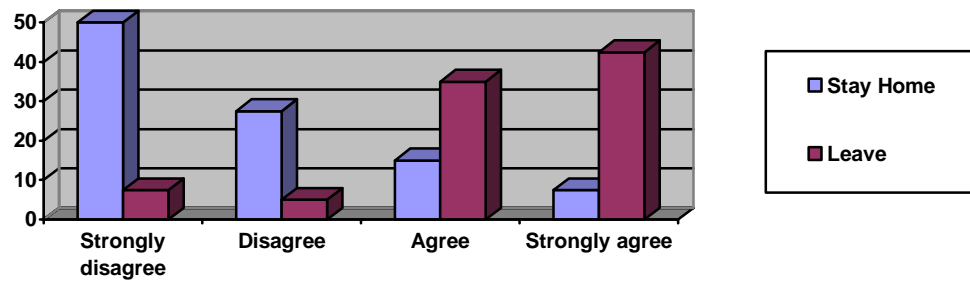


Figure 3: Percentage of respondent's agreement with staying home or evacuating.

Question 10 seeks to identify the respondent's intentions towards physical preparation activities in regards to making their property fire safe and defensible. The desired response would be that all of these activities would already have been done.

	Already done	Intend to do	May do	Would not do	Not sure
Replace combustible wood roof or wood shake siding.	65	5	5	15	10
Establish a stored water supply of at least 500 gallons and ability to use it.	45	2.5	15	20	17.5
Get equipment such as water containers, shovels, ladder, etc. to extinguish spot fires.	77.5	2.5	15	5	0
Prepare a kit containing protective clothing for each member of the household.	10	15	25	32.5	17.5
Store firewood and other combustibles away from the house.	87.5	7.5	2.5	2.5	0
Screen or cover all gaps to reduce risk of embers entering concealed spaces.	42.5	25	7.5	7.5	10
Manage vegetation to recommended defensible space guidelines.	85	7.5	5	2.5	0
Develop a homeowner association fire plan	7.5	12.5	22.5	15	42.5
Increase personal knowledge for dealing with fire and other emergencies.	32.5	52.5	15	0	0

Figure 4: Intentions of performing mitigation measures.

While the desired response would be “Already done, or Intend to do” for all categories; of those queried 30% have not nor do they intend to replace combustible roofs or siding, 52.5% do not intend to establish a water supply, 75% do not intend to prepare a kit containing protective clothing, and 80 % do not intend to develop a homeowner

association plan though one third of the respondents do not live in an association. Over 90% have or intend to institute defensible space practices, and over half desire to increase their personal knowledge for dealing with fire or other emergencies.

Question 14 was designed to follow up question 12 to determine what level of preparation residents would take in the next year. One quarter of the residents indicated they would continue as in the past, while three quarters indicated they would do more than in the past. Of those, 12% indicated a great deal more would be done.

An important aspect of preparation involves planning. Question 12 asked if a plan was made for what household members would do in a wildfire. Seventy two percent indicated they had, while 27% indicated they had not. Of those that indicated they had prepared a plan, only 12% wrote the plan out. Most respondent's plans had at least somewhat considered all household members needs, and discussed with them the plan. Fewer than half indicated the plan was practiced or shared with neighbors.

To gain insight into the psychological readiness of residents supporting their plan, three questions were asked. Before the fire what did you intend to do? During the fire what did you do? In the future what do you plan to do? Respondents indicated a slightly more conservative response when indicating what other family members would do. The following figures illustrate the respondents' and others' plans and actions.

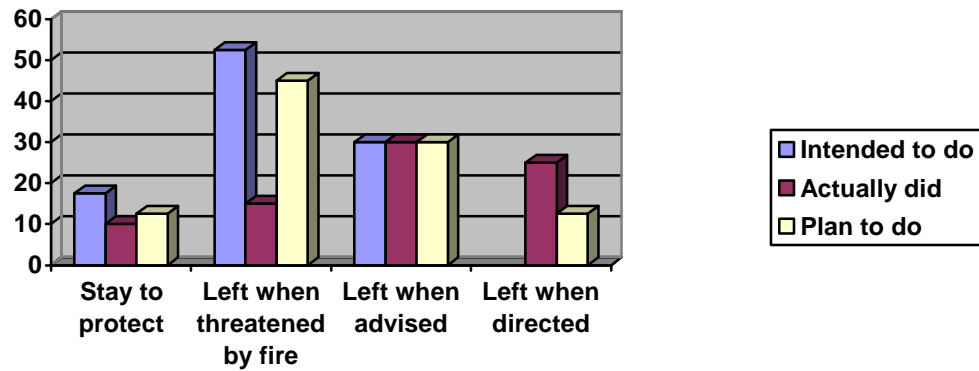


Figure 5: Respondent's plans and actual action

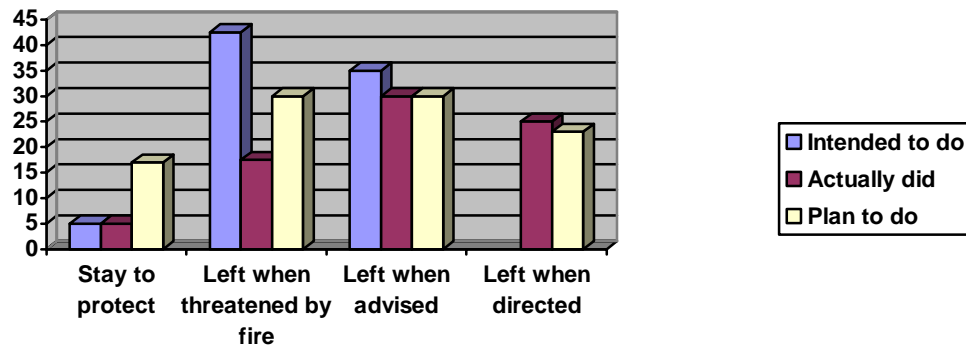


Figure 6: Other household member's plans and actual action.

Fewer than 20% of survey respondents planned to stay and defend their residences, but most individuals that planned to stay actually did, and plan to do so in the future. More than fifty percent planned to leave when threatened by fire, but 80 % of those modified their plan and left when advised or were directed to leave. Of those directed to leave fewer than half plan to follow the direction in the future. While respondents' answers to question 17 indicated a general satisfaction with being directed to leave, there was some frustration expressed because of it. From written comments, this frustration came from

not being allowed to return to their home after they were told to evacuate; when they had not planned to leave initially.

When asked how the respondents first became aware of the fire, the majority (72.5%) observed it themselves. The news media was cited as informing 12.5%, slightly more than the ten percent who learned about it from a neighbor. Only one respondent indicated they initially learned of the fire from a reverse 911 call back. Over 90% received information that there was a fire in the area and the corresponding need for evacuation. Two thirds of the respondents received information about the fire and associated road closures. Half indicated getting information on how to protect their homes, while one third indicated receiving advice on personal safety, where to evacuate to, and what to do with animals. Of those that received information, 80-90 % indicated the information was helpful. Respondents further indicated that this information is either very or extremely important for them to receive.

While respondents correctly identified firefighters as being involved in the firefighting effort, only two thirds of the respondents were aware that the forest service and other emergency services were involved. Ten percent indicated they, other household members, and neighbors stayed and fought the fire to some degree.

The last area of information gathered from the survey was in question 21 and dealt with what priority should be given to fire suppression/prevention activities. All respondents agreed fighting the fire was the highest priority. Three quarters indicated information dissemination during a fire was the next priority. Two thirds indicated education as a high priority while the remaining felt it was a medium priority. Fifty

percent felt preseason hazard reduction and the enforcement of wildfire regulations was a high priority, while 40 % felt those activities should be a moderate priority.

The results of the literature review identified what base of knowledge a homeowner must have, and what mitigation measures must a homeowner have taken, for Shelter-In-Place to be a safe and viable strategy during a wildfire. It further identified whether district residents had this base of knowledge, and provided some insight into the extent mitigation measures have been instituted. The results of this section of research indicate a wide variation between what is desired and expected for a SIP program and the actual comprehensive preparations of the residents living in the Picnic Rock Fire area.

Discussion

The results of this research proved to be compatible with the findings of others discussed in the literature review. Beginning with question one, the information provided by Ms. Smith of the attorney generals office was supported by evidence of federal and state law. The local government of Larimer County *does not* have the lawful right to issue a mandatory evacuation order (TCUS, 1992: CSC, 1877), and would only have that right by using home rule laws and passing an ordinance similar to that of Colorado Springs (CSEP, 2003). The state does however, have the right to issue a mandatory evacuation order when a disaster is declared by the governor (NexisLexis, 2004). Additionally, once residents have evacuated, local government does have the right to keep them from reentering the evacuated area (NexisLexis, 2004). The lack of clear understanding of the law may be the basis for the confusion and frustration expressed by some residents in the survey. When residents receive an evacuation order (EPG, 2004), it is often viewed as mandatory evacuation. The response to survey questions 15-18 that

differentiated between being advised to evacuate vs. being directed to evacuate supports this premise. An interesting finding was half the number of residents that did leave when advised too indicated they do not plan to evacuate in the future. This would be an appropriate choice if residents adopt the SIP principles identified in research question three, but could have very negative consequences if they do not. The implication of these findings indicates that citizens residing in PFA and LFPD will have the tendency to not evacuate in the future, resulting in more people remaining in the fire area. The fire districts have an obligation to both honor that choice and encourage residents to do so safely. Firefighters and law enforcement must also be clear that they are only advising the resident, not mandating the resident, to evacuate. Whether residents choose to SIP or evacuate, the fire service is obliged to provide timely, accurate, and complete fire information to the public. Interaction with the public has been identified as an important SIP principle (Odgers & Rhodes, 2002). This assertion has been supported by the survey results that indicate respondents feel information is either very or extremely important, and written comments stating how this was poorly handled during the Picnic Rock fire.

The benefits of adopting SIP strategy are two fold. The first benefit discussed is the benefit to PFA and LFPD. By instituting an effective SIP strategy, civilians become an asset to the fire department vs. a liability. Harrap (2004 a,b,c) would agree. By SIP, the home owner takes responsibility upon themselves to protect their own property. This alleviates the need to have an engine at the home to protect it. If the fire department attempted to place an engine at all homes triaged as “at risk” and “needs assistance” 63 engines would be required. If residents stayed to protect their own property where the home was triaged as “savable with assistance” and the fire department sent engines to

protect “at risk” homes, only twelve engines would be required. This is an 80% decrease in number of engines required. Better still, if Bonner Peak Ranch moved to become a SIP community similar to the Stevenson Ranch described by Foote (2004), all fire resources could concentrate on fire control, not structure defense. Another advantage the fire department would realize would be the substantial reduction in number of evacuees that would need to be managed; a serious problem identified by Nasiatka (2003) during the California fire siege.

The second benefit is to the home owner. When done properly, the home owner is safer SIP than last minute evacuation (Braun, 2002; CFA 2004; NFPA, 1991, 1992). In Bonner Peak Ranch main roads are one lane with few turnouts. They cross brush choked draws, have few turn around locations, and no secondary exits. High potential for entrapment and loss of life exists if late evacuation were to occur, a substantial risk identified by CFAA (1999) and the AFAC (2001). Yet most survey responses indicated district residents thought it safer to evacuate at the last minute rather than shelter in place. This is a misconception that must be addressed. Another benefit the homeowner would realize is the increased survivability of their home. Studies by Wilson & Ferguson (1984) and Leonard & McArthur (2003) show home survivability increases as the number of persons in attendance increase. While reviewing California wildfire video footage, the author observed numerous instances where a civilian could have safely defended their home, yet the home was lost because no one was there to control the spot fires, an all too common occurrence described by Bishop (1998).

Ultimately SIP is a viable and obtainable strategy that will produce better results than the current suppression/evacuation strategy employed by PFA and LFPD. However for this to occur, the issues raised in question three must be addressed.

SIP is an effective strategy only when comprehensive preparation has taken place. The preparation model advanced by Rhodes and Odgers (2002) requires an awareness of the risk, knowledge of both fire and human behavior, planning for the fire event, physical preparations to reduce the properties susceptibility to fire, and psychological readiness for the fire event. An overwhelming number of survey respondents indicated that the primary responsibility for home protection lies with the homeowner. Secondly, the responsibility resides with the fire service. When looking at the number of respondents that indicated a desire for more wildfire information and willingness to work on their property, it behooves PFA and LFPD to provide the education and expertise to the homeowner.

Respondents generally perceived the risk of wildfire accurately, and indicated the fire departments ability to respond to wildfires was very good. Thus for the majority of wildfires, the suppression model of response is adequate. However for the few fires that become wind driven or plume dominated conflagrations, this no longer holds true. It is during these fires that SIP becomes critical.

The second category of comprehensive preparation deals with knowledge. Knowledge is the foundation of effective preparation (Odgers & Rhodes, 2002). Most residents realize defensible space described by Firewise (2005) does not require clear cutting all vegetation around their home. They further understand that firewood should be stored away from the home, and that outside fires are not permissible during fire bans.

This knowledge has been carried through into action. Most respondents indicated these risks had been mitigated, though the authors triaging of structures identified more homes at risk than perceived by residents. The accuracy of respondent's knowledge decreased after this, and general fire knowledge from similar questions was on average 20% less than that of Australians as reported by Rhodes and Odgers (2002).

The overwhelming body of research by Cohen (1999, 2000 b, nd a, b), Ahern and Chladil (1999), and Ramsay, McArthur and Dowling (1987) all indicate the loss of structures is primarily due to ember attack, not the fire front. In fact most structures resist ignition from the fire front quite well. This fact has not been communicated to the public. Most do not understand how a house will burn. Two thirds of the respondents indicated a house would explode in a severe wildfire and an additional 25% did not know if it would or not. Further, only five percent knew a wood frame house would provide protection from the fire front. This misconception may explain why the majority of respondents disagreed with the idea of staying at home during the fire and that it is better to leave even if at the last minute. It also may be the reason less than half of the respondents had screened openings for ember protection where recommended by building codes (ICC, 2003), and 25% believe wood shake roofing and siding is acceptable.

Personal safety is the third area of knowledge needed. The concept of intense radiant heat from wildfire is not generally understood by the public, nor is the knowledge on how to protect oneself from it. Without a foundational understanding of fire behavior described in layman terms by Schauble (2004) and Webster (2000), residents will be lacking knowledge to make adequate survival decisions.

Planning is the third element of preparation. While 75 % indicated having developed a plan, less than 25% practiced it or wrote it down. Fewer yet worked to develop a homeowner association plan. Plans that are not reinforced in writing and practice are more susceptible to change. This may explain the disconnect observed in what respondents stated they would do when compared to what they actually did when deciding whether to stay or go. The most critical element of planning involves making the decision before the fire whether to evacuate early or SIP.

Physical preparations include creating and maintaining defensible space, making the home ignition resistant by removing ember traps, and developing equipment and supplies to actively combat spot fires safely. For a home to be rated as stand alone, defensible space and ignition resistance must both be addressed. For a home to qualify as a viable shelter, all three preparation elements must be present. Physical preparations tended to be 15% higher than those of Australians surveyed by Rhodes and Odgers (2002).

There is no way to effectively measure psychological readiness, yet the individual's response to the fire is critical. Acting appropriately with correct knowledge is life saving, acting inappropriately or with incorrect knowledge can be life threatening. (Krusel and Petris, 1992). Supplying residents with correct and timely information both before and during the fire is crucial for residents to be secure in their decision process.

It is the author's opinion that wildland SIP program implementation for PFA, LFPD and their citizens is both desirable and doable. The process will require a substantial investment of time and energy on the part of the fire department in developing a public education program that presents the requisite information in a manner that is

conducive to acceptance by the public. It then becomes the public's responsibility to act on the knowledge provided. Only when both are accomplished, will the negative effects of a WUI fire be effectively mitigated.

Recommendations

Based on the results of this research, it is the author's recommendation that Poudre Fire Authority and the Livermore Fire Protection District move forward with adopting the Shelter-In-Place concept as a foundational planning tool when developing and implementing strategies for WUI mitigation. With the implementation of SIP, the problems associated with the ineffective strategy of evacuation/suppression of large WUI fires will be reduced by an effective strategy that shares the responsibility of the problem with those who the fire affects most, the home owner. This shared responsibility for WUI mitigation increases community safety without a corresponding fire department increase in staffing and equipment. It further reduces the threat of loss of life and property by proactively mitigating the hazard through risk reduction. Effective SIP implementation leads to predictable, positive outcomes; where as status quo supports less predictable outcomes with a much greater potential for loss.

The author recommends the following steps be taken to implement SIP and intends to be an advocate for change.

- Educate the District Board of Directors, Operations Team and WUI Team on the merits of SIP and obtain their support for the program.
- Request the Fire Prevention Bureau to research and pursue the adoption of a WUI fire code.

- Educate firefighters in SIP principles, provide an understanding of the resident's right not to evacuate, and develop operational directives that support the fire department to operate to best advantage.
- Develop a comprehensive SIP public education program that includes all five major areas of awareness, knowledge, planning, physical preparation, and psychological readiness.
- Deliver the program to residents in Bonner Peak as a test population.
- Adjust the program as needed, and then advance to other WUI communities in the districts.
- Work with dispatch and law enforcement to discourage last minute evacuations.

It is imperative that SIP is actively marketed as a complete package, and anything less than the complete program allows for greater vulnerability and risk. It is also understood that SIP is not intended for everyone. Only those who have fully prepared, and are of sound body and mind, should consider SIP. The young, aged, and infirmed should evacuate well ahead of the fire.

Future readers should be aware that the task of adopting SIP as a WUI mitigation strategy is contradictory to what is generally considered acceptable practice in the United States. To accomplish this daunting task, one must be willing to challenge and change the cultural beliefs of both the fire service and the public. This becomes an easier when factual knowledge supports the effort. However, a contagious passion for effective risk reduction will be the impetus required to make effective change with the public that resides in the WUI.

REFERENCE LIST

- Ahern, A., Chladil, M. (1999). *How Far do Bushfires Penetrate Urban Areas?* Albury, Australia: School of Environmental & Information Sciences, Charles Sturt University.
- Australasian Fire Authorities Council [AFAC]. (2001). *Position Paper on Community Safety and Evacuation During Bushfires*. Victoria: Australia. AFAC Limited.
- Australian Standard for Construction in Bushfire Prone Areas [ASC]. (1999). Building Code of Australia. AS3959.
- Bishop, J. (1998). Hang on to what you've won. *Fire Chief, June*, 58-59.
- Boura, J. (1998). Community Fireguard: Creating Partnerships with the Community to Minimize the Impact of Bushfire. *Australian Journal of Emergency Management*, 13, 59-64.
- Braun, K. (2002). Bushfire Threat to Homeowners. *Community Perspectives about Fire*, 2, 64-71.
- California Fire Alliance [CFA]. (2004). *California Fire Siege 2003, The Story*.
- Cohen, J. (1999). *Reducing the Wildland Fire Threat to Homes: Where and How Much?* Missoula, MT: USDA Forest Service.
- Cohen, J. (2000a). *Examination of the Home Destruction in Los Alamos Associated with the Cerro Grand Fire*. Missoula, MT: USDA Forest Service.
- Cohen, J. (2000b). Preventing Disaster: Home Ignitability in the Wildland-Urban Interface. *Journal of Forestry*. 98 (3).15-21.
- Cohen, J. (2000c). *What is the Wildland Fire Threat to Homes?* Missoula, MT: USDA Forest Service.

- Cohen, J. (n.d.a). *A Site Specific Approach for Assessing the Fire Risk to Structures at the WUI*. Missoula, Montana: USDA Forest Service.
- Cohen, J. (n.d.b). *Wildland-Urban Fire- A Different Approach*. Missoula, MT: USDA Forest Service.
- .Cohen, J.; Johnson, N.; Walther, L. (2001). Saving Homes from Wildfires: Regulating the Home Ignition Zone. *Zoning News*. Washington, D.C.: American Planning Association.
- Colorado Springs Fire Department Evacuation Plan [CSEP]*. (2003). Retrieved from disk obtained from csfd.springsgov.com Version – P Colorado Springs Fire Department Mitigation Plan.
- Constitution of the State of Colorado [CSC]*. (1877). Retrieved on August 9, 2005, from <http://i2i.org/Publications/ColoradoConstitution/iscolocn.htm>
- Country Fire Authority, Australia [CFAA]. (1999). *Review of Community Response to Wildfire Policy*. Waverley, VIC: VRJ Risk Engineers Pty Ltd.
- Ellis, S., Kanowski, P. & Whelan, R. (2004). National Inquiry on Bushfire Mitigation and Management. Canberra, Australia: Commonwealth of Australia. Retrieved January 25, 2005, from <http://www.coagbushfireinquiry.gov.au/findings>
- Emergency Preparedness Guide [EPG]*. (2004). Fort Collins, CO: Larimer County Sheriff's Office.
- Firewise. (2005). Retrieved January 16, 2005 from <http://www.firewise.org>
- Flynn, B. (2003). Remote Control. *NFPA Journal*. March/April. 4-9.
- Franklin, S. (1998) Sheltering in Place: Surviving Catastrophic Wildfire. *American Fire Journal*. 50 (11). 12-13.

- Foote, E. (2004). *Preventing Wildland/Urban Interface Fire Disasters*. Santa Rosa, CA: Author.
- Gledhill, J. (1999). Prepare, Stay and Survive. *Wildfire*. 8 (6), 8-13.
- Harrap, K. (2004a). *Evacuation: Strategic Withdrawal or Abandoning the Community?* Sydney, Australia: New South Wales Rural Fire Service [NSWRFS].
- Harrap, K. (2004b). Shelter Shock. *Wildfire*. 13, 18.
- Harrap, K. (2004c). *Protecting the Wildland/Urban Interface Community: The Australian Perspective*. Sydney, Australia: New South Wales Rural Fire Service.
- International Code Council [ICC]. (2003). *2003 International Urban-Wildland Interface Code*. Retrieved on January 15, 2004, from http://www.iccsafe.org/ps/pdf/2003_IUWIC.pdf
- Krusel, N; Petris, S. (1992). Staying Alive: Lessons Learnt from a Study of Civilian Deaths in the Ash Wednesday Bushfires. *Fire Management Quarterly*. December, 3-19.
- Leonard, J.; McArthur, N. (2003). A History of Research into Building Performance in Australian Bushfires. *Fire Australia*. May, 16-19.
- Lindroth, R. (2004) *Community Defense from Wildfire, an International Comparison*. Emmitsburg, MD: National Fire Academy.
- Nasiatka, P. (2003). *Southern California Firestorm 2003*. Marana, AZ: Mission Centered Solutions.
- National Fire Protection Association [NFPA]. (1991). *The Oakland/Berkeley Hills Fire*. Quincy, MA: NFPA.

- National Fire Protection Association. (1992). *Fire Storm Case Study*. Quincy, MA: NFPA.
- National Fire Protection Association [NFPA]. (2002a). *Standard for Protection of Life and Property from Wildfire*. (NFPA 1144). Quincy, MA: NFPA.
- New South Wales Rural Fire Service [NSWRFS]. (2001) *Planning for Bushfire Protection*. Sydney, Australia: NSWRFs.
- New South Wales Rural Fire Service [NSWRFS]. (2002). *Southern Region Community Education Project*. Sydney, Australia: Cliff Reece & Associates PTY Limited.
- NexisLexis. (2004). *Rights Reserved Not Disparaged*. Retrieved on August 9, 2005 from <http://198.187.128.12/mbPrint/17161f53.htm>
- Oaks, D. (2001). Fight or Flight. *Building Standards, LXX* 5. 22-25.
- Odgers, P., Rhodes, A. (2002). *Community Response to the New South Wales Bushfires 2001-2002*. Sydney, Australia: Australasian Fire Authorities Counsel.
- Ramsey, C., McArthur, N., Dowling, V. (1987). Building Survival in Bushfires. *Operations, 182*, 1-3 6-8.
- Rancho Santa Fe Fire Protection District [RSF-Fire]. (2004). *Sheltering in Place During Wildfires*. Rancho Santa Fe, CA: Rancho Santa Fe Fire Protection District.
- Schauble, J. (2004). *The Australian Bushfire Safety Guide*. Sydney, Australia: Harper Collins Publishers.
- Scarlett, L., Heftel, C., Wiss, C., Ismay, R., Coburn, B., White, G., et al. (2004). *American Perspectives on the Wildland/Urban Interface*. Wildland Urban Interface Working Team.

The Constitution of the United States with Index and The Declaration of Independence

[TCUS]. (1992). Washington, D.C.: Commission on the Bicentennial of the United States Constitution.

Webster, J. (2000). *The Complete Bushfire Safety Book*. Sydney, Australia: Random House Australia Pty Ltd.

Whitaker, R. (2004). *Firewise, Fire-Safe How to Survive a Bushfire*. Sydney, Australia: Reed New Holland Publishers Pty Ltd.

Wilson, S., Ferguson, R. (1984). Fight or Flee? A case study of the Mount Macedon Bushfire. *Australian Forestry* 47 (4). 230-236.

Appendix A: Letters of Introduction

Livermore Fire Protection District Survey

July 28, 2005

Dear Resident

The Livermore Fire Protection District is interested in collecting information on the effects of the wildland fires in the Bonner Peak Ranch area over the last several years, the most recent being the Picnic Rock Fire. The information gathered will be used in a National Fire Academy research project that aims to develop a greater understanding of the needs of Bonner Peak residents in preparing for, and during, wildland fire emergencies.

The accompanying survey is an important component of this project. Your participation in this survey and the information you provide are valuable and will help the Livermore Fire Protection District and other emergency services improve wildland fire safety in your area. Your personal identity is not tied to this survey, your answers are confidential, and will not be used for any other purpose beyond this research project.

Thank you for your time and support of this project. Please return the survey within one week of its receipt. If you wish to obtain information on protecting your home from wildfire, or have questions about this survey or other aspects of the project, please contact Ron Lindroth at (970) 224-4979.

Sincerely,

Ron Lindroth

Assistant Chief

Livermore Fire Protection District

Poudre Fire Authority Survey

July 30, 2005

Dear Resident:

The Poudre Fire Authority is interested in collecting information on the effects of the wildland fires in the foothills area over the last several years, the most significant being the Picnic Rock Fire. The information gathered will be used in a National Fire Academy research project that aims to develop a greater understanding of the needs of district residents in preparing for, and during, wildland fire emergencies.

The accompanying survey is an important component of this project. Your participation in this survey and the information you provide are valuable and will help the Poudre Fire Authority and other emergency services improve wildland fire safety in your area. Your personal identity is not tied to this survey, your answers are confidential, and will not be used for any other purpose beyond this research project.

Thank you for your time and support of this project. Please return the survey within one week of its receipt. If you wish to obtain information on protecting your home from wildfire, or have questions about this survey or other aspects of the project, please contact me at (970) 224-4979 or via email at rlindroth@fcgov.com

Sincerely,

Ron Lindroth, Captain
Poudre Fire Authority
LaPorte Station 7

Appendix B: Survey results expressed in percentages.

1. Would you say the following statements are generally true, false, or don't know?

	True	False	Don't know
All trees should be removed from an area within 1000 feet of the house.	10	85	5
Houses can explode in severe wildfires.	62.5	10	27.5
A wildland fire front will generally spread one mile an hour or less.	20	42.5	37.5
Most people who die in a wildfire die from the effects of the heat generated by the fire.	20	50	30
Most houses are destroyed in the short period of time it takes for the fire front to pass.	32.5	42.5	25
In choosing clothes, keeping cool is the most important consideration when fighting a fire.	12.5	72.5	15
If caught in a wildfire while driving, it is safer to stay in the car than to get out.	35	30	35
It is advisable to hose down your house on a high fire danger day just in case of fire.	10	65	25
During a total fire restriction, it is acceptable to have a charcoal or wood cooking fire.	0	95	5
A wood sided house can provide effective protection from the effects of a fire front.	5	80	15

2. To what extent do you agree or disagree that the following statements are good advice on what people should do during a wildfire.

	Strongly disagree	Disagree	Agree	Strongly agree
Plan on staying home during the fire.	50	27.5	15	7.5
Plan to leave the area of the fire, even if last minute.	7.5	5	35	42.5

3. How effective are the measures taken by the following in preventing wildfires in your area?

	Very effective	Effective	Ineffective	Very ineffective
Local county government	15	37.5	35	12.5
Fire departments	32.5	47.5	15	5
Forest services	15	52.5	17.5	10
Homeowner association	7.5	30	42.5	5

Wildfire Sheltering-In-Place

4. How effective are the measures taken in responding to wildfires in your area?

	Very effective	Effective	Ineffective	Very ineffective
Local county government	25	42.5	25	7.5
Fire departments	55	40	5	0
Forest services	35	47.5	10	2.5
Homeowner association	15	30	30	10

5. Who do you think should be responsible for wildfire safety in your area? Please rank the following from Most Responsible (1) to Least Responsible (6).

Local county government	5	3.9
Fire departments	2	2.6
Forest services	3	3.3
Homeowner association (Most rated either 2 or 5)	4	3.5
Individual households	1	1.5
Insurance companies	6	5.5

6. How likely do you think it is that the following events may occur in your area in the next two to five years?

	Very likely	Likely	Unlikely	Very unlikely
Severe storm	70	27.5	2.5	0
Terrorism	0	5	32.5	62.5
Wildfire	62.5	32.5	2.5	2.5
House fire	12.5	35	45	7.5
Vehicle crash	32.5	45	22.5	0
Theft / assault	5	37.5	45	12.5
Medical Emergency	45	45	10	0

7. How often do you think the following events occur in your area?

	Very often	Often	Seldom	Never
Severe storm	35	42.5	22.5	0
Terrorism	0	0	20	80
Wildfire	20	37.5	42.5	0
House fire	0	5	95	0
Vehicle crash	15	25	60	0
Theft / assault	2.5	5	85	7.5
Medical emergency	7.5	37.5	55	0

8. How well do you think your household would deal with being in a ...?

	Very well	Well	Poorly	
Severe storm	60	40	0	
Terrorism	17.5	40	42.5	
Wildfire	30	67.5	2.5	
House fire	20	65	15	
Vehicle crash	22.5	67.5	10	
Theft / assault	22.5	45	32.5	
Medical emergency	25	70	5	

9. How easy do you think it would be for your household to cope in the week after a...?

	Very easy	Easy	Hard	Very Hard
Severe storm	32.5	57.5	10	
Terrorism	7.5	22.5	30	40
Wildfire	5	47.5	42.5	5
House fire	2.5	17.5	50	30
Vehicle crash	5	32.5	50	12.5
Theft / assault	7.5	15	67.5	10
Medical emergency	5	32.5	60	2.5

10. For each of the following activities, indicate whether you have done them or intend to do them in the next twelve months.

	Already done	Intend to do	May do	Would not do	Not sure
Replace combustible wood roof or wood shake siding.	65	5	5	15	10
Establish a stored water supply of at least 500 gallons and ability to use it.	45	2.5	15	20	17.5
Get equipment such as water containers, shovels, ladder, etc. to extinguish spot fires.	77.5	2.5	15	5	0
Prepare a kit containing protective clothing for each member of the household.	10	15	25	32.5	17.5
Store firewood and other combustibles away from the house.	87.5	7.5	2.5	2.5	0
Screen or cover all gaps to reduce risk of embers entering concealed spaces.	42.5	25	7.5	7.5	10
Manage vegetation to recommended defensible space guidelines.	85	7.5	5	2.5	0
Develop a homeowner association fire plan	7.5	12.5	22.5	15	42.5
Increase personal knowledge for dealing with fire and other emergencies.	32.5	52.5	15	0	0

11. Has a plan been prepared for what you & others in your household would do in a wildfire?

Yes	72.5	<i>Please go to question 12</i>
No	27.5	<i>Please go to question 14</i>

12. Is your plan written?

Yes	12
No	88

13. Given you have prepared a plan of what to do in a wildfire, to what extent have you also...

	A lot	Somewhat	Not at all
Discussed your plan with all members of your household?	48	52	0
Practiced your plan?	25	20	55
Taken into account the different needs of everyone in your household?	54	35	11
Let your neighbors know about your plan?	11	28	61

14. In light of the recent wildfires and current fire conditions, do you think that over the next twelve months your household will prepare....?

Less than in the past	0
About the same as in the past	27.5
A little more than in the past	60
A great deal more than in the past	12.5

15. Before the recent wildfires in your area, which one of the following best describes what you intended to do, and which one best describes what others in your household intended to do, if a fire occurred while you were home?

	You	Others
Stay and protect the house throughout the fire.	17.5	5
Do as much as possible to protect your home but leave if threatened by the fire.	52.5	42.5
Stay, but leave if told to by emergency service personnel.	30	35
Leave as soon as you become aware of a fire in the area.	0	7.5

16. Which one of the following best describes what you did, and which one best describes what other members of your household did during the recent wildfire in your area?

	You	Others
Stayed to protect the house throughout the fire.	10	5
Did as much as possible to protect your home but left when threatened by the fire.	15	17.5
Left home because emergency services <u>advised</u> us to so.	30	30
Left home because emergency services <u>directed</u> us to do so.	25	25
Left as soon as we became aware of the fire.	0	0
Were not at risk so stayed home.	12.5	12.5
Was not at home.	7.5	5

17. If you were directed to leave your home during the wildfire, circle the number on each of the scales that best represents how you felt about being directed to leave.

Satisfied 1 2 3 4 Dissatisfied **(1.5)**

Consistent with your plan 1 2 3 4 Inconsistent with your plan **(1.1)**

Supported 1 2 3 4 Unsupported **(1.3)**

Not Resentful 1 2 3 4 Resentful **(1.2)**

At Ease 1 2 3 4 Ill at Ease **(1.3)**

Not frustrated 1 2 3 4 Frustrated **(2)**

18. If in the future you experienced a wildfire in your area which one of the following best describes what you would do, and which one describes what other members of your household would do?

	You	Others
Stay and protect your house throughout the fire.	12.5	17
Do as much as possible to protect your home but leave if threatened by the fire.	45	30
Leave home if <u>advised</u> to by emergency services.	30	30
Leave home if <u>ordered</u> to by emergency services.	12.5	23
Leave home as soon as become aware of the fire.	0	0
Don't know.	0	0

19. Which one of the following best describes how you first became aware of the wildfire in your area?

Saw the fire, smoke, or ash.	72.5
Heard a radio or TV announcement.	12.5
Received a 9-1-1 call back notification.	2.5
From emergency personnel.	0
From neighbors or friends.	10
Noticed the activity of emergency services in the area.	2.5
Other (<i>Please specify</i>)	

20. During the recent wildfires, who was involved in fighting the fire on or near your property? (Percentage of respondents acknowledging category of involvement)

Fire fighters	95
Other emergency service personnel (e.g., sheriffs office)	67.5
Forest service	62.5
Neighbors or friends not affiliated with the volunteer fire department	12.5
Self	10
Other household members	7.5
Not sure	10
Other (<i>Please specify</i>)	

21. What priority do you think the fire services should give to each of these activities?

	High	Medium	Low	Not a priority
Education of the community.	62.5	37.5		
Pre season hazard reduction.	52.5	37.5	5	5
Informing and advising a community during a wildfire.	75	17.5	7.5	
Fighting the wildfire.	97.5	2.5		
Enforcing wildfire regulations.	55	40	5	

22. Which of the following describe the way in which the recent wildfire affected your property? (You may need to check more than one box.) (Percentages sum to > 100%)

The wildfire caused damage to buildings, fences, or possessions on my property.	12.5
The fire burned vegetation on my property, but no buildings, fences or other possessions.	20
The fire burned within 100 yards of my property.	5
Burning sparks and embers landed on my property.	7.5
There was heavy smoke and ash, but no burning material on my property.	27.5
Could see smoke and fire at a distance from my property.	50
Unsure of the extent of the wildfire near my property.	5

23. Please indicate whether you received the following information during the Picnic Rock Fire and, if you did, whether it was helpful.

	Did you receive the information?		Was the information helpful?	
	Yes	No	Yes	No
General information about fires in Larimer County.	61	39	91	9
That there was a fire in your area.	94	6	90	10
The location and direction of spread of the fire.	75	25	89	11
Advice on how to protect your home during the fire.	53	47	84	16
Advice on personal safety during the fire.	39	61	78	22
Advice on whether to evacuate your home.	92	8	84	16
Advice about where to go if you left your home.	36	64	69	31
Advice on what to do with livestock and pets.	33	66	83	17
Road closures and reopening of roads.	64	36	87	13
What was being done by emergency services to bring the fire under control.	72	28	81	19
Other (<i>Please specify</i>)				

24. How important would it be for you to receive the following information during a wildfire?

	Extremely important	Very important	Important	Not very important
Information about fires in Larimer Co.		(2.1)		
Location, direction, and severity of the fire in your area.	(3)			
Weather forecasts and the implications for the fire situation.		(2.1)		
Road closures and openings.	(2.6)			
Advice on how to protect yourself and your property.		(2.3)		
Whether to leave, where to go, and when to return.		(1.8)		
How fire control efforts are progressing.	(2.5)			
Other information (<i>Please specify</i>)				

26. The following personal information would be helpful to better address your needs. (#'s)

- Are you... Male (24) or Female (19)
- Your age range is... 30's (5), 40's (11), 50's (13), 60's (7), 70's (5)
- There are dependent children or adults in your home... Yes (11), No (28)
- There are _____ persons living in your household.
One (5), Two (22), Three (7), Four (4), Five (2)

If you have any comments you would like to make in relation to the recent wildfires, or other related matters, your remarks would be appreciated.

Eleven comments were received that were pleased with the firefighting effort; that the firefighters were supportive, sensitive and helpful.

Four comments were received about communications; that there was poor information given, it was out dated, were not aware of the web site, and did not appreciate media on private property without permission.

Three comments were made stating it was a poor survey.

Three comments were received expressing negative feelings on how the fire was fought.

Two comments were received expressing negative feelings towards the Sheriffs Department; they were rude, insensitive, and failed to keep people out of the area.

One comment was received that expressed appreciation for the post fire meeting.

One comment was received expressing appreciation for the fire departments fire prevention education.

Appendix C: Wildland Fire Survey

Poudre Fire Authority
and
Livermore Fire Protection District
Wildland Fire Survey

Questionnaire

Instructions

There are 26 questions that require you to check the most appropriate response or rank a series of options. The survey should take about 15 minutes of your time. Once the survey is complete, please deposit it in the box labeled “Fire Department Survey” next to the mail boxes at the entrance of your association.

Thank you for helping us assist you in staying safe during wildfire emergencies.

Wildfire Sheltering-In-Place

1. Would you say the following statements are generally true or false?

	True	False	Don't know
All trees should be removed from an area within 1000 feet of the house.			
Houses can explode in severe wildfires.			
A wildland fire front will generally spread one mile an hour or less.			
Most people who die in a wildfire die from the effects of the heat generated by the fire.			
Most houses are destroyed in the short period of time it takes for the fire front to pass.			
In choosing cloths, keeping cool is the most important consideration when fighting a fire.			
If caught in a wildfire while driving, it is safer to stay in the car than to get out.			
It is advisable to hose down your house on a high fire danger day just in case of fire.			
During a total fire restriction, it is acceptable to have a charcoal or wood cooking fire.			
A wood sided house can provide effective protection from the effects of a fire front.			

2. To what extent do you agree or disagree that the following statements are good advice on what people should do during a wildfire.

	Strongly disagree	Disagree	Agree	Strongly agree
Plan on staying home during the fire.				
Plan to leave the area of the fire, even if last minute.				

3. How effective are the measures taken by the following in preventing wildfires in your area?

	Very effective	Effective	Ineffective	Very ineffective
Local government				
Fire services				
Forest services				
Homeowner association				

Wildfire Sheltering-In-Place

4. How effective are the measures taken in responding to wildfires in your area?

	Very effective	Effective	Ineffective	Very ineffective
Local government				
Fire services				
Forest services				
Homeowner association				

5. Who do you think should be responsible for wildfire safety in your area? Please rank the following from Most Responsible (1) to Least Responsible (6).

Local government	
Fire services	
Forest services	
Homeowner association	
Individual households	
Insurance companies	

6. How likely do you think it is that the following events may occur in your area in the next two to five years?

	Very likely	Likely	Unlikely	Very unlikely
Severe storm				
Terrorism				
Wildfire				
House fire				
Vehicle crash				
Theft / assault				
Medical Emergency				

7. How often do you think the following events occur in your area?

	Very often	Often	Seldom	Never
Severe storm				
Terrorism				
Wildfire				
House fire				
Vehicle crash				
Theft / assault				
Medical emergency				

8. How well do you think your household would deal with being in a ...?

	Very well	Well	Poorly	
Severe storm				
Terrorism				
Wildfire				
House fire				
Vehicle crash				
Theft / assault				
Medical emergency				

9. How easy do you think it would be for your household to cope in the week after a...?

	Very easy	Easy	Hard	Very Hard
Severe storm				
Terrorism				
Wildfire				
House fire				
Vehicle crash				
Theft / assault				
Medical emergency				

Wildfire Sheltering-In-Place

10. For each of the following activities, indicate whether you have done them or intend to do them in the next twelve months.

	Already done	Intend to do	May do	Would not do	Not sure
Replace combustible wood roof or wood shake siding.					
Establish a stored water supply of at least 500 gallons and ability to use it.					
Get equipment such as water containers, shovels, ladder, etc. to extinguish spot fires.					
Prepare a kit of personal protective clothing for each member of the household.					
Store firewood and other combustibles away from the house.					
Screen or cover all gaps to reduce risk of embers entering concealed spaces.					
Manage vegetation to recommended defensible space guidelines.					
Develop a homeowner association fire plan					
Increase personal knowledge for dealing with fire and other emergencies.					

11. Have you prepared a plan about what you and others in your household would do in a wildfire?

Yes		<i>Please go to question 12</i>
No		<i>Please go to question 14</i>

12. Is your plan written?

Yes	
No	

13. Given you have prepared a plan of what to do in a wildfire, to what extent have you also...

	A lot	Somewhat	Not at all
Discussed your plan with all members of your household?			
Practiced your plan?			
Taken into account the different needs of everyone in your household?			
Let your neighbors know about your plan?			

14. In light of the recent wildfires and current fire conditions, do you think that over the next twelve months your household will prepare....?

Less than in the past	
About the same as in the past	
A little more than in the past	
A great deal more than in the past	

15. Before the recent wildfires in your area, which one of the following best describes what you intended to do, and which one best describes what others in your household intended to do, if a fire occurred while you were home?

	You	Others
Stay and protect the house throughout the fire.		
Do as much as possible to protect your home but leave if threatened by the fire.		
Stay, but leave if told to by emergency service personnel.		
Leave as soon as you become aware of a fire in the area.		

16. Which one of the following best describes what you did, and which one best describes what other members of your household did during the recent wildfire in your area?

	You	Others
Stayed to protect the house throughout the fire.		
Did as much as possible to protect your home but left when threatened by the fire.		
Left home because emergency services <u>advised</u> us to so.		
Left home because emergency services <u>directed</u> us to do so.		
Left as soon as we became aware of the fire.		
Were not at risk so stayed home.		
Was not at home.		

17. If you were directed to leave your home during the wildfire, circle the number on each of the scales that best represents how you felt about being directed to leave.

Satisfied	1	2	3	4	Dissatisfied
Consistent with your plan	1	2	3	4	Inconsistent with your plan
Supported	1	2	3	4	Unsupported
Not Resentful	1	2	3	4	Resentful
At Ease	1	2	3	4	Ill at Ease
Not frustrated	1	2	3	4	Frustrated

18. If in the future you experienced a wildfire in your area which one of the following best describes what you would do, and which one describes what other members of your household would do?

	You	Others
Stay and protect your house throughout the fire.		
Do as much as possible to protect your home but leave if threatened by the fire.		
Leave home if <u>advised</u> to by emergency services.		
Leave home if <u>ordered</u> to by emergency services.		
Leave home as soon as become aware of the fire.		
Don't know.		

19. Which one of the following best describes how you first became aware of the wildfire in your area?

Saw the fire, smoke, or ash.	
Heard a radio or TV announcement.	
Received a 911 call back notification.	
From emergency personnel.	
From neighbors or friends.	
Noticed the activity of emergency services in the area.	
Other (<i>Please specify</i>)	

20. During the recent wildfires, who was involved in fighting the fire on or near your property?

Fire fighters	
Other emergency service personnel (e.g., sheriffs office)	
Forest service	
Neighbors or friends not affiliated with the volunteer fire department	
Self	
Other household members	
Not sure	
Other (<i>Please specify</i>)	

21. What priority do you think the fire services should give to each of these activities?

	High	Medium	Low	Not a priority
Education of the community.				
Pre season hazard reduction.				
Informing and advising a community during a wildfire.				
Fighting the wildfire.				
Enforcing wildfire regulations.				

22. Which of the following describe the way in which the recent wildfire affected your property? (You may need to check more than one box.)

The wildfire caused damage to buildings, fences, or possessions on my property.	
The fire burned vegetation on my property, but no buildings, fences or other possessions.	
The fire burned within 100 yards of my property.	
Burning sparks and embers landed on my property.	
There was heavy smoke and ash, but no burning material on my property.	
Could see smoke and fire at a distance from my property.	
Unsure of the extent of the wildfire near my property.	

23. Please indicate whether you received the following information during the Picnic Rock Fire and, if you did, whether it was helpful.

	Did you receive the information?		Was the information helpful?	
	Yes	No	Yes	No
General information about fires in Larimer County.				
That there was a fire in your area.				
The location and direction of spread of the fire.				
Advice on how to protect your home during the fire.				
Advice on personal safety during the fire.				
Advice on whether to evacuate your home.				
Advice about where to go if you left your home.				
Advice on what to do with livestock and pets.				
Road closures and reopening of roads.				
What was being done by emergency services to bring the fire under control.				
Other (<i>Please specify</i>)				

24. How important would it be for you to receive the following information during a wildfire?

	Extremely important	Very important	Important	Not very important
Information about fires in Larimer Co.				
Location, direction, and severity of the fire in your area.				
Weather forecasts and the implications for the fire situation.				
Road closures and openings.				
Advice on how to protect yourself and your property.				
Whether to leave, where to go, and when to return.				
How fire control efforts are progressing.				
Other information (<i>Please specify</i>)				

26. The following personal information would be helpful to better address your needs.

- Are you... Male or Female
- Your age range is... 20's, 30's, 40's, 50's, 60's, 70's, 80's, 90's
- There are dependent children or adults in your home... Yes No
- There are _____ persons living in your household.

If you have any comments you would like to make in relation to the recent wildfires, or other related matters, your remarks would be appreciated.

Thank you for your time and cooperation!