ENGINE COMPANY OPERATIONS IN THE WILDLAND/URBAN INTERFACE: STRUCTURE PROTECTION

LEADING COMMUNITY RISK REDUCTION

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ABSTRACT

The problem the research addressed was that Evesham Fire-Rescue firefighters were not specifically trained to safely perform structure protection in the wildland/urban interface. The purpose of the research was to develop a training manual that educated firefighters to safely perform structure protection. The research method used for the project was action research. The research resulted in a structure protection training manual for Evesham Fire-Rescue.

Both a literature review and interviews were conducted to answer the following questions:

1. What elements should be examined to triage a structure according to risk in the wildland/urban interface?
2. What tactics can be performed to reduce the risk of ignition to the structure?
3. What safety precautions do firefighters need to use while operating in the wildland/urban interface that is not typical to normal structure firefighting?

Upon the completion of the literature review and interviewing content experts the results identified that the following elements should be examined to safely protect a structure: Rescue, Involvement, Exposures, Roof Coverings, Defensible Space, Water Supply, Personnel, Escape Routes, Access & Egress, Fuel, Weather, Hazardous Materials, Siding on Buildings, Heat Traps, Power Lines, Topography, Equipment and Fire Behavior.

The following tactics should be performed to reduce the risk of structure ignition: stretching handlines, clearing fuels, removing hazardous materials and vehicles, setting ladders, constructing a fireline, and preparing the interior.

To operate safely firefighters should follow the Ten Standard Fire Orders, Watch-Out Situations, and Look-Outs, Awareness, Communication, Escape Routes and Safety Zones (LACES).

It was recommended that Evesham Fire-Rescue develop standard operating procedures and train for structure protection in the wildland/urban interface and involve agencies that may assist in the operations.

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INTRODUCTION

The sight of large fires destroying numerous acres of forest and homes on the television news each evening is becoming a common sight. These fires can destroy complete developments that have been built in wooded areas. When this occurs, the fire is sometimes labeled a wildland/urban interface fire. With more homes being built in the forest and remote areas the greater the chances of homes being exposed to these types of fires.

According to the National Association of Counties (2003-2004) "Catastrophic wildfires not only cause damage to the forests and other lands, but place the lives of firefighters at risk, pose threats to human safety and health, personal property, wildlife species, sustainable ecosystems, and air and water quality (¶ 5)." They go on to explain that nationwide in 1999 six million acres of public lands were burned. To illustrate the fact they stated that the land burned is equivalent to a 1.5 mile-wide swath from Washington D.C. to Los Angeles and back again.

Is the wildland/urban interface problem something new? The Federal Wildland Fire Policy (2002) explains that the problem is not a new one and the solutions to the problem are not newly conceived. Documents created to address the problem in 1960s, 1970s, 1980s all contain the same goals and suggestions as today.

The southern portion of Evesham Township is part of the New Jersey Pine Barrens, which is a section of New Jersey covered by Pine Trees. This portion of the township also has several developments and individual homes located in the Pine Barrens. According to the New Jersey Forest Fire Service (1996-2004) web site entitled

Wildfire in New Jersey " Land-use pressures, improved transportation, more leisure time and an increase desire for a more rural lifestyle have resulted in a proliferation of resident subdivision and developments in wildland area that are subject to forest fire hazards. The majority have been planned and built without due consideration for forest fire protection" (¶ 1).

Evesham Fire-Rescue has the responsibility to protect the citizens of the township and their homes located in the wildland/urban interface. The problem is that while all department firefighters are trained in structural firefighting, the firefighters are not specifically trained to perform risk analysis and structure protection in the wildland/urban interface. The lack of a formal training program for the protection of structures places the firefighters at risk of injury and/or death and decreases the probability of successfully protecting the property.

The purpose of the research is to develop a training manual that educates firefighters regarding the unique challenges involved in the wildland/urban interface and teaches them proper risk analysis and structure protection methods to use in the wildland/urban interface.

The research method used for the project is action research. The research will result in the development of a training manual for Evesham Fire-Rescue that will be used to teach firefighters how to protect structures in the wildland/urban interface.

A literature review and personal interviews of content experts in the field of wildland/urban interface firefighting was conducted in order to answer the following questions:

1. What elements should be examined to triage a structure according to risk in wildland/urban interface?
2. As the fire approaches a structure, what tactics can be performed to reduce the risk of ignition to the structure?
3. What safety precautions do firefighters need to use while operating in the wildland/urban, interface that is not typical to normal structure firefighting?

BACKGROUND AND SIGNIFICANCE

Evesham Fire-Rescue is a combination department that delivers fire suppression, Basic Life Support (BLS) emergency ambulance transport, fire prevention and education, emergency management, and special operations rescue services to over 46,000 residents of the township. Evesham Township is close to thirty square miles and is located in the southwest portion of the State of New Jersey, approximately ten miles east of the City of Philadelphia, Pennsylvania. The department responds to approximately 4,500 calls for service annually. The breakdown of calls consists of approximately 1,500 fire calls and 3,000 emergency medical calls.

Each year Evesham Fire-Rescue responds to both forest fires and brush fires throughout the community and neighboring jurisdictions. Most of these incidents are small and handled with one to three firefighting resources. In 1986 the department responded to a forest fire in the Kings Grant development located in the central part of the township. This fire grew rapidly and required numerous resources to finally extinguish it. In the end, the fire consumed 25 acres; complete destroyed one home and heavily damaged three others (personal communications). Since that time the department

has not suffered any significant damages to homes or businesses as the result of forest fires.

Housing development has flourished in the township since 1986, which has resulted in several developments and numerous homes being constructed in the wildland/urban interface. This influx of homes in the wildland/urban interface has increased the risk of homes being destroyed by a forest fire and the risk to firefighters being injured by placing them in positions to protect property. The Environment News Service (2004) explains that the ever increasing number of homes being built in the woods makes it critical to prepare for wildland fires. The New Jersey Forest Fire Service (1996-2004) web site entitled *Wildfire in New Jersey* states " The potential for a wildfire disaster in New Jersey has been dramatically illustrated numerous times….during the summer drought of 1997 , an 800-acre fire damaged 52 homes and threatened over 300 more homes in Berkeley Township" (¶ 2).

The development of a wildland/urban interface structure protection training program is instrumental to the protection of property and to the safety of the department's firefighters operating in the interface. The training program helps to support the operational objectives of the United States Fire Administrative (USFA, 2002) by "helping to reduce the loss of life from fire of firefighters (p. II-2)." It also relates to the National Fire Academy's (2003) course entitled *Leading Community Risk Reduction* by taking the community hazard of the wildland/urban interface and the vulnerability of the hazard and attempting to reduce the risk to firefighters and structures.

LITERATURE REVIEW

In order for firefighters to protect property in the wildland/urban interface, they must be properly trained on how to achieve this safely and effectively.

International Fire Service Training Association (IFSTA, 2003) states:

> Another aspect of the increasing population in the wildland/urban interface is that municipal firefighters, primarily trained and equipped to fight structure fires, are more likely than ever to fight wildfires. The reverse is also true- wildland firefighters are now more likely to fight structure fires. Firefighters across North America are killed each year because they lack the training necessary for them to know how wildland fires are affected by differences in fuels, weather and topography; to know how to safely and effectively fight these fires; or to recognize when they are in life threatening situation until it is too late. (p.xi)

Federal Wildland Fire Policy (2002) identifies problems with firefighting qualifications for the wildland/urban interface because the certification is divided between structural and wildland certifications. Firefighters placed in positions to protect property can jeopardize their safety by operating beyond their training, experience, and equipment capabilities. The policy recommends that the National Fire Academy should develop operational curricula for the wildland/urban interface.

Society of American Foresters (2002) in support of the National Fire Plan encourages the funding and training of firefighters in suppression with emphasis on safety of the firefighters and public.

Queen (1992) believes that both structure firefighters and wildland firefighters should be cross-trained with each other and both need to train on the needs of the wildland/urban

interface. The author explains that training is necessary in the wildland/urban interface, that knowledge and experience is one of the best tools to use to combat and survive a wildland/urban interface fire.

Firefighters in departments that may respond to interface fires should receive training in structure protection and basic wildland firefighting, with officers receiving additional operational issues in the wildland/urban interface and ICS courses (Long, 2001). The author points out that annually a structure protection drill should be conducted.

Because of the special hazards of the wildland/urban interface just discussed and because firefighters are either trained as structural firefighters or wildland firefighters, it is a common theme among authors that cross training between structural and wildland firefighters is necessary to ensure safety of the firefighters and the smooth operation of the suppression forces (Bullock, 1996), (Queen, 1992), (Dittmar, 1998), (Nelson, 1999), (IFSTA, 2003), (Long, 2001).

Bisbee (1994) points out that a wildfire training program needs to be supported by department standard operating procedures (SOPs). He explains that the SOPs are the backbone of any training program and that the SOPs should be mastered on the training grounds.

DeGrosky (2002) states “ Organizations create operating procedures to establish accountability, prevent uncoordinated effort, satisfy appropriate standards, strengthen operations and provide a foundation of a cohesive training strategy.”

In his Executive Fire Officer (EFO) research, Bullock (1996) listed the adoption and training of a structural triage system as one of the most important items to be addressed.

Nelson (1999) recommends that the Wildland/Urban/Rural Structure Triage System should be used as a method to determine which homes should be protected and which ones should be allowed to burn because of safety reasons.

Departments should develop and train with a structure-triage checklist. Training on the checklist should emphasis's the limitations and dangers in applying a single set of structure-triage criteria in wildfire situations (Brown, 1994).

Structures are usually placed in a classification upon completion of triage:

- Needing little or no attention
- Defensible but needing protection
- Indefensible or hopeless. (IFSTA, 2003), (Teie, 1997), (NJ Forest Fire Service, 1996-2004)

The following is a list of the common elements and the authors who recommend them for consideration during structure triage. Some authors used different names for similar described elements.

- Rescue - civilians who are still in their homes or attempting to evacuate from the area and need assistance (May, 2000), (Queen, 1992), (Bradford, 2001), (IFSTA, 2003).
- Involvement - the amount of the structure that is already on fire (May, 2000), (Cowardin, 1992), (Queen, 1992), (Bradford, 2001), (IFSTA, 2003).
- Exposures – other structures or combustibles close enough to become ignited (May, 2000), (Cowardin, 1992), (Queen, 1992), (IFSTA, 2003).
- Roof Coverings - the type of roof covering, such as wood shingles which are combustible or tiles which are noncombustible (May, 2000), (Cowardin, 1992) (Teie, 1997), (Queen, 1992), (IFSTA, 2003), (Bradford, 2001), (Brown, 1994), (Hall 2001).
- Defensible Space- the area around the structure that is clear of combustible. Most authors recommend at least 30 feet of defensible space (May, 2000), (Cowardin, 1992), (Teie, 1997), (Queen, 1992), (Bradford, 2001), (IFSTA, 2003), (Brown, 1994), (Hall 2001).

- Water Supply – the amount of water that personnel have to use to fight the fire or refill their tanks (May, 2000), (Cowardin, 1992), (Queen, 1992), (Bradford, 2001), (IFSTA, 2003), (Brown, 1994), (Hall 2001).

- Personnel – the number of firefighters on location to help defend structures or fight the fire (May, 2000), (Cowardin, 1992), (Teie, 1997), (Queen, 1992), (Bradford, 2001), (IFSTA, 2003).

- Escape Routes, Access & Egress – equipment needs safe access and egress to the structure. There should be two ways out or safety areas (May, 2000), (Teie, 1997), (Queen, 1992), (Bradford, 2001), (IFSTA, 2003), (Brown, 1994), (Hall 2001).

- Fuel- the more fuel to burn around the structure the harder it will be to save the structure. The type of fuel must also be considered. Firefighters may not be able to extinguish flammable or combustible fuels with limited water (May, 2000), (Cowardin, 1992), (Teie, 1997), (Queen, 1992), (Bradford, 2001), (IFSTA, 2003), (Brown, 1994), (Hall 2001).

- Weather- the weather needs to be considered because of effects on the fire. Wind may help it spread quickly or a steady rain may help extinguish it (May, 2000), (Teie, 1997), (Queen, 1992), (Bradford, 2001), (IFSTA, 2003), (Brown, 1994).

- Hazardous Materials- firefighters should stay clear of hazardous materials for safety reasons and their presence may increase the risk of structure ignition (Teie, 1997), (Bradford, 2001), (IFSTA, 2003), (Brown, 1994).

- Siding on Buildings- combustible siding increases the risk of ignition to the structure (IFSTA, 2003), (Brown, 1994), (Hall 2001).

- Heat Traps, Open Gable, Vents –the greater the number of opening for fire to enter the structure the less likely of saving it (Teie, 1997), (Bradford, 2001), (IFSTA, 2003), (Brown, 1994), (Hall 2001).

- Power Lines- a downed energized wire may hurt or kill a firefighter and may ignite fuels or structures that it may contact (IFSTA, 2003), (Brown, 1994).

- Topography- the steepness of slopes will affect the spread of fire. A steep slope will make structures located on it difficult to defend (Cowardin, 1992), (Teie, 1997), (Queen, 1992), (IFSTA, 2001), (IFSTA, 2003), (Brown, 1994).

- Equipment- proper amounts of equipment and resources will be needed to protect structures (Cowardin, 1992), (Teie, 1997) (Bradford, 2001), (IFSTA, 2003).

- Fire Behavior – The speed and intensity of the fire will determine how difficult it will be to protect a structure (Teie, 1997), (Queen, 1992), (Bradford, 2001), (IFSTA, 2003).

IFSTA (2003) places the elements listed into six different categories: firefighter safety, structural characteristics, fuels, fire behavior, available resources and available water.

The elements just discussed helps firefighters determine if they should attempt to protect a structure or not. Firefighters also need to know what they can do to help reduce the risk of ignition of a structure as a forest fire approaches.

Most authors recommend that when fire is approaching a structure, firefighters need to prepare both the structure itself and around the perimeter of the structure as time permits. They recommend stretching two handlines (one around each side), the clearing of fuels, removing hazardous materials, constructing a fireline around the structure, securing or removing private vehicles and pets from around the structure. Regarding the structure itself, they recommend setting up ladders, clearing combustibles from the roof and gutters, preparing the interior by removing combustible materials from the windows, closing doors and windows, turning off gas and fans or air conditioning units. They also recommend that the electricity be left on for lighting purposes both inside and outside. If the structure becomes involved then the electricity should be secured before suppression efforts are initiated (IFSTA, 2003), (Bradford, 2001), (Queen, 1992), (May, 2000), (NJ Forest Fire Service, 1996-2004), (Brown, 1994).

Both IFSTA (2003) and Bradford (2001) discuss performing the tactics to protect the structures as time permits. Cowardin (1992) using his Wildland/Urban/Rural/Structural Triage system requires that the crew have at least 10 minutes to perform tactics in order to defend a structure unless that is the only structure being threatened.

Bradford (2001) references the large number of orders, guidelines, situations, and commonalities that are used in wildland firefighting. He does not believe that they all apply to the wildland/urban interface but the ones that are applicable he discusses from the perspective of the engine company doing structure protection. Other authors also agree with the safety perspectives discussed and listed by Bradford. Below each safety item is listed.

Ten Standard Fire Orders:

- Fight fires aggressively, but provide for safety first. The order discusses the balance between aggressive fire fighting and knowing the capabilities and limitations of the crew and equipment.

- Initiate all actions based on current and expected fire behavior. The action of the crew is based on the intensity of the fire. As the intensity changes the crew needs to adapt the plan as necessary.

- Recognize current weather conditions and obtain a forecast. The crew needs to know the weather and how it will affect the fire.

- Ensure that instructions are given and understood. Everyone on the crew must understand the plan.

- Know what the fire is doing at all times. The crew needs to keep abreast of what the fire is doing (rate of spread, spotting, flame length) so it can protect the structures and themselves.

- Remain in communication with crew members, your supervisor, and adjoining forces. Communications is needed to coordinate tactics and to keep updated about the fire.

- Determine safety zones and escape routes. Engine crews need to determine area of refuge and escape to avoid a fast approaching flame front.

- Post lookouts to watch over potentially dangerous situations. Crews may not be able to the fire situation because of smoke or thick vegetation. A look out should be assigned to monitor conditions.

- Maintain control of your personnel at all times. The supervisor must maintain discipline and accountability.

- Stay alert, keep calm, think clearly and act decisively. (Bradford, 2001), (IFSTA, 2003), (Winston, 2000)

Watch-Out Situations are situations that should raise a red flag in your crews mind because the fire has the advantage. The watch-out situations listed below are also from a structure protection perspective.

Watch-Out Situations:

- Structures of wood construction and exterior finish.
- Poor Access and narrow one-way roads.
- Inadequate water supply.
- Inadequate clearance of vegetation around the structure.
- Extreme fire behavior.
- Winds in excess of twenty-five miles an hour.
- Poorly organized public evacuation.
- Bridge load limits unclear.
- Fire not scouted or sized-up.
- Laying hose downhill with unburned fuel between you and the fire below.
- Working on a hillside where rolling material can injure you or ignite fuel below you.
- The weather is becoming hotter, and the wind is increasing or changing direction.
- Your crews are exhausted and feel like taking a nap. (Bradford, 2001), (IFSTA, 2003), (Winston, 2000), (NJ Forest Fire Service, 1996-2004)

As a safety issue firefighters should learn from previous mistakes in an attempt to avoid future mistakes. Several authors list the common denominators of fire behavior on tragedy fires or entrapment situations. The five common denominators are:

- Most incidents happen on small fires or on isolated areas of large fires.
- Most fires appear innocent before a big blowup.
- Flare-ups generally occur in light fuels.
- Fires run uphill fast in narrow drainages, saddles and steep slopes.
- Helicopters and air tankers can promote spot fires or cause the fire to flare up. (Bradford, 2001), (IFSTA, 2003), (Winston, 2000)

In an effort to encourage firefighters to remember the essentials of all the different safety items, the acronym LCES was introduced. LCES stands for Lookouts, Communications, Escape Routes and Safety Zones. LCES must be considered when crews make tactical plans (Bradford, 2001), (IFSTA, 2003), (Winston, 2000).

Dittmar (1998) found that most respondents in her study believed that more emphasis in training should be place on keeping crews out of harms way instead of teaching what to do if they are in danger.

The last item of safety is the type of personal protective equipment (PPE) that should be used in the wildland/urban interface.

Queen (1992) believes that the proper PPE to wear on a wildland/urban interface fire is wildland firefighting gear. He goes on to state that firefighters wearing structure fire PPE in the wildland/urban interface will increase their possibility of heat exhaustion or heat stroke.

Hall (2001) believes that wildland PPE is not always adequate for fire operations in the wildland/urban interface.

It was a common theme among several authors that wildland PPE should be used unless the crew is fighting a fire inside a structure then structural PPE should be used

including self contained breathing apparatus (May, 2000), (Bradford, 2001), (IFSTA, 2003), (Winston, 2000).

An interview of two content experts in the field of wildland/urban interface was conducted. It was decided to select two people for the interview who had experience in the wildland/urban interface with one person concentrating from the structural side and the other person from the wildland side. The questions that were asked to the interviewees are contained in Appendix A.

Ted Lowden, Fire Chief of Evesham Fire-Rescue and Executive Fire Officer graduate, was selected as the representative from the structural side of firefighting because of his membership to the National Wildland Coordinating Group (NWCG) and his 30 years experience in structural firefighting. He helped to develop a Wildland/Urban Interface program for the NWCG. The following is information obtained from the interview:

Mr. Lowden believed that the elements identified in the literature review for structure triage was a good list to use as a reference for structure triage. He discussed that the elements should be placed into some type of check list for easy reference. Mr. Lowden also supported the use of standard operating procedures but cautioned about the need to keep them flexible because of the dynamics of different situations that may be encountered.

He also stated that the tactics listed were good but again flexibility must be remembered. The wildland/urban interface encountered in New Jersey will have limited resources with a single engine company attempting to protect three to five homes. One engine company will not have enough manpower or equipment to stretch

two handlines or put up that many ladders. The triage process would have to be adhered to.

Mr. Lowden stated that safety has to stay the highest priority throughout the duration of operations in the wildland/urban interface. He also believes that structural firefighting gear should be used for structural protection with procedures in place to ensure the gear is worn when combating the fire and can be removed when preparing the area for the approaching the fire for safety reasons. (T. Lowden, personal communication, September 29, 2004)

The other interview was conducted with Maris Gabliks who is the New Jersey State Forest Warden. He has 20 year of experience in wildland firefighting and also volunteers with the Adelphia Fire Department on the structural side. He is also a member of the Northeast Forest Fire Supervisors and graduate of the Executive Fire Officer Program. The following is information obtained from the interview:

Mr. Gabliks believed that the list identified for structure triage by the literature review was fairly comprehensive, but felt strongly that the subjects of Evacuation Potential and Spot Fires needed to be added or described in more detail under other headings. He went on to explain that the two most important elements to consider during triage was defensible space and firefighter safety. He also stated that fire department operations in the wildland/urban interface must be supported by standard operating procedures.

Mr. Gabliks believed that the tactics listed from the literature review was very complete but crews should concentrate on three things, which are handlines in place, staying mobile, and the construction of a fire line around the structure. He goes on to explain that in New Jersey and especially in the Pine Barrens crews will have very little time to prepare structures. Wildland/Urban Interface fires in New Jersey are usually small compared to out west. Fires in New Jersey may only be 25 to 50 acres but can threaten hundreds of homes in a short time period.

Mr. Gabliks stated that the best safety items for firefighters to follow is Look-outs, Communications, Escape Routes and Safety Zones (LCES). He explained that most firefighters would not be able to remember the large number of orders and watch-out situations. He also stated that sometimes Awareness is added to LCES, which would make it LACES.

Similar to Chief Lowden, Mr. Gabliks believes that firefighters should be in structural gear when performing structure protection with the ability to take items off as needed during non-firefighting duties. (M. Gabliks, personal communications, September 30, 2004)

In summary both the literature review and interviews identified that the wildland/urban interface is not a new problem. The solutions to the problem also are not new. Similar to other problems in the fire service, the key to success in the wildland/urban interface is training personnel to handle the emergency and support those operations with standard operating procedures. Both the literature review and content

experts identified similar elements to consider for structure triage and proper engine tactics for structure protection. The subject of safety is key to all operations in the wildland/urban interface as identified by the authors and content experts.

PROCEDURES

Action research method was selected to help provide the necessary information to answer the proposed research questions and to develop a training program for the department. To properly research the subject of structure protection in the wildland/urban interface it was decided to conduct a literature review, and two personal interviews on the topic.

The literature review began in the month of April 2003 at the National Fire Academy's Learning Resource Center. Fire service magazines, reports, books and previous Executive Fire Officer applied research projects were reviewed in order to provide up to date relevant information on the topic.

In the following months numerous online searches were conducted looking for any relevant information regarding structure protection operations in the wildland/urban interface. The Evesham Fire-Rescue resource library was also searched for information relating to the topic.

It was decided that the best method to gather the most up to date information on the topic would be to conduct interviews of content experts. The purpose of the research is to develop a training manual that educates firefighters regarding the unique challenges involved in the wildland/urban interface and teaches them proper risk analysis and structure protection methods to use in the wildland/urban interface.

Two interviews were conducted. Both Ted Lowden and Maris Gabliks were selected because of their years of experience in their fire service and operations in the wildland/urban interface. Mr. Lowden was selected as a representative of structural firefighting and Mr. Gabliks as a representative of wildland firefighting.

Ted Lowden, Fire Chief of Evesham Fire-Rescue and Executive Fire Officer graduate was selected as the representative from the structural side of firefighting because of his membership to the National Wildland Coordinating Group (NWCG), and his 30 years experience in structural firefighting. He helped to develop a Wildland/Urban Interface program for the NWCG. The interview was conducted on September 29, 2004 and listed in the Literature Review.

Maris Gabliks is the New Jersey State Forest Warden. He has 20 year of experience in wildland firefighting and also volunteers with the Adelphia Fire Department on the structural side. He is also a member of the Northeast Forest Fire Supervisors and graduate of the Executive Fire Officer Program. The interview was conducted on September 30, 2004 and listed in the Literature Review.

Both Ted Lowden and Maris Gabliks were extremely helpful and cooperative with providing accurate up-to-date information for the research. The author would like to acknowledge their cooperation, educational insight, and for taking the time out of their busy schedule to allow for a personal interview.

Assumptions and Limitations

There is a large amount of information on the subject of wildland/urban interface and the research conducted did not come close to reviewing everything on the subject.

It is assumed that the information obtained is factual and relevant to the topic as explained by the authors.

RESULTS

What elements should be examined to triage a structure according to risk in wildland/urban interface?

The research results identified that the following elements should be examined when triaging a structure: Rescue, Involvement, Exposures, Roof Coverings, Defensible Space, Water Supply, Personnel, Escape Routes, Access & Egress, Fuel, Weather, Hazardous Materials, Siding on Buildings, Heat Traps, Open Gable, Vents, Power Lines, Topography, Equipment, Fire Behavior, Spot Fires and Evacuation Potential.

As the fire approaches a structure, what tactics can be performed to reduce the risk of ignition to the structure?

The research results identified the following tactics that can be performed to reduce the risk of ignition to the structure: around the perimeter of the structure as time permits stretching two handlines (one around each side), the clearing of fuels, removing hazardous materials, securing or removing private vehicles and pets from around the structure, and constructing a fireline around the structure.

Regarding the structure itself setting up of ladders for access, the clearing of combustibles from the roof and gutters, and prepare the interior by removing combustible materials from the windows, close doors and windows, turn off gas and fans or air conditioning units.

What safety precautions do firefighters need to use while operating in the wildland/urban, interface that is not typical to normal structure firefighting?

The research results identified the following safety items should be learned by firefighters operating in the wildland/urban interface: Ten Standard Fire Orders Watch-Out Situations which are situations that should raise a red flag in your crews mind, the list of common denominators of fire behavior on tragedy fires or entrapment situations, Look-outs, Awareness, Communications, Escape Routes, Safety and the need to use wildland personal protective equipment (PPE) in the wildland/urban interface, unless the crew is fighting a fire at the structure then structural PPE should be used.

DISCUSSION

Both the literature review and the content experts agree for the need to train firefighters to operate in the wildland/urban interface. International Fire Service Training Association (IFSTA, 2003) states:

> Another aspect of the increasing population in the wildland/urban interface is that municipal firefighters, primarily trained and equipped to fight structure fires, are more likely than ever to fight wildfires. (p.xi)

Long (2001) believe that firefighters should receive training in structure protection and basic wildland firefighting. The author points out that annually a structure protection drill should be conducted.

Queen (1992) believes that both structure firefighters and wildland firefighters should be cross-trained with each other and both need to train on the needs of the wildland/urban interface. The author explains that training is necessary in the wildland/urban interface, that knowledge and experience is one of the best tools to use to combat and survive a wildland/urban interface fire.

Evesham Fire-Rescue does not have members with much experience in the wildland/urban interface. Most of the incidents that have occurred in the past ten years are small and no homes have been significantly threatened by the fires. Also the number of firefighters operating in the department with over ten years experience is under ten percent. If the department encounters a significant wildland/urban interface incident, the personnel will lack experience and need to use their skills and knowledge required from training to operate at the incident.

The research also pointed out the need for departments to have Standard Operating Procedures (SOPs) or Guidelines (SOGs) for operations in the wildland/urban interface and to support the training program.

Bisbee (1994) explains that SOPs are the backbone of a wildland training program and they should be mastered on the training grounds.

DeGrosky (2002) states " Organizations create operating procedures to establish accountability, prevent uncoordinated effort, satisfy appropriate standards, strengthen operations and provide a foundation of a cohesive training strategy."

Mr. Lowden also supported the use of standard operating procedures but cautioned about the need to keep them flexible because of the dynamics of different situations that may be encountered (T. Lowden, personal communication, September 29, 2004).

Evesham Fire-Rescue currently does not have any procedures for operations in the wildland/urban interface.

Numerous authors listed the same elements that need to be examined when protecting a structure. The element of defensible space was discussed by nine different authors.

Defensible Space- the area around the structure that is clear of combustible. Most authors recommend at least 30 feet of defensible space (May, 2000), (Cowardin, 1992), (Teie, 1997), (Queen, 1992), (Bradford, 2001), (IFSTA, 2003), (Brown, 1994), (Hall 2001).

Mr. Gabliks felt strongly that Evacuation Potential and Spot Fires needed to be added or described in more detail under other headings. He went on to explain that the two most important elements to consider during triage was defensible space and firefighter safety (M. Gabliks, personal communications, September 30, 2004).

IFSTA (2003) placed all the elements listed into six different categories: firefighter safety, structural characteristics, fuels, fire behavior, available resources and available water. The listing of all the elements into six categories makes it a little easier to teach firefighters to recall the information when it is needed. It also helps make it easy to have a convenient check off sheet that could be used in the field. Currently Evesham Fire-Rescue does not have a check off sheet for structure protection.

Similar, most authors recommend the same type of tactics to be performed to decrease the risk of ignition to a structure. The authors recommend stretching two handlines (one around each side), the clearing of fuels, removing hazardous materials, securing or removing private vehicles and pets from around the structure. Regarding the structure itself they recommend setting up of ladders for access, clearing combustibles from the roof and gutters, and preparing the interior by removing combustible materials

from the windows, closing doors and windows, turning off gas and fans or air conditioning units. (IFSTA, 2003), (Bradford, 2001), (Queen, 1992), (May, 2000), (NJ Forest Fire Service, 1996-2004), (Brown, 1994).

Mr. Gabliks stressed the importance of three things. They include handlines in place, staying mobile, and the construction of a fire line around the structure. He goes on to explain the in New Jersey and especially in the Pine Barrens, crews will have very little time to prepare structures. Wildland/Urban Interface fires in New Jersey are usually small compared to out west. Fires in New Jersey may only be 25 to 50 acres but can threaten hundreds of homes in a short time period (M. Gabliks, personal communications, September 30, 2004).

The tactics to be performed to protect the structure as time permits will require the judgment of the officer to know both the speed and fire behavior measured against the crew's efficiency to perform what is needed to protect the structure. Both IFSTA (2003) and Bradford (2001) only discuss performing the tactics as time permits. Cowardin (1992) uses the benchmark of at least 10 minutes to defend a structure unless that is the only structure being threatened.

As mentioned, Evesham Fire-Rescue personnel does not have experience with operations in the wildland/urban interface which will not allow them to accurately predict what may be accomplished before a fire will arrive. Department personnel will only be able to use what their training has taught them.

In reference to safety items most authors used items from the field of wildland firefighting. The big safety items the research discovered was:

- Ten Standard Fire Orders(Bradford, 2001) (IFSTA, 2003), (Winston, 2000), (NJ Forest Fire Service, 1996-2004)
- Watch-Out Situations(Bradford, 2001) (IFSTA, 2003), (Winston, 2000), (NJ Forest Fire Service, 1996-2004).
- Common denominators of fire behavior on tragedy fires or entrapment situations(Bradford, 2001), (IFSTA, 2003), (Winston, 2000).
- LCES (Bradford, 2001), (IFSTA, 2003), (Winston, 2000).
  L**A**CES (M. Gabliks, personal communications, September 30, 2004).
- Wildland PPE should be used unless the crew is fighting a fire at the structure then structural PPE should be used (May, 2000), (Bradford, 2001), (IFSTA, 2003), (Winston, 2000).

No author mentioned how some of the common safety elements used in structural firefighting may or may not be used in the wildland/urban interface. Some of the items that could have been discussed would include the use of Rapid Intervention Teams (RIT), or whether crews still need to meet the requirements of two-in, two-out when operating inside a structure during a wildland/urban interface, and the use or need of an accountability system.

This research will have an impact on Evesham Fire-Rescue. The findings clearly delineate the number of elements that firefighters need to take into account to properly protect a structure. It also shows given enough time ahead of the fire what can be performed to help reduce the likely hood of a structure igniting from the fire. The department needs to stress the safety elements listed in the research as the foundation of the training program. While the department will operate in the wildland/urban interface

several times a year the severity of these fires over the past ten years has been minor and has not given the personnel of the department the experience needed to operate safely if a large scale incident would occur. The wildland/urban interface structure protection training program is crucial because department personnel will be forced to rely on it for the knowledge and skills to operate in the wildland/urban interface when a large scale incident occurs.

RECOMMENDATIONS

Based upon the results of the research, the following recommendations are made:

1. Departments who operate in the wildland/urban interface and have or may have the responsibility of structure protection should train their personnel on structure protection methods and safety issues relevant to the wildland/urban interface. Evesham Fire-Rescue should use the training guide in Appendix B to train firefighters on the proper method of protecting a structure and safety concerns in the wildland/urban interface.
2. Evesham Fire-Rescue should develop a check off sheet for structure protection that can be used by the engine officer.
3. Departments who operate with other agencies in the wildland/urban interface should coordinate their responsibilities and training before operating in the interface. Each agency or department needs to know their role and expectations of each other before the incident occurs. Evesham Fire-Rescue should involve the New Jersey Forest Fire Service and neighboring departments in the training program for structure protection and the planning process for operations in the wildland/urban interface.

4. Departments should investigate the purchase of wildland firefighting gear for extended operations in wildland/urban interface or establish procedures that will limit the time of firefighters operating in structural personal protective equipment. Currently Evesham Fire-Rescue only operates in structural PPE.
5. Departments should establish Standard Operating Procedures (SOPs) or Guidelines for operations in the wildland/urban interface. The procedures or guidelines should support the training program. Evesham Fire-Rescue should develop a standard operating procedure for operations in the wildland/urban interface.
6. Future research should be conducted related to safety elements commonly used in structural firefighting such as Rapid Intervention Teams (RIT), the requirements of two-in, two-out or the accountability system when operating inside a structure during a wildland/urban interface. The research did not reveal the use of any of these items in relationship to operating in the wildland/urban interface.

REFERENCE LIST

Bisbee, M. (1994, June). Get braced for the interface. *Fire Chief*, pp.27-33.

Bullock, G. E. (1996). *Addressing the wildland/urban interface problem.* (Applied Research Project). Emmitsburg, MD: National Fire Academy, Executive Fire Officer Program.

Bradford, G. (2001) *Structure protection in the I-Zone*. Saddle Brook, NJ: Fire Engineering Books and Videos.

Brown, K. (1994, March). *Structure triage during wildland/urban interface/intermix fires.* (Applied Research Project). Emmitsburg, MD: National Fire Academy, Executive Fire Officer Program.

Cowardin, D.H. (1992, September). Wildland/urban/rural structural triage. *American Fire Journal*, pp. 28-29.

DeGrosky, M. (2002, April). Imperfect fit. (36 paragraphs). *Fire Chief* (On-line, private site). Available: http://www.keepmedia.com/pubs/FireChief/2002/04/01/148220 (August 28, 2004).

Dittmar, M.J. (1998, May). The wildland interface: Impact on local fire departments. *Fire Engineering*, pp. 65-83.

Environment News Service. (2004). Scientist: Wildfire prevention more than logging. (23 paragraphs). (On-line, private site). Available: http://www.keepmedia.com/pubs/EnvironmentNewsService/2004/08/04/520880 (September 10, 2004)

Federal Wildland Fire Policy. (2002). Wildland/urban interface protection. (41 paragraphs). (On-line, government site). Available: http://www.fs.fed.us/land/wdfire7c.htm (August 19, 2004)

Hall, D.R. (2001). *Wildland urban interface concerns.* (Applied Research Project). Emmitsburg, MD: National Fire Academy, Executive Fire Officer Program.

International Society of Fire Service Instructors. (2003) *Wildland fire fighting for structural firefighters.* (4th ed.). Stillwater, OK: Oklahoma State University.

Long, M. (2001, August). *Wildland/urban interface fire preplanning for the Lake Dillion fire department.* (Applied Research Project). Emmitsburg, MD: National Fire Academy, Executive Fire Officer Program.

May, T. (2000). *600 Series Pinellas County fire department standard operating procedures wildland/urban interface fires.* (Applied Research Project). Emmitsburg, MD: National Fire Academy, Executive Fire Officer Program.

National Association of Counties. (2003-2004). 2003-2004 Resolution on reducing the risk of catastrophic wildfire on public lands. (9 paragraphs). (On-line, private site). Available: http://www.naco.org/Content/ContentGroups?Legislative_Affairs/Advocacy1/Public_Land (August 28, 2004).

National Fire Academy. (2003). Leading Community Risk Reduction, Student Manual. Emmitsburg, MD: Author.

Nelson, R. (1999). *Preparing our community for a wildland fire disaster*. (Applied Research Project). Emmitsburg, MD: National Fire Academy, Executive Fire Officer Program.

New Jersey Forest Fire Service. (1996-2004). A firefighters guide to protecting homes in the wildland/urban interface. (8 paragraphs). (On-Line, government site). Available: http://www.state.nj.us/dep/parksandforests/fire/firefighters_guide.html (September 10, 2004).

New Jersey Forest Fire Service. (1996-2004). Wildfire in New Jersey. (3 paragraphs). (On-Line, government site). Available: http://www.state.nj.us/dep/parksandforests/fire/prescribed_burning.htm (September 10, 2004).

Queen, P.R. (1992, August). Fighting fires in the urban/wildland interface: 2. Structure protection. *American Fire Journal,* pp.34-39.

Society of American Foresters. (2002). Wildfire management. (12 paragraphs). (On-line, private site). Available: http://www.safnet.org (August 24, 2004).

Teie, W. (1997) *Fire officers handbook on wildland firefighting*. Deer Valley Press, Rescue, CA

United States Fire Administration (2002, June 1). *Executive Fire Officer Program Operational Policies and Procedures*. Emmitsburg, MD: United States Fire Administration and Federal Emergency Management Agency.

Winston, R.M. (2000, May). Basic wildland fire safety for structural firefighters. *Firehouse,* pp.86-90.

APPENDIX A

The interview questions listed below are related to the following research and research questions:

Evesham Fire-Rescue has the responsibility to protect the citizens of the township and their homes located in the wildland/urban interface. The problem is that while all department firefighters are trained in structural firefighting, the firefighters are not specifically trained in risk analysis and structure protection in the wildland/urban interface. The lack of a formal training program for the protection of structures places the firefighters at risk of injury and/or death and decreases the probability of successfully protecting the property.

The purpose of the research is to develop a training manual that educates firefighters regarding the unique challenges involved in the wildland/urban interface and teaches them proper risk analysis and structure protection methods to use in the wildland/urban interface.

The research method used for the project is action research. The research will result in the development of a training manual for Evesham Fire-Rescue that will be used to teach firefighters how to protect structures in the wildland/urban interface.

A literature review and personal interviews of content experts in the field of wildland/urban interface firefighting was conducted in order to answer the following questions:

- What elements should be examined to triage a structure according to risk in wildland/urban interface?
- As the fire approaches a structure, what tactics can be performed to reduce the risk of ignition to the structure?
- What safety precautions do firefighters need to learn about in the wildland/urban interface that is not typical to normal structure firefighting?

Most authors believe that the following elements should be reviewed when triaging a structure:

Rescue	Involvement	Exposures	Roof Coverings
Defensible Space	Water Supply	Personnel	Escape Routes
Access & Egress	Fuel	Weather	Hazardous Materials
Pets & Livestock	Siding on Buildings	Heat Traps	Open Gable/Vents
Power Lines	Topography	Equipment	Fire Behavior.

1. Do you agree with the elements listed or do you believe some should be deleted or do you have others you believe should be added and why?

2. Should departments have standard operating procedures to address wildland//urban interface operations?

Most authors recommend the following tactics to be performed to decrease the risk of ignition to a structure:
Stretching two handlines (one around each side) Clearing of fuels
Removing hazardous materials
Securing or removing private vehicles and pets from around the structure
Setting up of ladders for access
Clearing of combustibles from the roof and gutters
Constructing a fireline around the structure
Prepare the interior by removing combustible materials from the windows, close doors and windows, turn off gas and fans or air conditioning units.

3. Do you agree with the tactics listed or do you believe some should be deleted or do you have others you believe should be added and why?

When perform protection tactics both IFSTA (2003) and Bradford (2001) only discuss performing the tactics as time permits. Cowardin (1992) uses the benchmark of at least 10 minutes to defend a structure unless that is the only structure being threatened.

4. Do you know of any guidelines that officers can use as a benchmark regarding the amount of time needed to reduce the risk of ignition to a structure?

In reference to safety items most authors used items from the field of wildland firefighting. The big safety items the research discovered was: Ten Standard Fire Orders, Watch-Out Situations, Common denominators of fire behavior on tragedy fires or entrapment situations, and that wildland PPE should be used unless the crew is fighting a fire inside a structure then structural PPE should be used including self contained breathing apparatus.

5. Do you feel that departments should address any additional safety items that effect their operations in the wildland/urban interface?

6. What is your position on the type of PPE (Structural, Wildland, Both) that should be used in the wildland/urban interface and why?

APPENDIX B

Evesham Fire-Rescue

Structure Protection and
Firefighter Safety Training Program for Wildland/Urban Interface Operations.

The training program is broken into four sections: Introduction to the Wildland/Urban Interface, Structure Triage, Engine Company Tactics, and Firefighter Safety.

The goal of the program is for firefighters to learn about the unique challenges associated with wildland/urban interface fires and teach them proper risk analysis and structure protection methods to use in the wildland/urban interface.

Section 1- Introduction to the Wildland/Urban Interface

Reference material:

- Structure Protection in the I-Zone: Preface
- Wildland Fire Fighting for Structural Firefighters: Introduction & Chapter 7
- American Heat : March 2000 Fires that Changed the Fire Service – Wildlands Calabasa Fire

Objectives:

- Identify the unique challenges that a wildland/urban interface fire presents verses a wildland fire or structural fire.
- Identify the dangers of operating in the wildland/urban interface.

Show American Heat Video: March 2000 Fires that Changed the Fire Service – Wildlands - Calabasa Fire

Discuss the following:
During the discussion point out parts of the video that relate to the sections.

Why is the wildland/urban interface problem growing?

- More people want to live in secluded areas, such as the woods.
- Available land
- Improved transportation

Has New Jersey ever experienced a wildland/urban interface fire?

- Year 1963 fire destroyed 183,000 acres & consumed 186 homes and 187 buildings.
- Year 1997 fire burned 800 acres and damaged 52 homes and threatened over 300 more in Berkely Township
- Evesham Township, Year 1985 fire burned and damaged four homes.

How is a wildland/urban interface fire different than a typical wildland fire or structure fire?

- Impact on the number of people
- Access and Egress
- Resources required
- Number of exposures to protect
- Number of civilians to evacuate or rescue
- Different tactics – operating off tank water verses laying lines (Structure fire)

What are some of the dangers of a wildland/urban interface fire?

- Amount of fuel
- Amount of fire
- Escape Routes
- Visibility – cars fleeing striking apparatus or firefighters
- Civilians needing to evacuate or need rescuing

Section 2 – Structure Triage

Reference Material:

- Structure Protection in the I-Zone: Chapter 11
- Wildland Fire Fighting for Structural Firefighters: Chapter 7
- American Heat : April 2004 Firestorm 2003 Safe Structure Protection

Objectives:

- Identify reasons why we want to triage structures.
- Identify three categories of threatened structures.
- Identify elements of structure triage and explain how they impact the engine company.

Show American Heat Video: April 2004 Firestorm 2003 Safe Structure Protection

Discuss the following:
During the discussion point out parts of the video that relate to the sections.

Structure Triage is defined as the process of categorizing threatened structures according to their defensibility.

Why do we perform the triage process?

- Saving homes that have a chance of being saved
- Save as much as possible with the resources available

  Best case scenario is to assign an engine to every house that must be protected. Because it will be rare to have the necessary resources to achieve this, it is necessary to triage homes and make the best use of the resources.

*It will be hard for firefighters to write off homes.
*Trying to save homes that should be written off will result in spreading resources too thin, which may result in the loss of homes that could have been saved.

Triaged structures will be classified into three categories:

- Needs little or no attention for now
- Needs protection but can be saved
- Hopeless, can't be saved or requires too many resources.

There are numerous elements to consider when triaging a structure. The following is the list of considerations that a crew can use to classify the structure. IFSTA places the elements into six different categories: firefighter safety, structural characteristics, fuels, fire behavior, available resources and available water.

Firefighter Safety
* Firefighter safety will be covered in more detail in the last section of the program but the following elements need to be considered during triage.

- Ingress/egress – Safety zones
  - Two ways out are better than one.
  - Always try to have a safety zone that the entire crew is aware of.
  - Watch heavy fuels – both ground and canopy

- Power Lines
  - May block ingress/egress
  - Possible electrocution
  - May ignite fuels or structure

- Smoke
  - Impaired vision for drivers
  - Limits crew's ability to observe approaching fire behavior

- Hazardous Materials
  - Smoke may be Toxic
  - Runoff water may be contaminated

- LPG and aboveground fuel storage
  - Watch for BLEVE
  - May not have enough water to extinguish fuels to protect the structure

Safety Message! If the fire threatens your position and escape route, abandon all structures and GET OUT!

Structural Characteristics

- Roof

- Siding
- Windows
- Heat Traps
- Size of structure
- Position on Slope

Fuels

- Surrounding fuels
- Size and arrangement
- Age
- Proximity
- Loading
- Types
- Improvements
- Defensible Space
- Yard Accumulations
- Flame or heat duration
- Explosives

Fire Behavior

- Rate and direction of spread
- Topographic influence
- Flame length
- Spotting/fire embers
- Time of day
- Time of year
- Natural or other barriers

Available Resources

- On-site private resources
- Type and amount of resources
- Resources Available
- Resources arrival time
- Personnel training and experience level.

Available Water

- Crews should fill or top off tanks when ever they get the chance.
- Engine operate should make sure to leave at least 100 gallons in the tank incase it is need to protect the engine and crew.

Section 3 – Engine Company Tactics

Reference Material:

- Structure Protection in the I-Zone: Chapter 11
- Wildland Fire Fighting for Structural Firefighters: Chapter 7

Objectives:

- Identify tactics that can be performed that will reduce the chances of structure ignition around the perimeter of the structure.
- Identify tactics that can be performed that will reduce the chances of structure ignition to the structure.
- Identify engine position and steps to be performed to protect the engine during structure protection.

Tactics to be performed around the perimeter of the structure as time permits:

- Stretch two handlines (one around each side of the structure) 1-3/4 lines
- Clear fuels
- Remove hazardous materials
- Secure or remove private vehicles
- Secure pets & livestock
- Constructing a fireline around the structure.

Tactics to be performed to the structure as time permits:

- Setting up of ladders for access to the roof
- Clear combustibles from the roof and gutters
- Prepare the interior by removing combustible materials from the windows
- Close doors and windows,
- Turn off gas and fans or air conditioning units.

Special Note!

*** It is recommended that the electricity be left on for lighting purposes both inside and outside. If the structure becomes involved then the electricity should be secured before suppression efforts are initiated. ***

Engine Positioning – For Safety the engine should always be backed into the protection area. This will allow for faster egress.

- Park off the roadway to avoid blocking other fire apparatus or evacuating vehicles. However, structural engines may be too heavy to safely take them off the roadway.
- Remove fuel as necessary to avoid parking in close proximity to flammable vegetation.
- Park on the lee side of the structure to minimize exposure to heat and blowing embers.
- Park near (but not too close to) the structure so that hoselines can be kept short.
- Keep cab doors closed and windows rolled up to keep out burning material.
- Place engine's air-conditioning system (if so equipped) in recirculation mode to avoid drawing in smoke from outside.
- Do not park next to or under hazards such as the following:
  - Power lines
  - Flammable trees or snags
  - PG tanks or other pressure vessels

- Structures that might burn

- Maintain a high idle to reduce stalling potential.
- Keep headlights to maintain visibility.
- Do not remove/deploy nonessential equipment from apparatus.

Section 4 – Firefighter Safety

Reference Material:

- Structure Protection in the I-Zone: Chapter 1
- Wildland Fire Fighting for Structural Firefighters: Chapter 8
- American Heat : April 2001 Taming the Wildland/Urban Interface – Los Alamos 1 & 2.

Objectives:

- Identify the ten rules of wildland firefighting.
- Identify at least seven Watch-Out situations.
- Identify the five common denominators of tragedy fires.
- Identify why firefighters need to remember “LCES”!

Discuss the following:
Ten Standard Fire Orders

- Fight fires aggressively, but provide for safety first. The order discusses the balance between aggressive fire fighting and knowing the capabilities and limitations of the crew and equipment.
- Initiate all actions based on current and expected fire behavior. The action of the crew is based on the intensity of the fire. As the intensity changes the crew needs to adapt the plan as necessary.
- Recognize current weather conditions and obtain a forecast. The crew needs to know the weather and how it will affect the fire.
- Ensure that instructions are given and understood. Everyone on the crew must understand the plan.
- Know what the fire is doing at all times. The crew needs to keep abreast of what the fire is doing (rate of spread, spotting, flame length) so it can protect the structures and themselves.
- Remain in communication with crew members, your supervisor, and adjoining forces. Communications is needed to coordinate tactics and to keep updated about the fire.
- Determine safety zones and escape routes. Engine crews need to determine area of refuge and escape to avoid a fast approaching flame front.
- Post lookouts to watch over potentially dangerous situations. Crews may not be able to the fire situation because of smoke or thick vegetation. A look out should be assigned to monitor conditions.
- Maintain control of your personnel at all times. The supervisor must maintain discipline and accountability.
- Stay alert, keep calm, think clearly and act decisively.

Watch-Out Situations are situations that should raise a red flag in your crews mind because the fire has the advantage. The watch-out situations listed below are also from a structure protection perspective.

- Structures of wood construction and exterior finish.
- Poor Access and narrow one-way roads.
- Inadequate water supply.
- Inadequate clearance of vegetation around the structure.
- Extreme fire behavior.
- Winds in excess of twenty-five miles an hour.
- Poorly organized public evacuation.
- Bridge load limits unclear.
- Fire not scouted or sized-up.
- Laying hose downhill with unburned fuel between you and the fire below.
- Working on a hillside where rolling material can injure you or ignite fuel below you.
- The weather is becoming hotter, and the wind is increasing or changing direction.
- Your crews are exhausted and feel like taking a nap.

As a safety issue firefighters should learn from previous mistakes in an attempt to avoid future mistakes. The following is a list the common denominators of fire behavior on tragedy fires or entrapment situations:

- Most incidents happen on small fires or on isolated areas of large fires.
- Most fires appear innocent before a big blowup.
- Flare-ups generally occur in light fuels.
- Fires run uphill fast in narrow drainages, saddles and steep slopes.
- Helicopters and air tankers can promote spot fires or cause the fire to flare up.

LCES- In order for firefighters to remember the essentials of safety the acronym LCES was introduced as the minimum safety components. LCES stands for

- Lookouts
- Communications
- Escape Routes
- Safety Zones

Show American Heat Video: April 2001 Taming the Wildland/Urban Interface – Los Alamos 1 & 2.

Tactical Drill- a tactical drill will be held in the near future to allow firefighters to demonstrate what they have learned from the training program. Firefighters should be broken into 4 or 5 person engine crews and given orders to set-up for structure protection. Training should be reinforced as identified in the practical evolution.